OPTISONIC 6300 Handbook

Ultrasonic clamp-on flowmeter with remote signal converter

ER 4.0.0_

KROHNE

IMPRINT

1.1 Software history

For all GDC devices, the "Electronic Revision" (ER) is consulted to document the revision status of the electronics according to NE 53. It is easy to see from the ER whether any fault repairs or major changes to the electronic equipment have taken place and what effect they have had on compatibility.

1	Downwards compatible changes and fault repair with no effect on operation (e.g. spelling mistakes on display)	
2-_	Downwards compatible hardware and/or software change of interfaces:	
	H	HART® version 7
	P	Profibus
	F	Foundation Fieldbus
	M	Modbus
	X	all interfaces
3-_	Downwards compatible hardware and/or software change of inputs and outputs	
	I	Current output
	F, P	Frequency output, pulse output
	S	Status output
	C	Control input
	CI	Current input
	X	all inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed	

Table 1-1: Description of changes

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

Release date	Electronic revision	Changes and compatibility	Documentation
2018-09	ER 4.0.0_	5	MA OPTISONIC 6300 R01

Table 1-2: Changes and effect on compatibility

1.2 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.

1.3 Certification

CE marking

The manufacturer certifies successful testing of the product by applying the CE marking.

This device fulfils the statutory requirements of the relevant EU directives.

For full information of the EU directives and standards and the approved certifications, please refer to the EU Declaration of Conformity or the website of the manufacturer.

Other approvals and standards

For more information, please refer to the dedicated documentation.

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

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

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

1.4.2 Disclaimer

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

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

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

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

1.4.3 Product liability and warranty

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

1.4.4 Information concerning the documentation

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

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

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

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

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

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

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

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

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

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

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

LEGAL NOTICE!
This note contains information on statutory directives and standards.

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

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

1.5 Safety instructions for the operator

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

2.1 Scope of delivery

INFORMATION!
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

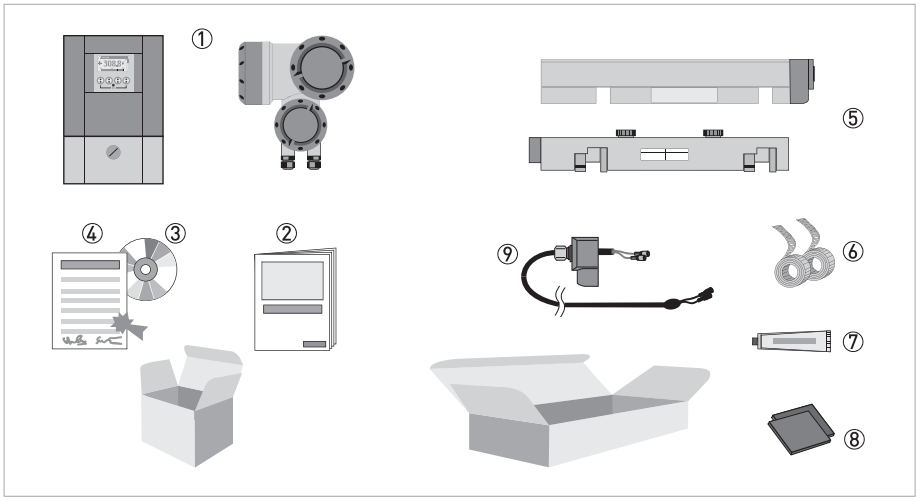


Figure 2-1: Scope of delivery

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.

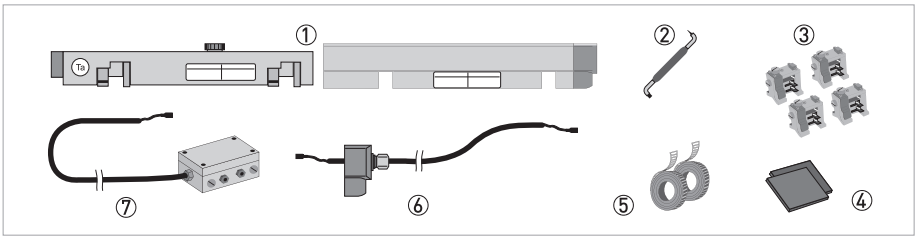


Figure 2-2: Additionally for large version

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!

2.2 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).

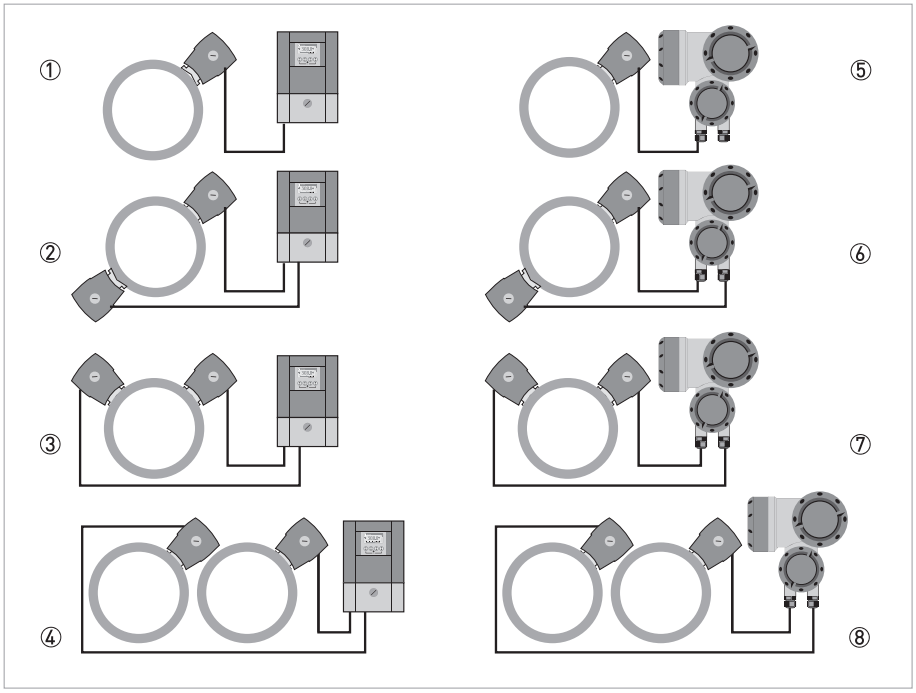


Figure 2-3: System configuration possibilities

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 28.

2.2.1 Field housing

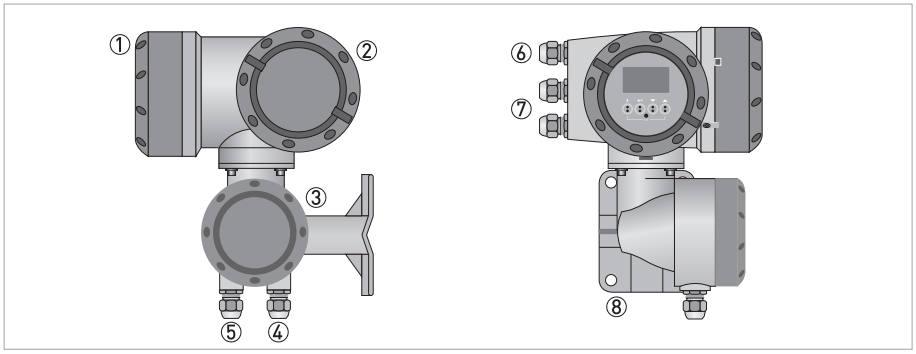


Figure 2-4: Construction of the field housing

① Cover for electronics and display
② Cover for power supply and inputs/outputs terminal compartment
③ Cover for flow sensor terminal compartment
④ Use cable entry 4 and/or 5 for flow sensor signal cable
⑤ (see ④)
⑥ Cable entry for power supply
⑦ Cable entry for inputs and outputs
⑧ Mounting plate for pipe and wall mounting

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

2.2.2 Wall housing

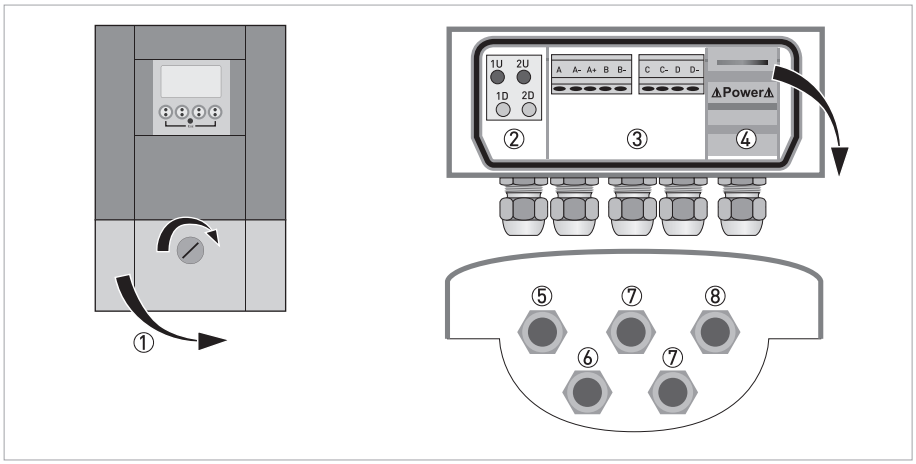


Figure 2-5: Construction of wall-mounted housing

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

2.3 Nameplates

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

2.3.1 Overview of the nameplates (examples)

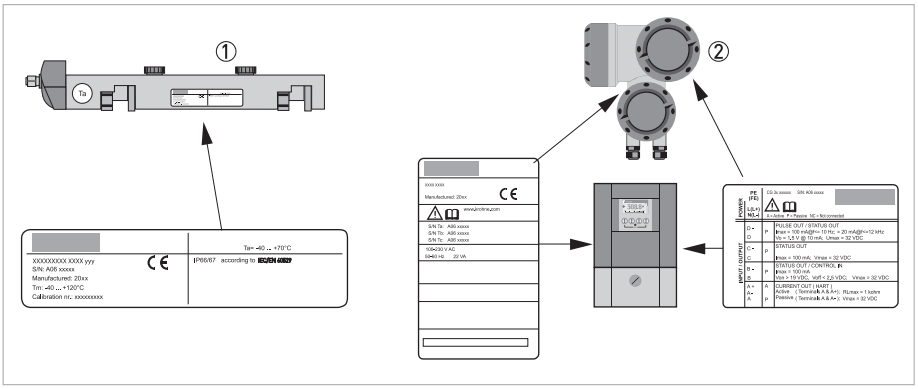


Figure 2-6: Visual check

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

2.3.2 Examples of nameplates on the signal converter

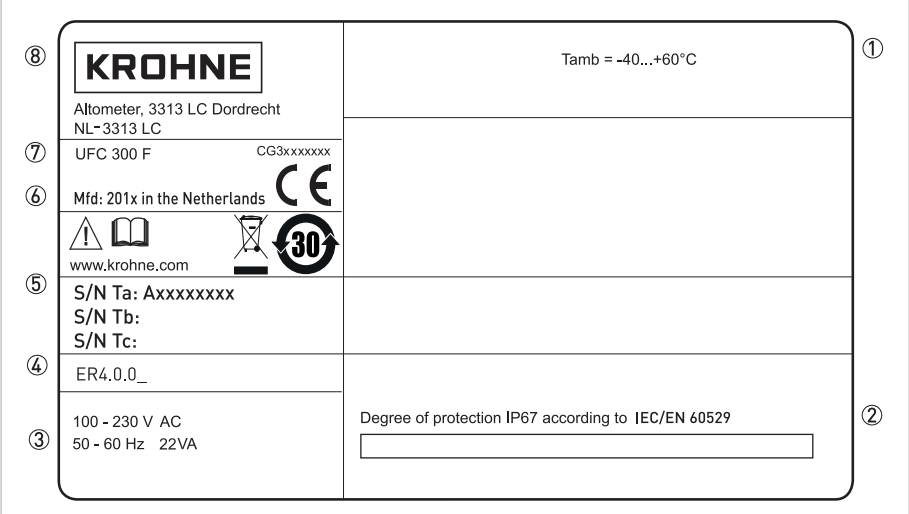


Figure 2-7: Example of nameplate UFC 300 F (field version)

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

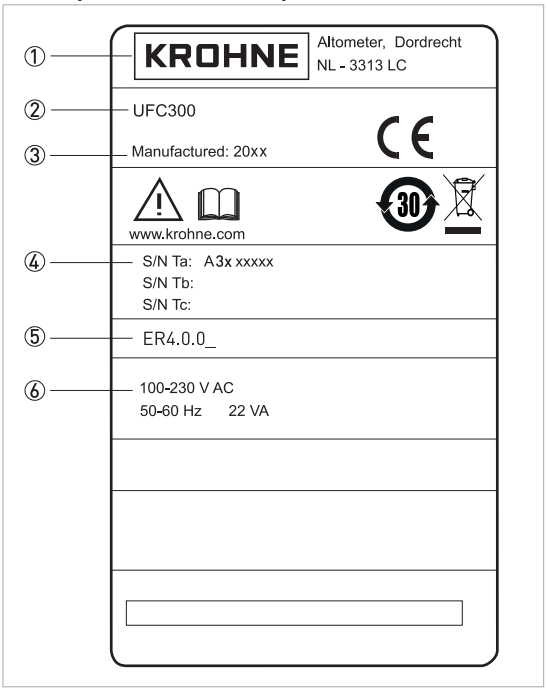


Figure 2-8: Example nameplate (wall version)

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

2.3.3 Nameplate for the measuring sensor

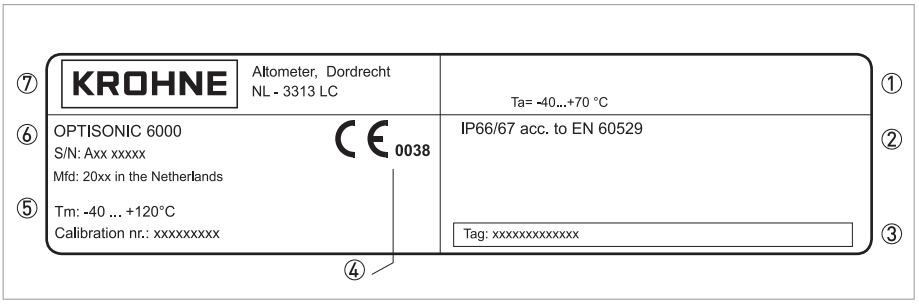


Figure 2-9: Nameplate of the flow sensor (example)

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

2.3.4 Example of IO nameplate

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

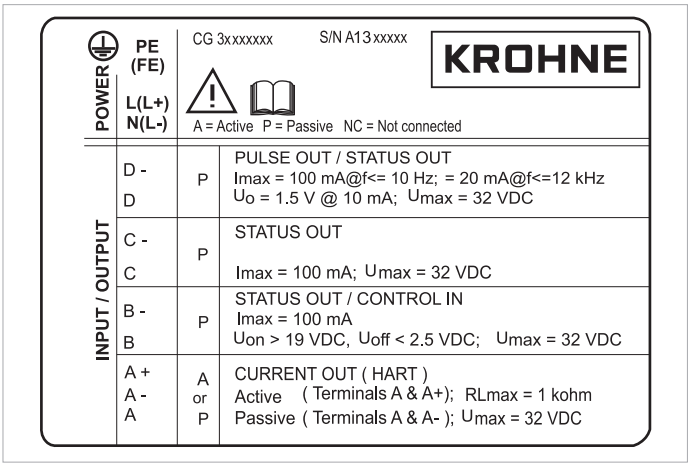


Figure 2-10: Nameplate inputs / outputs

- 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

3.1 General notes on installation

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

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

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

3.2 Storage

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

3.3 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.

3.4 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 44

3.5 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. The measuring devices are tested for a vibration/shock level as described in the chapter "Technical data".*

3.6 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.

3.7 Installation conditions

3.7.1 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.

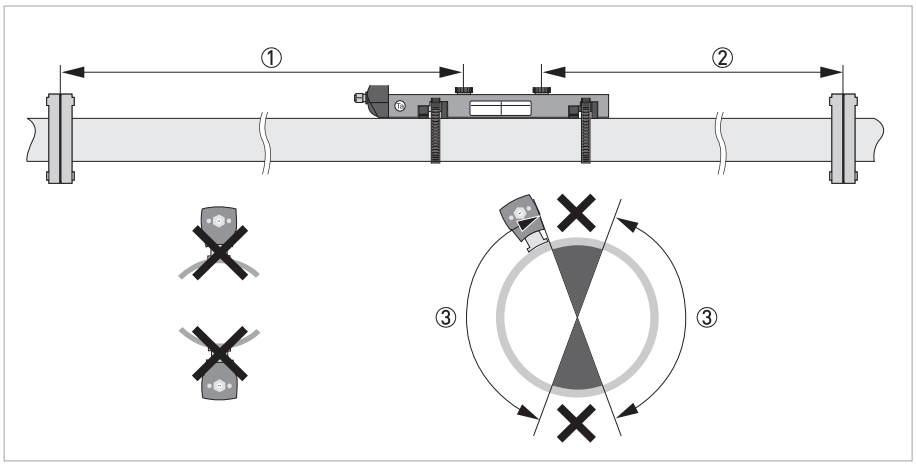


Figure 3-1: Inlet, outlet and recommended mounting area

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.*

3.7.2 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.

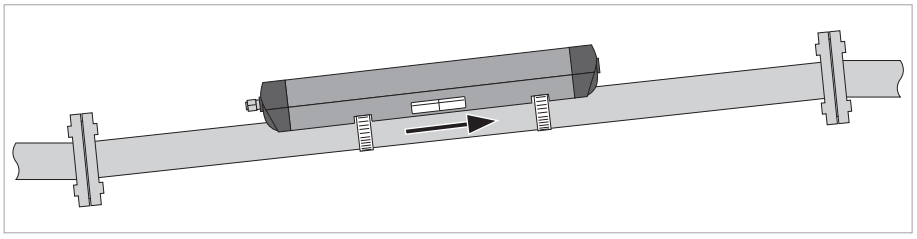


Figure 3-2: Long horizontal pipes

3.7.3 Bends in 2 or 3 dimensions

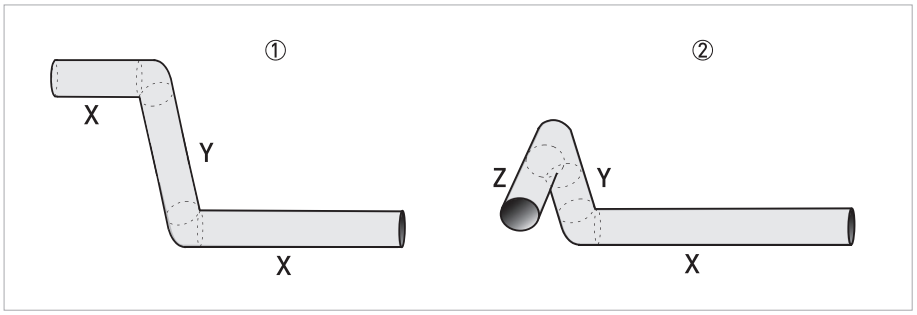


Figure 3-3: 2 and/or 3 dimensional bends upstream of the flowmeter

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).*

3.7.4 T-section

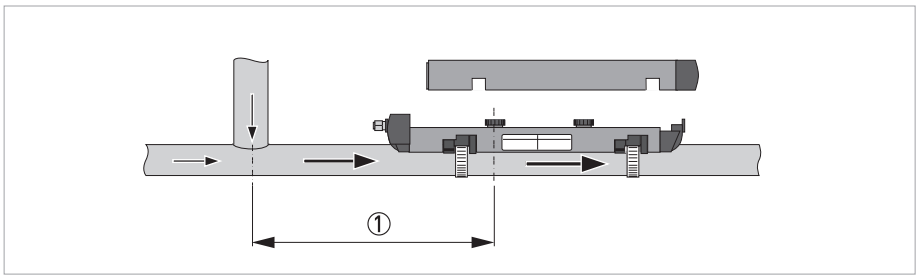


Figure 3-4: Distance behind a T-section

① ≥ 20 DN

3.7.5 Bends

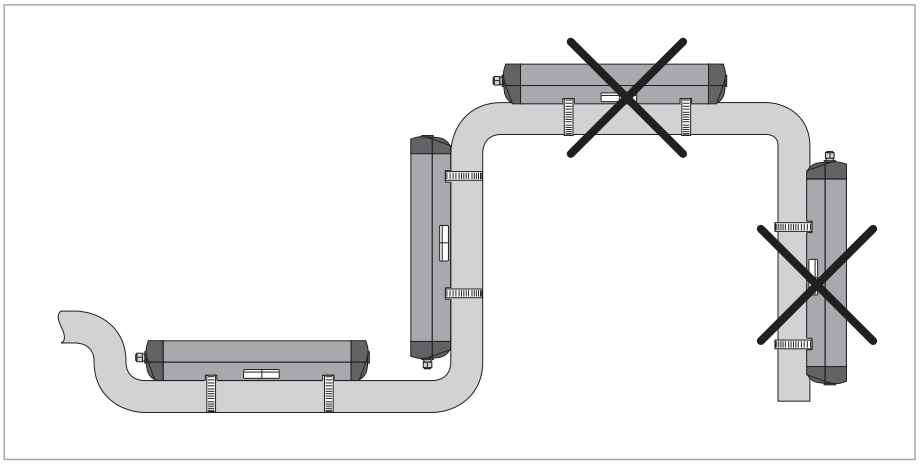


Figure 3-5: Installation in bending pipes

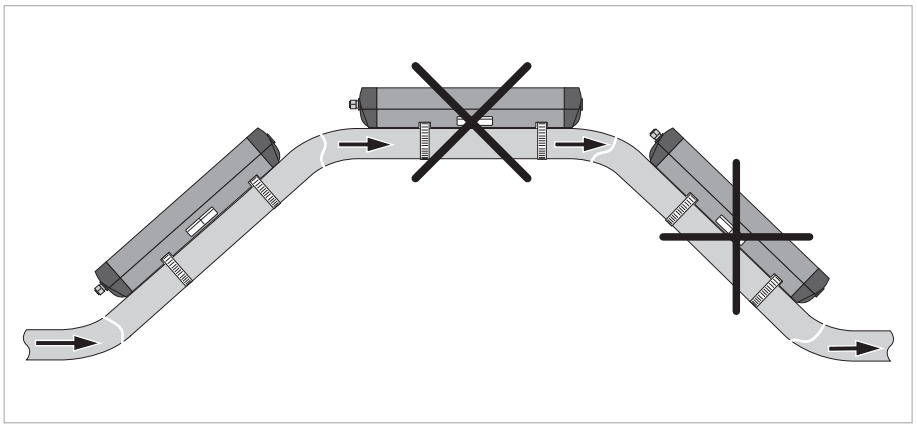


Figure 3-6: Installation in bending pipes

3.7.6 Open feed or discharge

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

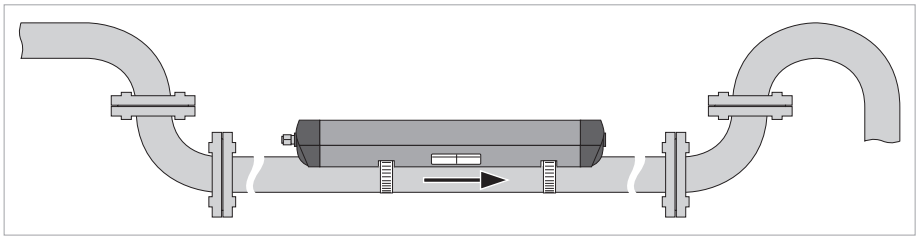


Figure 3-7: Open feed or discharge

3.7.7 Position of pump

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

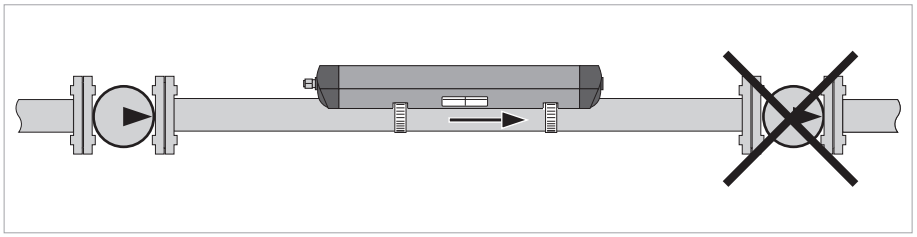


Figure 3-8: Position of pump

3.7.8 Position of control valve

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

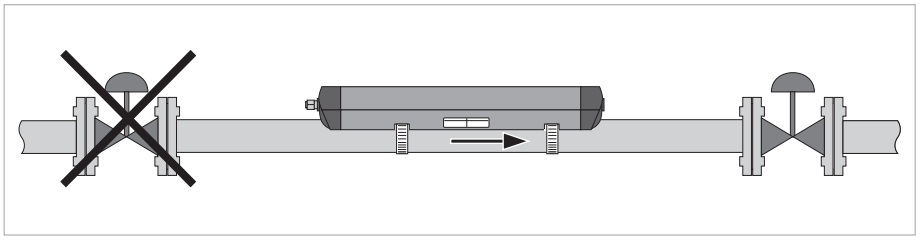


Figure 3-9: Position of control valve

3.7.9 Pipe diameters and sensor construction

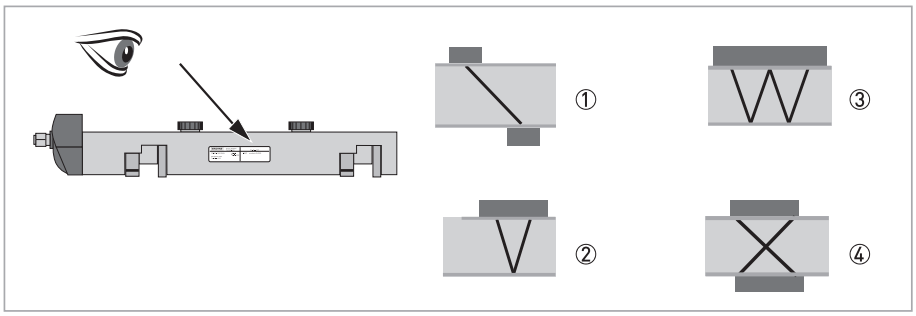


Figure 3-10: Measuring modes

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 3-1: Version and preferred measuring mode

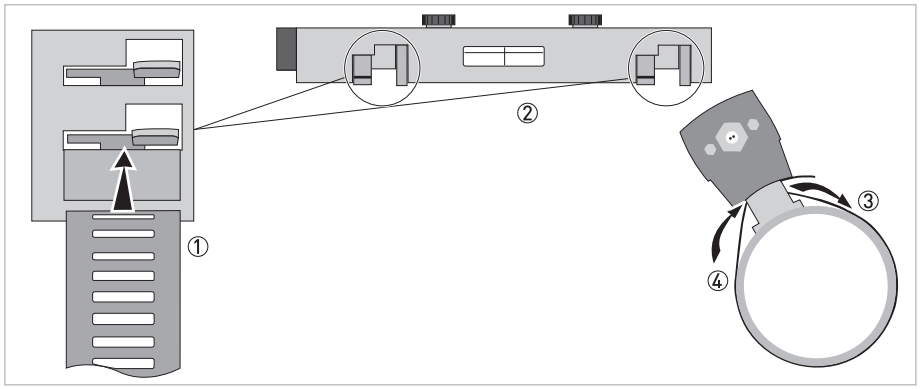
3.7.10 Pipe and media parameters

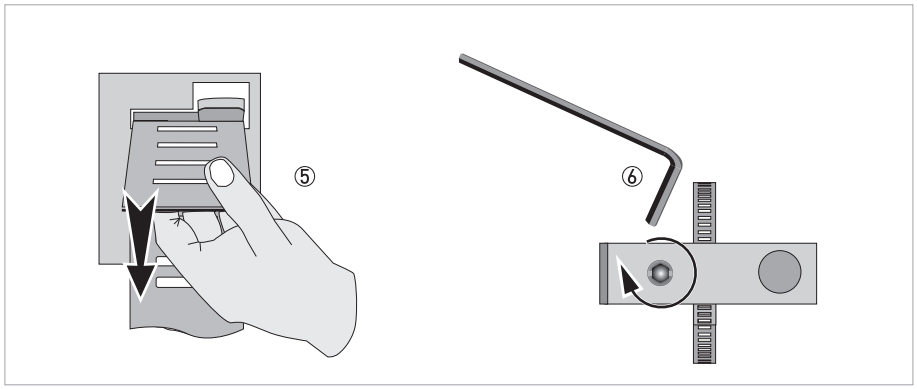
INFORMATION!
Detailed databases of most pipe and media parameters are on the supplied CD.

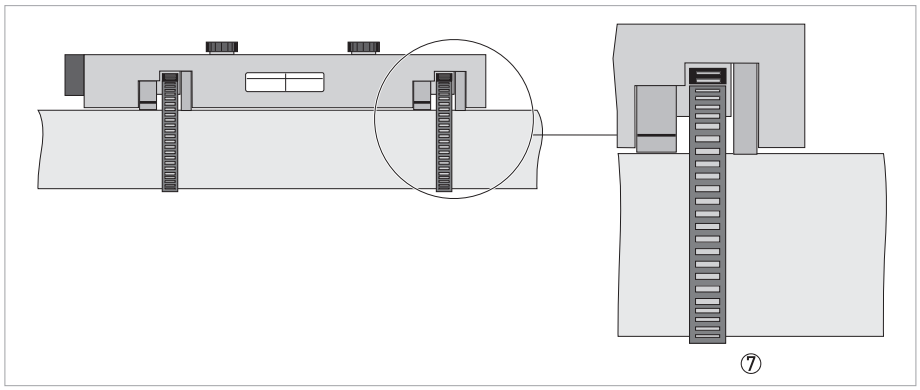
3.8 Installation of the flowmeter

3.8.1 General mechanical installation

Installation of the rails with the metal straps



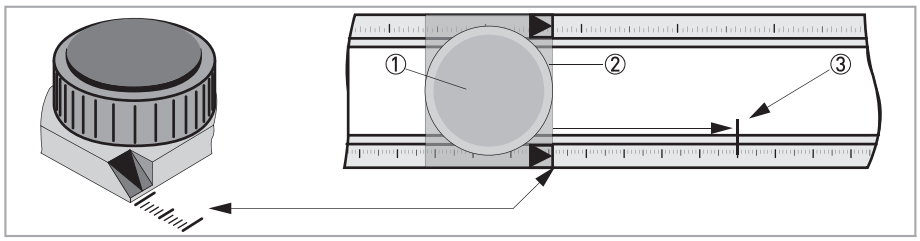




- ① guide one end of the metal strap through the lower strap lock on both the side of the sensor rail ②.
- ③ + ④ wrap both metal strap around the piping.
- ⑤ return the other end of the metal strap through the upper strap lock on both the side of the sensor rail ②.
- ⑥ tighten and lock the strap locks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

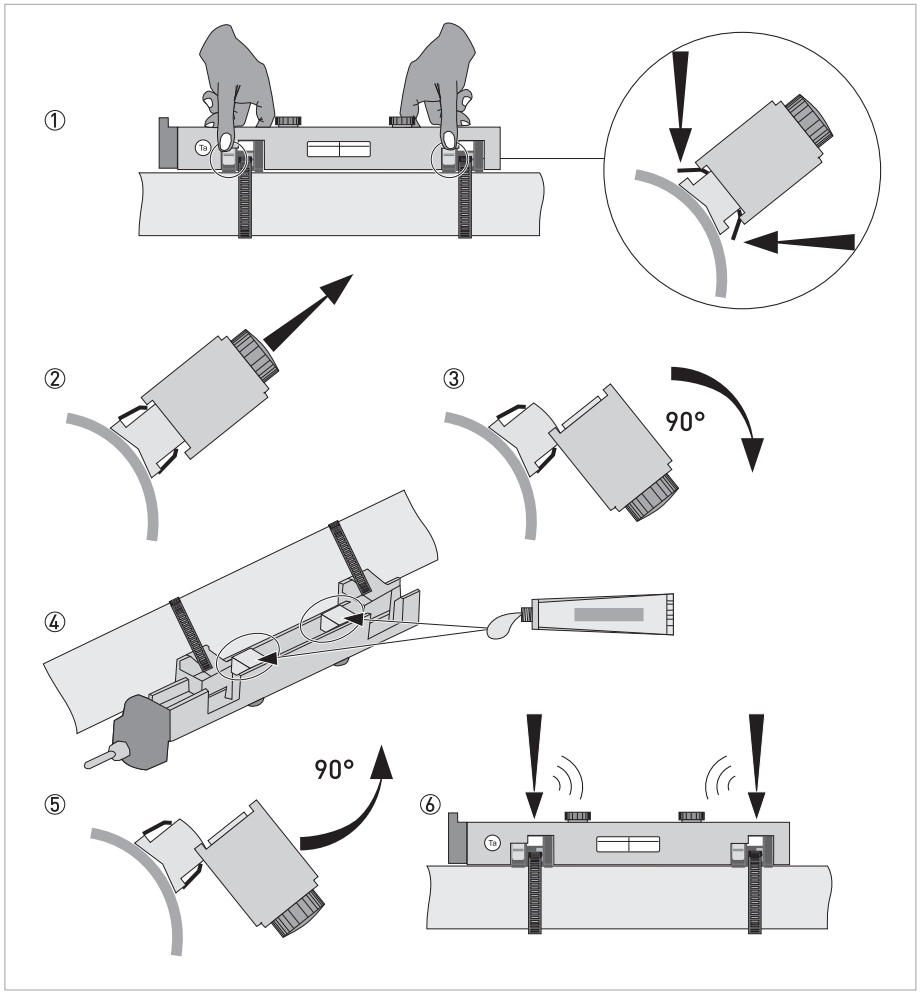
➲ Both sides from sensor rail are secured on the piping ⑦.

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.

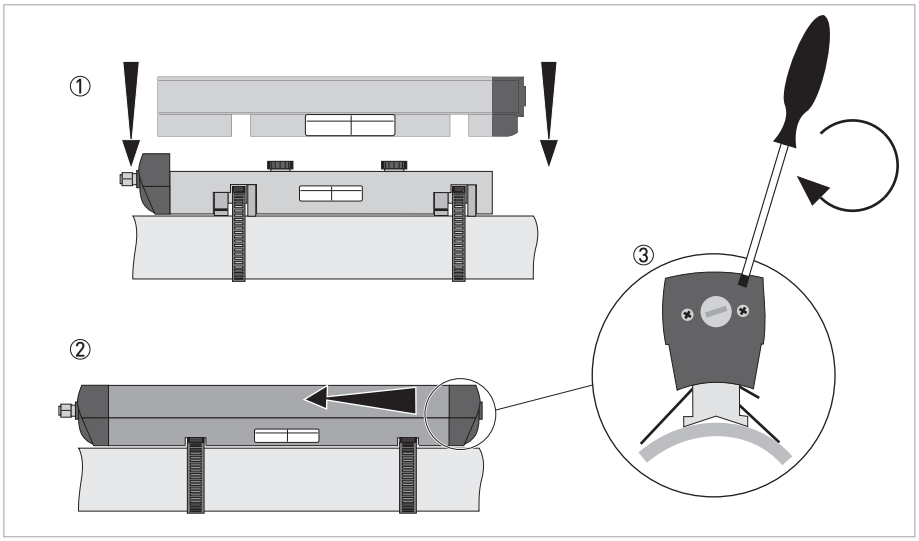
Greasing the transducer surfaces



- 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



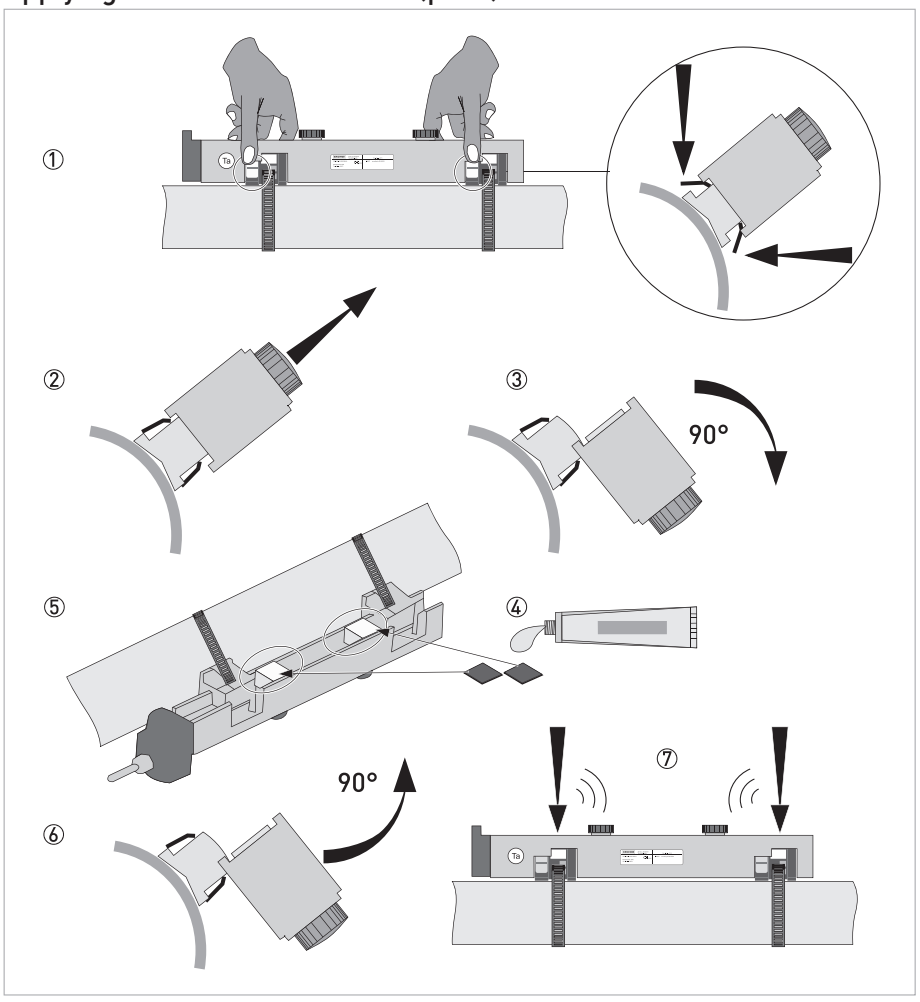
- ① put back the cover, vertically onto the rail
- ② slide cover sidewards and close housing
- ③ secure the cover on the rail housing by turning screw on the side

3.8.2 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.

3.8.3 Installation instructions for small and medium version

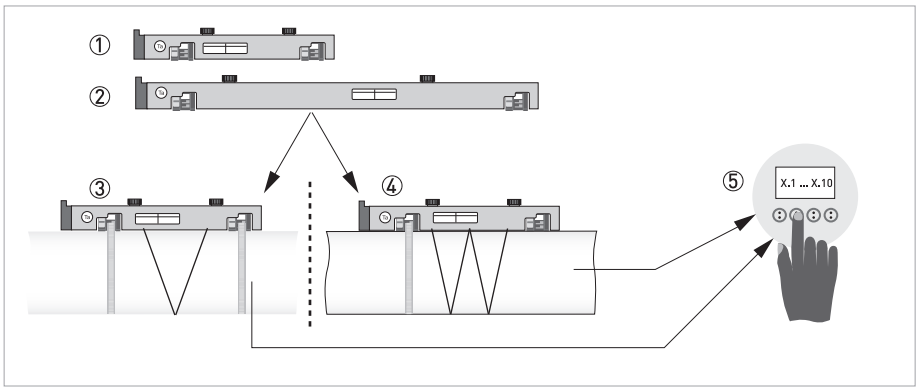


Figure 3-11: Procedure for installation of small or medium version

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

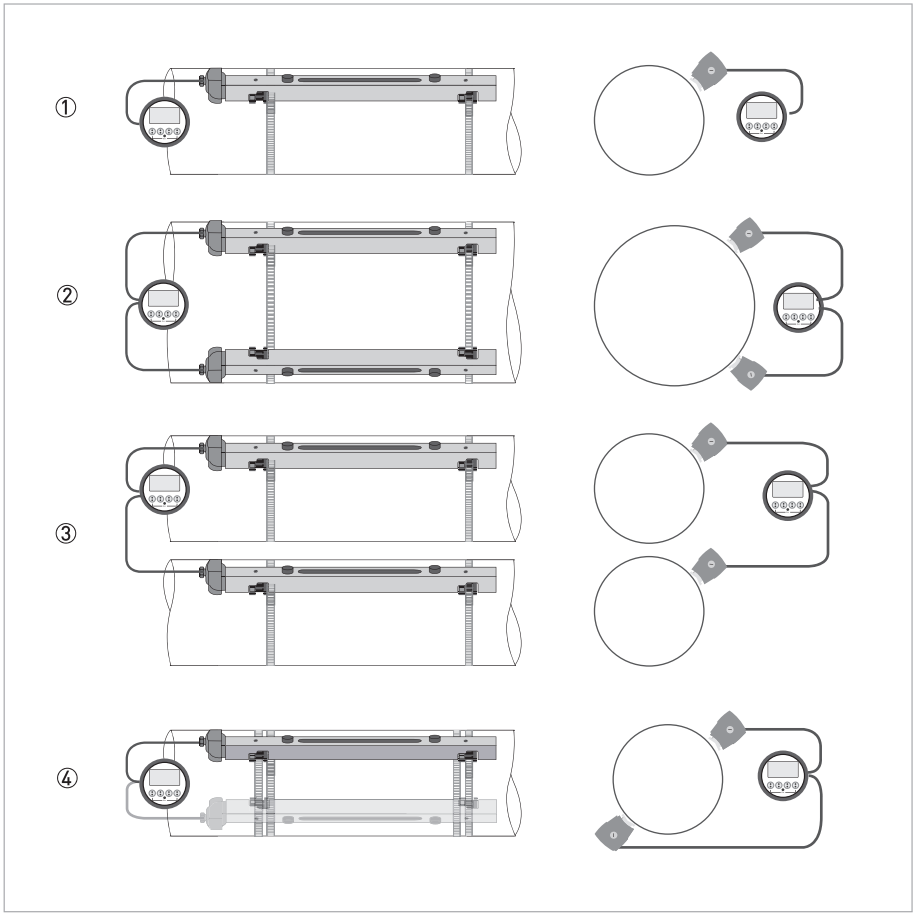


Figure 3-12: Device configurations "Small and Medium"

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".

3.8.4 Mechanical installation of large version

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

3.8.5 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.

Mounting the UP rail

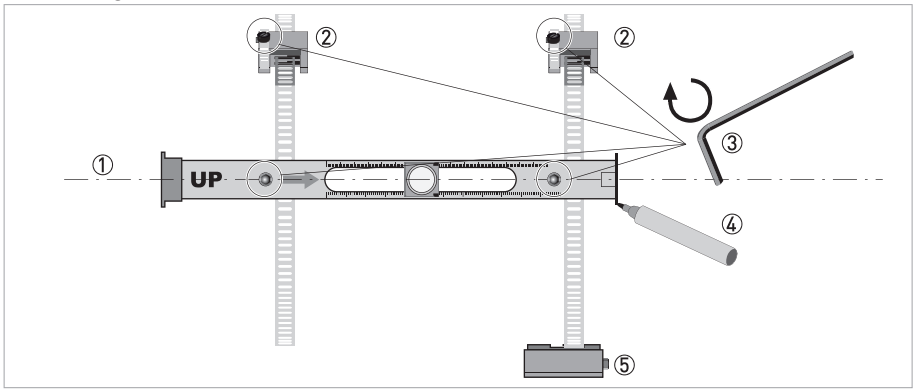


Figure 3-13: Mounting the large rail

① Align the UP rail with the pipeline.
② Fixing units
③ Turn screws clockwise to secure.
④ Mark the position.
⑤ Cable box

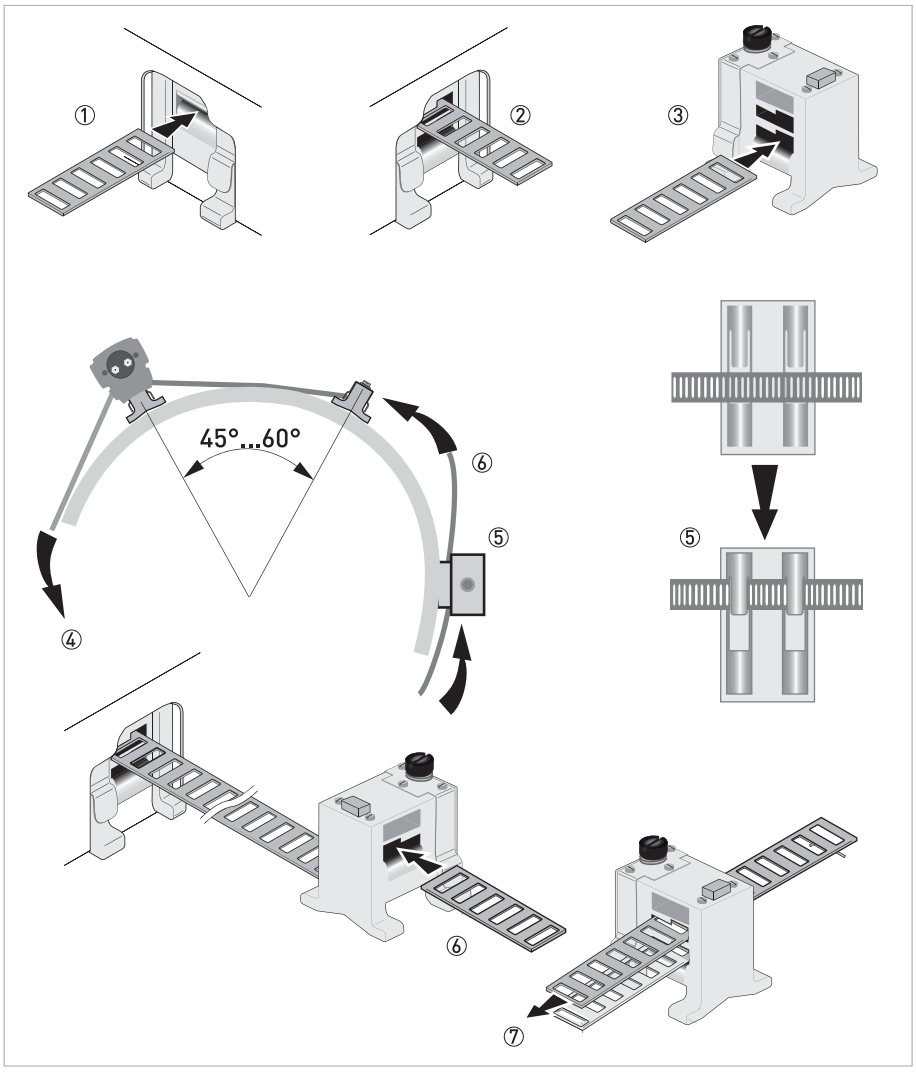


Figure 3-14: Mounting large version rail

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.

3.8.6 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. Both options are described in the following sections.

3.8.7 Find the transducer location with a fixed reference point

- Set the transducer positions for both rails mentioned in the previous table.
- Calculate the half of the circumference.

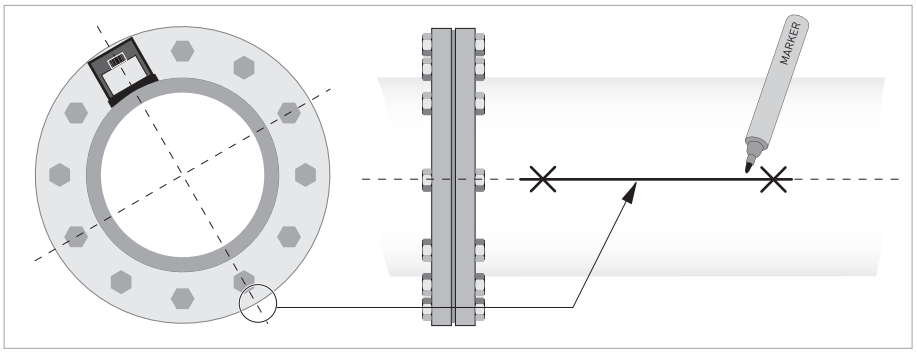


Figure 3-15: Mark this 180° alignment line on the pipe.

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.

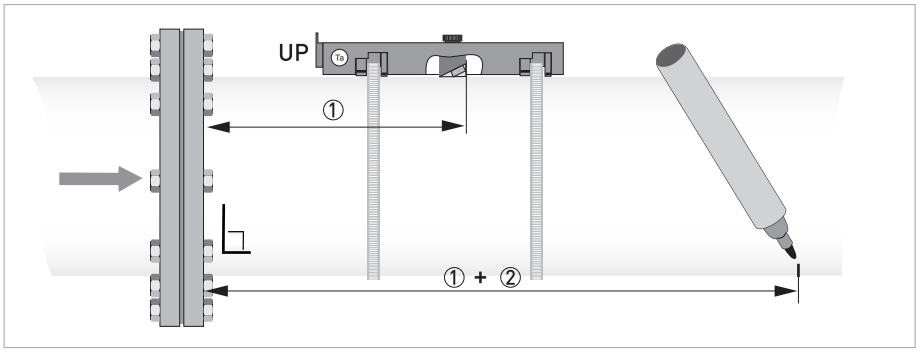


Figure 3-16: Find the opposite location with a reference point

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.

3.8.8 Determine the transducer position with a paper roll

With the use of a paper (or plastic material) roll ①, the position of the transducers at the right position can be found. The next steps need to be followed:

Step 1

- Fit the paper tightly around the pipe ②
- Make sure that both the ends of the paper overlap each other
- Then mark both radial lines of the sides of the paper roll ③
- Cut the paper to the length (C) exactly ④

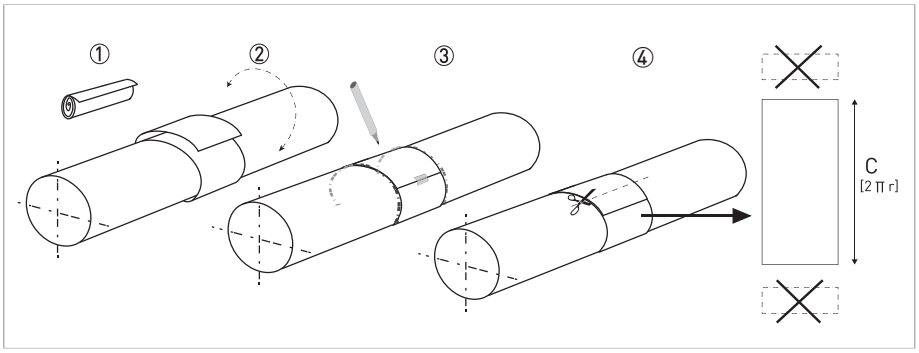


Figure 3-17: Preparing the paper roll template

Step 2

- Fold the paper exactly in half ①
- Put the folded paper back and fit it tightly on the pipe ②

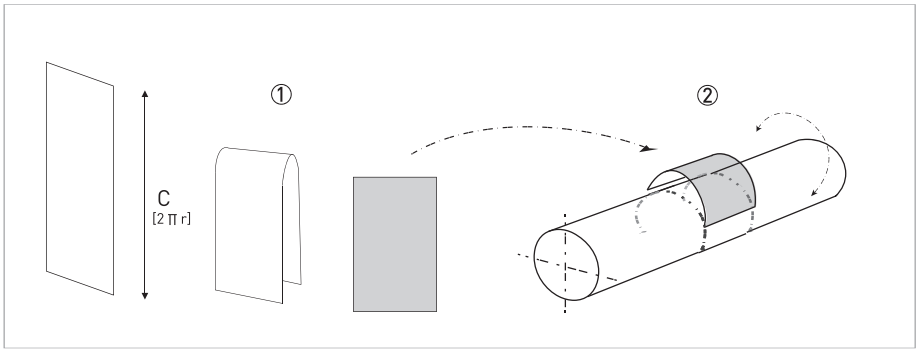


Figure 3-18: Fold paper and place back on pipe line

Step 3

- Mark both ends A and B of the paper on the pipe
- Mark one side of the length C of the paper, perpendicular to both A and B
- Draw the axial lines ③ on the pipeline (from the top and bottom side of the paper roll). Use a straight edge or long ruler

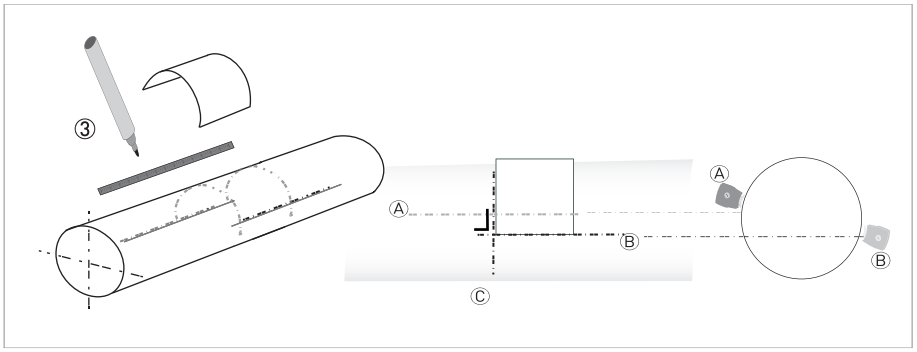


Figure 3-19: Markings on the pipeline

INFORMATION!
Markings A and B correspond with transducer rail A and B (UP and DOWN).
Mark C is the perpendicular line with respect to the lines A and B.

- After marking the lines:

➲ Determine with horizontal lines A/B and the vertical line C, the position of the rails and transducers and place them accordingly

3.8.9 Installing the DOWN rail in Z-mode

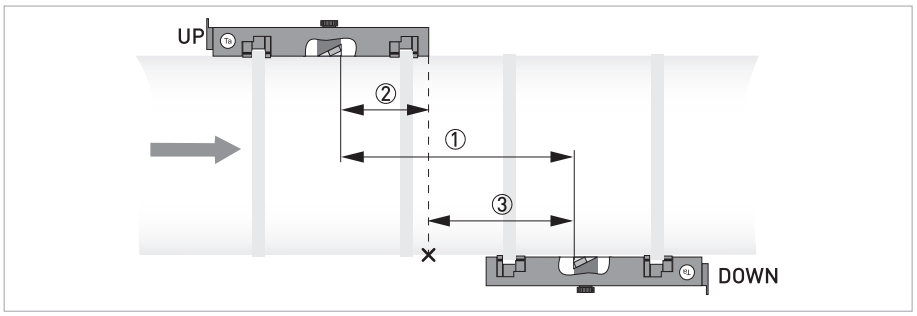


Figure 3-20: Finding the location for the DOWN rail

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, refer to *General mechanical installation* on page 28

INFORMATION!
Continue with the instructions as described in the section refer to General instructions for programming on page 94.

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

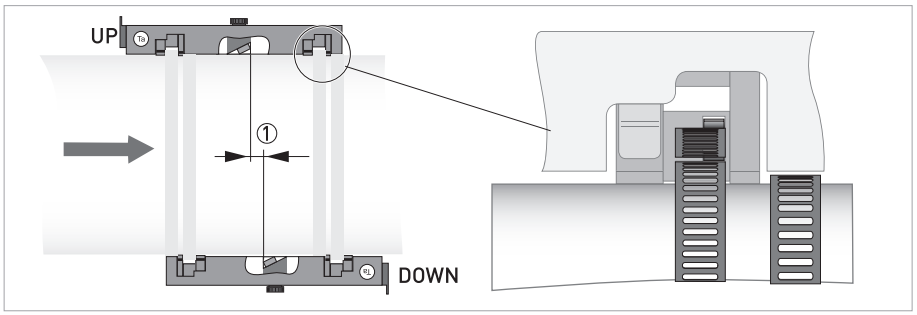


Figure 3-21: Transducers almost opposite, distance small ①

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

Installing 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).

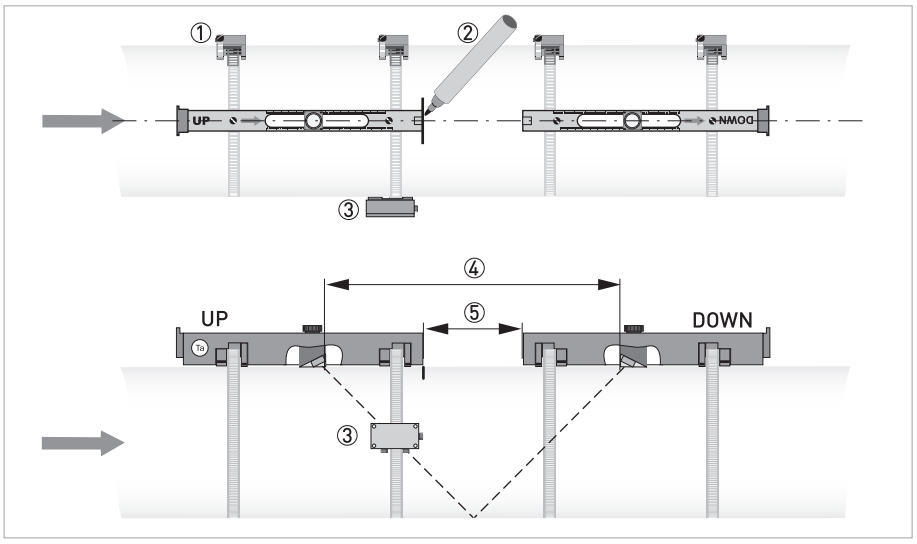


Figure 3-22: Mounting large version in V-mode

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"

- Grease all transducers, see refer to *General mechanical installation* on page 28.

INFORMATION!
Continue with the instructions as described in the section refer to General instructions for programming on page 94.

3.8.10 Configuration instructions for large version

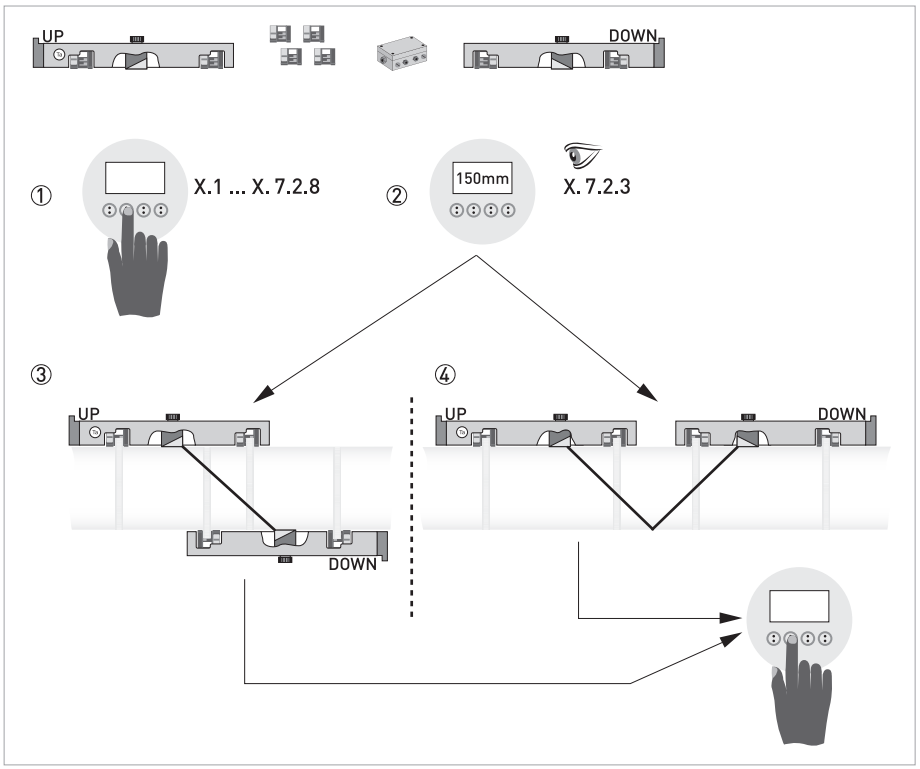


Figure 3-23: Procedure for installation of large version

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

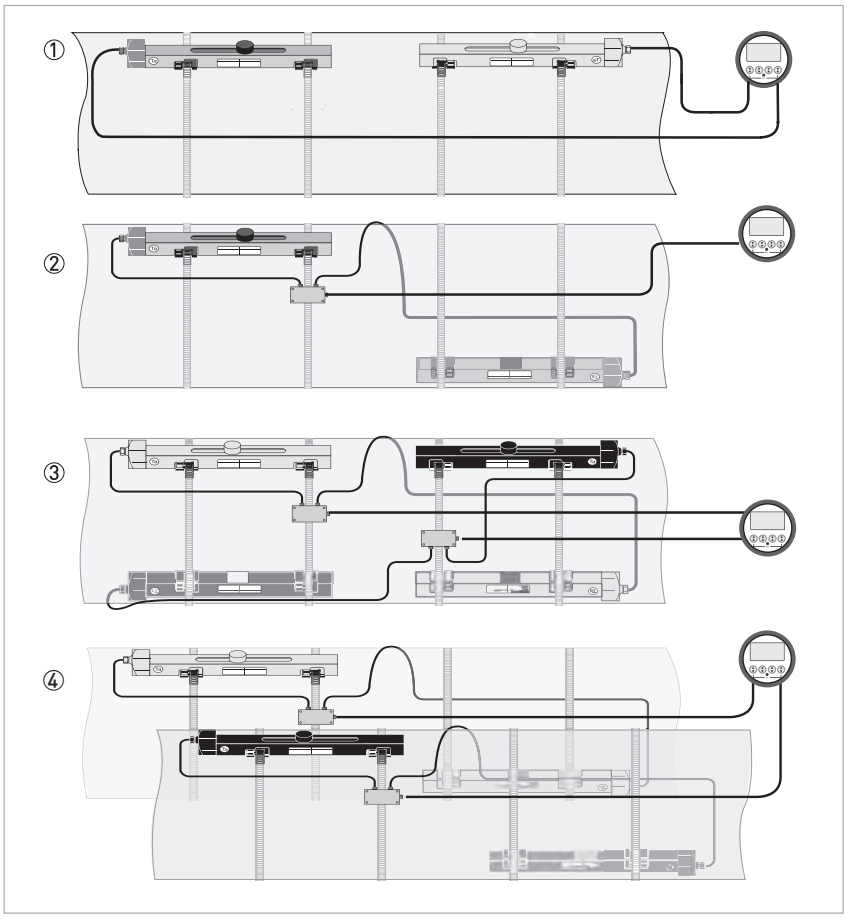


Figure 3-24: Device configurations for "Large" versions

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 94 .

INFORMATION!
Information and details for the mechanical installation and for the electrical connections refer to Electrical connections signal converter on page 54.

3.8.11 Installation instructions for X mode configuration

The X mode measurement version of the unit is setup in a 2 path configuration, with a crossed wire connection of 2 sensors.

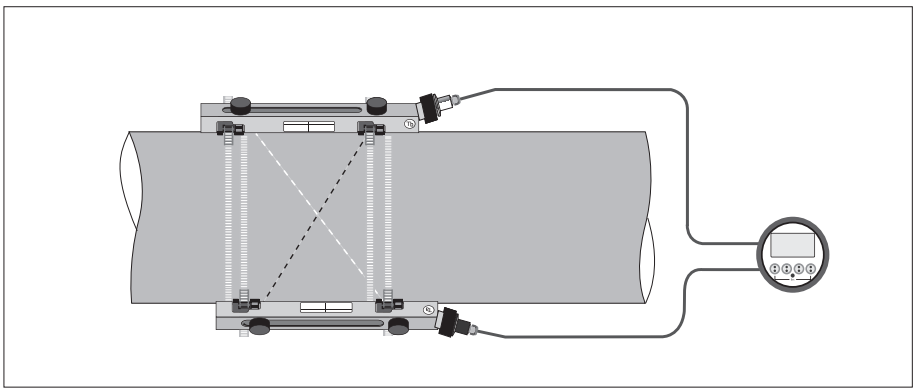


Figure 3-25: X beam configuration of medium version

Install the sensors according to the above image. Make sure that the two rails are installed exactly on opposite sides of the pipe.
Connect the sensors according to the following instruction:

Sensor Ta

- Blue cable: U1
- Green cable: D2

Sensor Tb

- Blue cable: U2
- Green cable: D1

Set up

Programming of the sensor setup (transducer 1 settings) in the installation menu X :

- Set menu item X4.2 = number of paths → 2
- Set menu item X7.3 = number of traverses → change to 1 traverse
- Set menu item X7.4 = transducer distance →
  the exact distance between up transducer of Ta to the down transducer of Tb
- Repeat the process for transducer 2

3.9 Installation of the converter

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

CAUTION!
Always use the supplied signal cable. Keep the distance between the sensor and the signal converter as short as possible.

3.9.1 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.

3.9.2 Pipe mounting

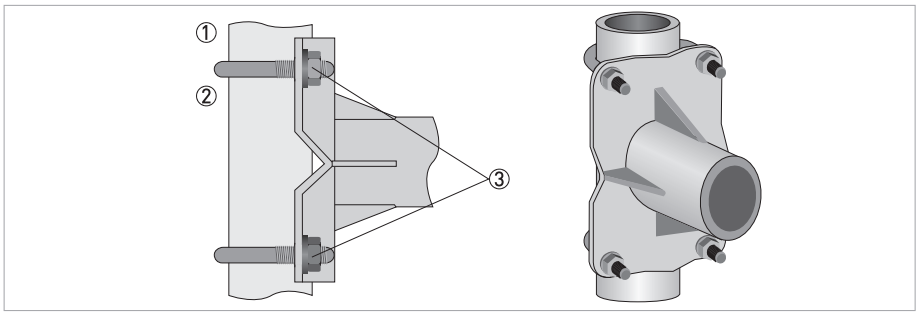


Figure 3-26: Pipe mounting of the field housing

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

3.9.3 Wall mounting

Mounting the field version (F) on the wall

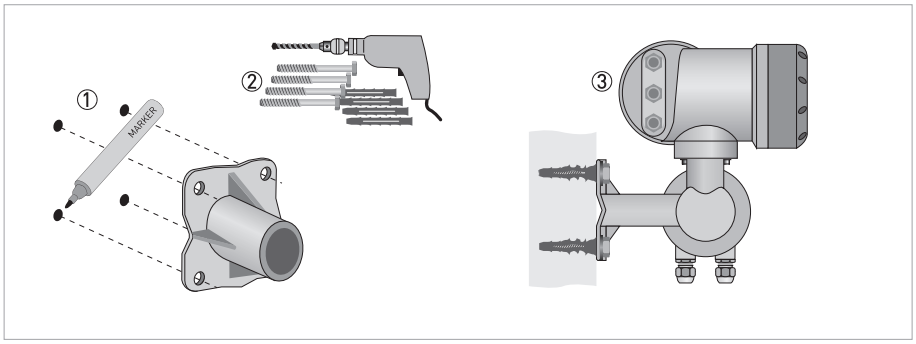


Figure 3-27: Wall mounting of the field housing

① Prepare the holes with the aid of the mounting plate.
further information refer to *Mounting plate of field housing* on page 191.
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.

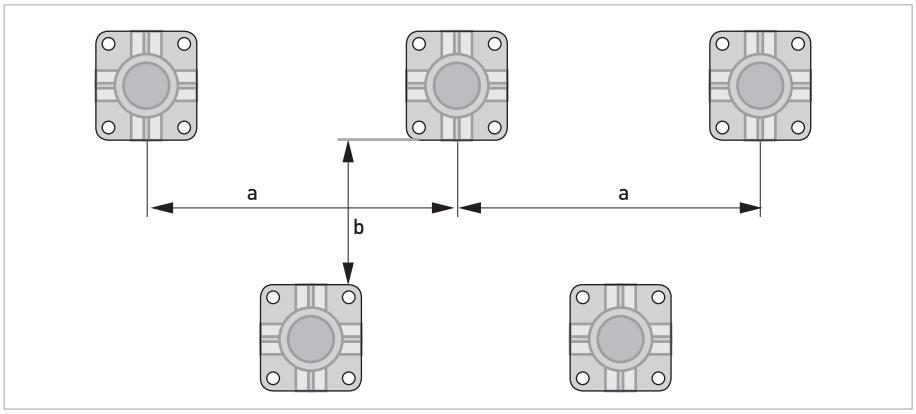


Figure 3-28: Mounting multiple devices next to each other

a ≥ 600 mm / 23.6"
b ≥ 250 mm / 9.8"

Mounting the wall version (W)

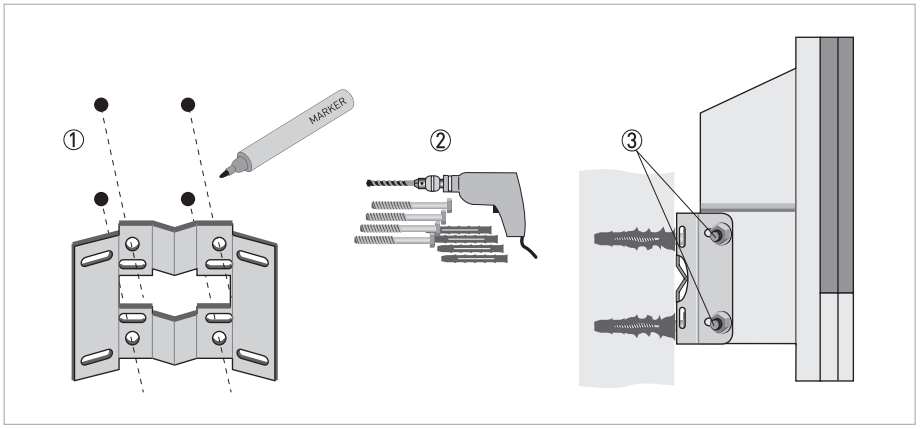


Figure 3-29: Wall mounting of the wall-mounted housing

① Prepare the holes with the aid of the mounting plate. For further information refer to *Mounting plate of wall-mounted housing* on page 191.
② Fasten the mounting plate securely to the wall.
③ Screw the signal converter to the mounting plate with the nuts and washers.

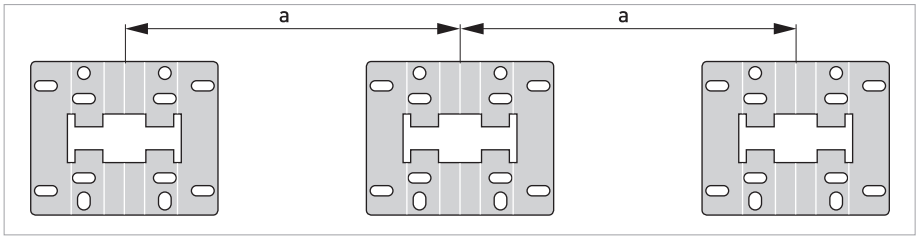


Figure 3-30: Mounting multiple devices next to each other

a ≥ 240 mm / 9.4"

3.9.4 Turning the display of the field housing version

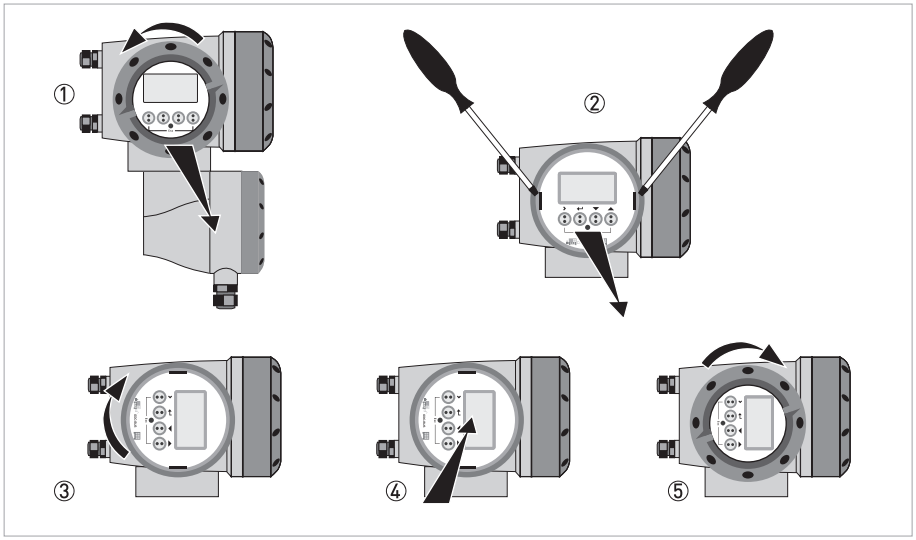


Figure 3-31: Turning the display of the field housing version

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.

3.10 Installation for energy measurement

The combination of the measured flow rate and a temperature difference over a heat/cold producer/consumer can be used to determine the amount of energy used by that device. The temperature difference can be measured with temperature transmitters, connected to the signal converter. In this case, the temperature difference is determined by measuring the temperature before and after the heat/cold producer/consumer.

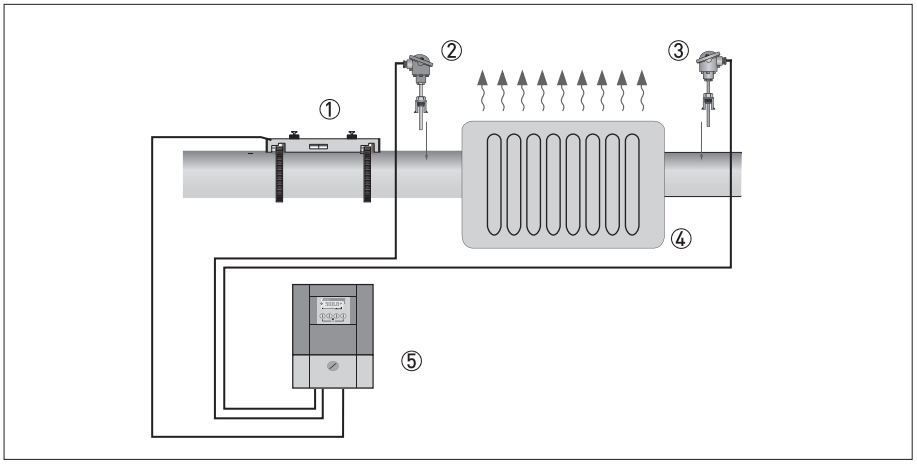


Figure 3-32: Energy measurement of heat/cold producer/consumer

① Mounted rail (in any measuring mode)
② PT 100 temperature sensor with 4-20 mA transmitter, upstream of the heat/cold producer/consumer
③ PT 100 temperature sensor with 4-20 mA transmitter, downstream of the heat/cold producer/consumer
④ Radiator
⑤ Converter

INFORMATION!

Please find more detailed information in the following section.

3.10.1 Preparation of energy measurement

① Install a flow measurement as described in the previous chapter.
② Temperature sensors including 0(4)-20 mA transmitters should be used.
③ Connect the temperature sensors correctly according to the connection diagram (refer to *Connection diagrams of inputs and outputs* on page 72).

Temperature sensors are available on site:

Make sure that the temperature sensors to be used, are available on site and/or installed already at the measuring point. The specific type must be suitable for proper use with the 4...20 mA current input of the I/O connections of the UFC 300 signal converter.

3.11 Program the converter for energy measurement

Three settings must be programmed in order to measure the amount of energy.

3.11.1 Program the I/O input

- Go to menu C4 via "Setup ▸ I/O ▸ hardware"

Δ I/O 4.1
- - - ▸ **hardware** - - -

- Select "terminals A" and "terminals B" as "current input"

Δ current in A 4.2.1
- - - ▸ **range 0%....100%** **04.0...20.0 mA** extended range

Δ current in B 4.3.1
- - - ▸ **range 0%....100%** **04.0...20.0 mA** extended range

If another energy set is used, choose the required values.

INFORMATION!
The "Extended range A/B 0% and 100%" are meant for an alarm function. If a value is measured that is lower than the "Extended range A/B 0%" value or higher than the "Extended range A/B 100%" value, a warning "Over range xx" will appear.

3.11.2 Program the process input

- Go to menu C1.10 via "Setup ▸ Process input ▸ flow mode ▸ "

Δ process input C1.10
standard **flow mode ▸** cold

or

Δ process input C1.10
standard **flow mode ▸** **heat**

- Choose "Heat" or "Cold" to activate energy measurement.

Δ process input C1.14
A: supply B: return **current inputs ▸** **A: supply B: return**

- Choose in "current inputs ▸ " which sensor is located at the supply side of the process.

INFORMATION!
In case the function is "Heating", the temperature at the "supply" side is the highest.
In case the function is "Cooling", the temperature at the "supply" side is the lowest.

Manually entering the temperature values

- If there are no temperature sensors available for connecting, set the "Temperature input" to "Fixed".

Δ process input C1.11
Flow mode **Temperature inputs fixed** ▸ Supply temperature

- Set the location of the flow sensor (supply or return side of the installation) in order to calculate the correct specific heat of the liquid.
- Check if the shown fluid is correct.

INFORMATION!

The type of fluid is set in the flow sensor installation wizard. In case the fluid is set to water-glycol mixture in the flow sensor installation wizard the concentration of glycol in water can be set in the heating/cooling setup menu.

Δ process input C1.14
Temperature input **current inputs** ▸ A: supply B: return Flow sensor

3.11.3 Program the totalisers

- Go to menu C5 I/O Totalisers and select a totaliser for counting energy.

Δ totaliser C5._.1
Function of totaliser ▸ sum totaliser Measurement

- At the "Function of totaliser", select "Sum" for counting both positive and negative energy flows.
- Select "+ counter" for only counting positive energy flows.
- Select "- counter" for only counting negative energy flows.
- At the "Measurement" option, select "Power". The energy value counter unit is kJ.

3.11.4 Start measurement

The following parameters are available when heating or cooling measurement is switched on:

- Temperature A/B
- Thermal power (power)
- Thermal energy (totalized power)

To setup the display to view those parameters please refer to the display setup paragraph (menu C7).

The unit for energy measurement can be set to Joule (kilo, mega, giga), Wh (kilo, mega) or BTU (kilo, million (MM)). In case any other unit is required the free unit can be used. To setup the free unit go to "Measurement ▸ Setup ▸ Units ▸ ".
First select the power or energy parameter, then select "Free unit". Enter the text for the unit of power.
Then select the W factor for the unit of power that is set in previous step.

The factor for energy is the amount of Joules in the free unit. The factor for power is the amount of Watt in the free unit.

Underneath you find a table with factors for alternative energy units.

Unit of power	Description	W factor (amount of Watt in unit)
Ton (refrigeration)	A ton of refridgeration is defined as the cooling power to melt one short ton (2000 pounds or 907 kg) of ice in a 24 hour period. This is equal to 12000 BTU per hour or 3527 W.	3527
kilo calorie per second	Power required to heat 1 kg of water with 1 degree Celsius in 1 second.	4187

Unit of energy	Description	J factor (amount of Joule in unit)
Ton-hour (refrigeration)	A ton-hour of refridgeration is defined as the energy to melt one short ton (2000 pounds or 907 kg) of ice.	12660000
kilo calorie per second	Amount of heat required to increase 1 kg of water with 1 degree Celsius.	4187
Therm	Equal to 100000 BTU	105506000

4.1 Safety instructions

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

DANGER!
Observe the national regulations for electrical installations!

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

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

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

4.2 Laying electrical cables correctly

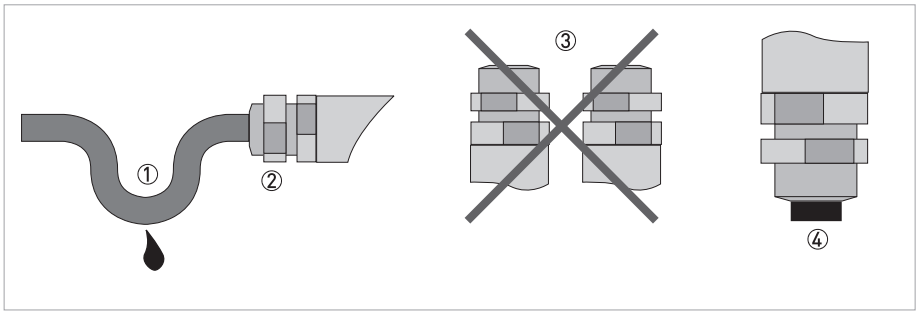


Figure 4-1: Protect housing from dust and water

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.

4.3 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

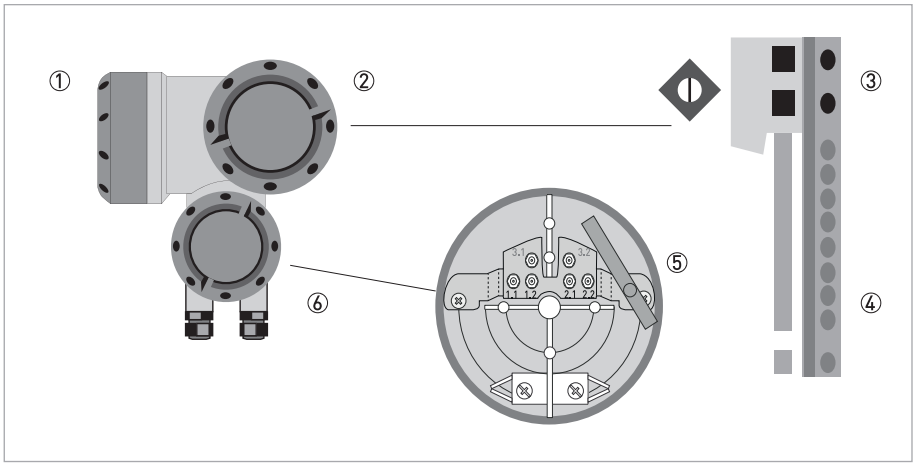


Figure 4-2: Construction of field version

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

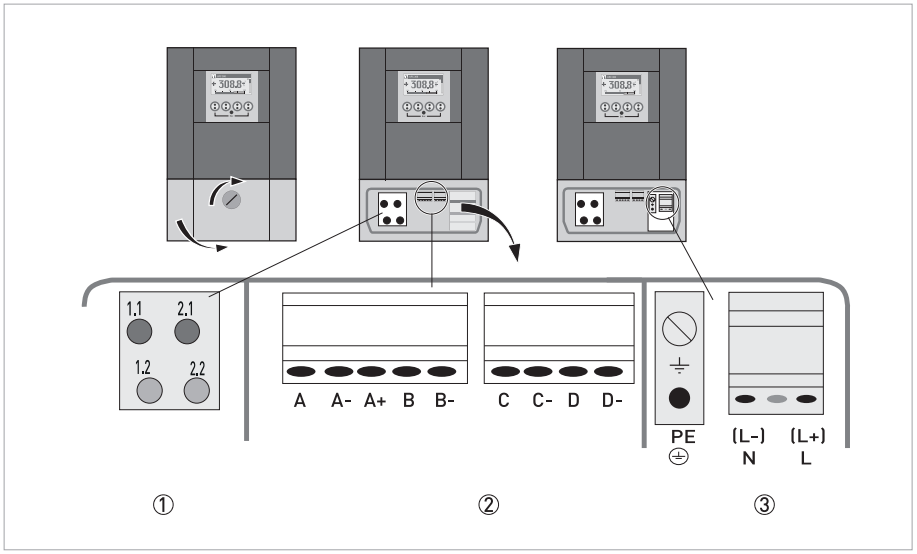


Figure 4-3: Construction of wall version

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.

4.4 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.

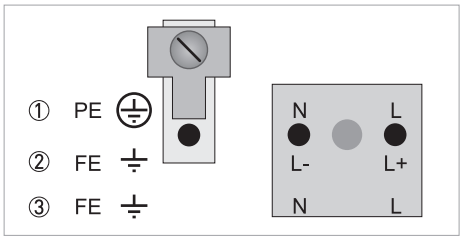


Figure 4-4: Power supply connection

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.

4.4.1 Signal converter power supply connections

Field version

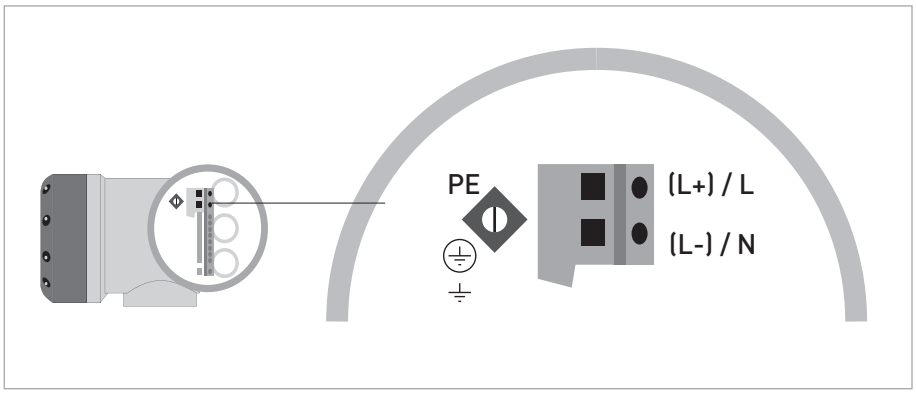


Figure 4-5: Signal converter field version, power supply connections

Wall version

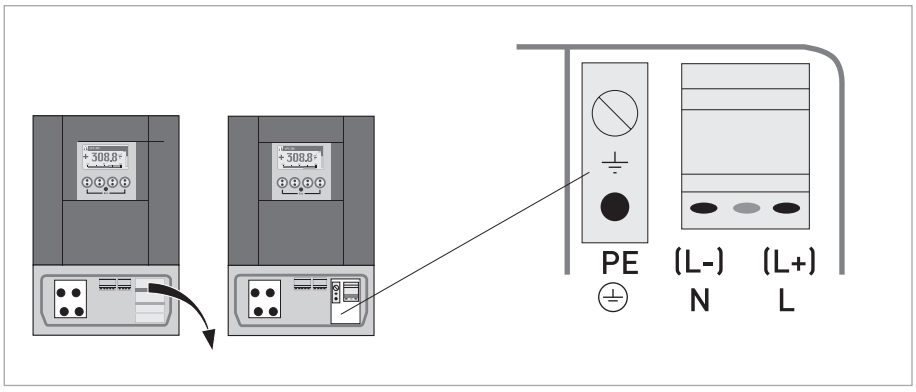


Figure 4-6: Signal converter wall version, power supply

4.5 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.

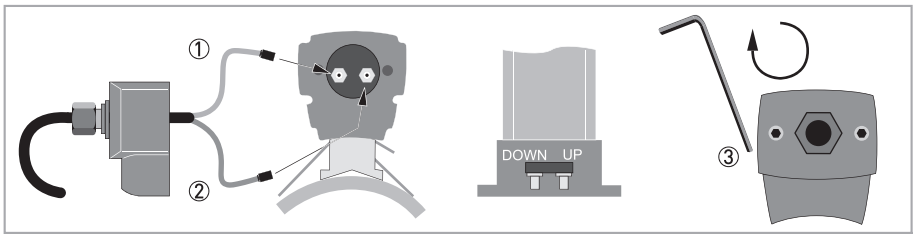


Figure 4-7: Connecting the signal cable to the rail (small and medium version)

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

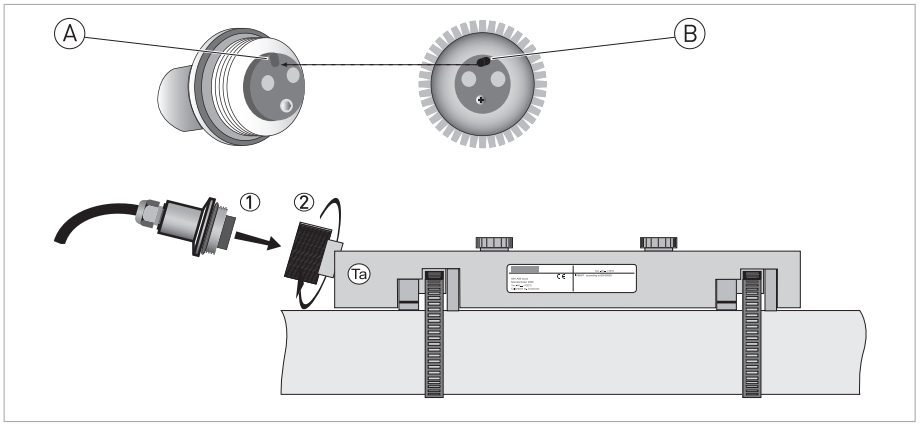


Figure 4-8: Connect the signal cable in case of stainless steel / XT version.

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".

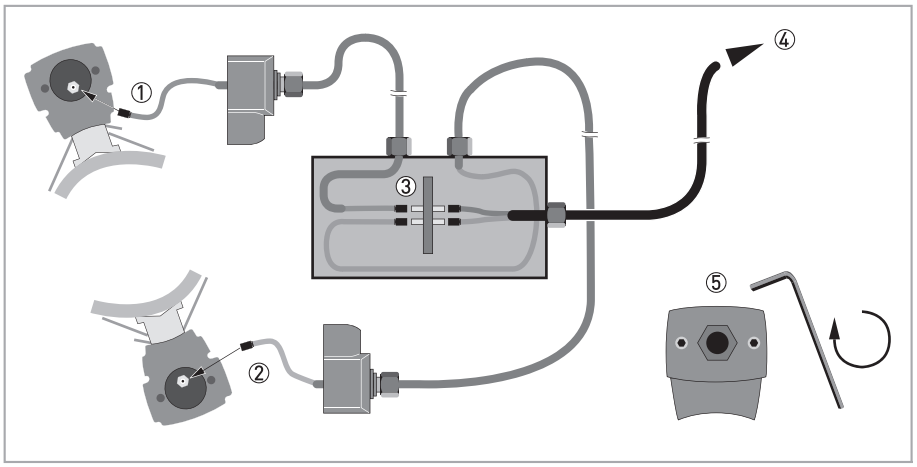


Figure 4-9: Connections in cable box (large version)

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.

4.5.1 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

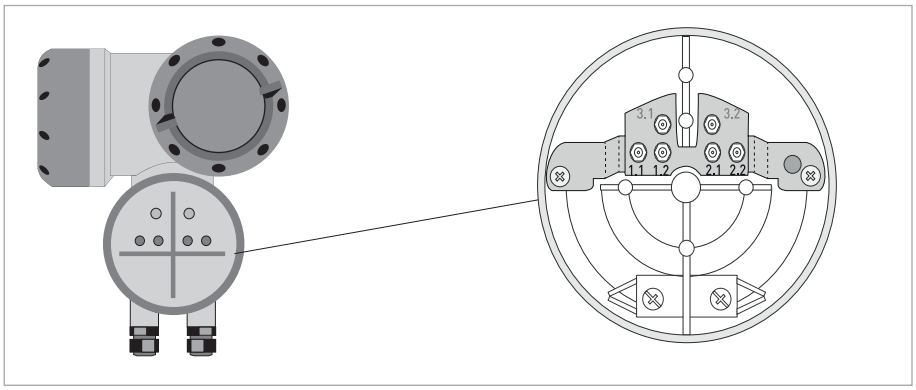


Figure 4-10: Connect signal cable

Construction of console (F-version)

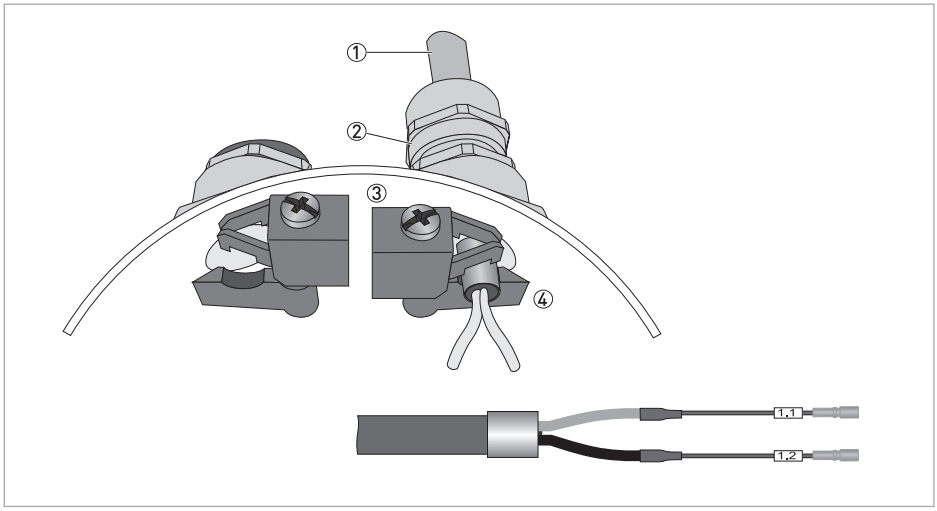


Figure 4-11: Inserting cable and secure with clamp on shielding bush

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

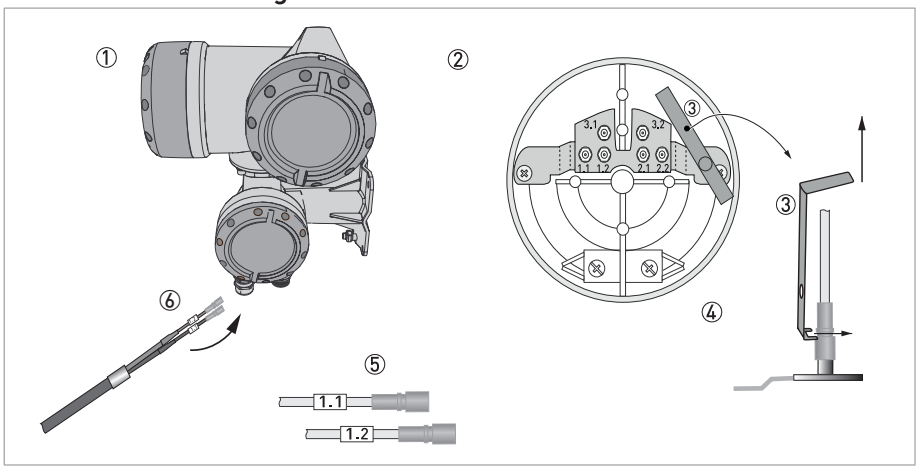


Figure 4-12: Construction of field version

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)

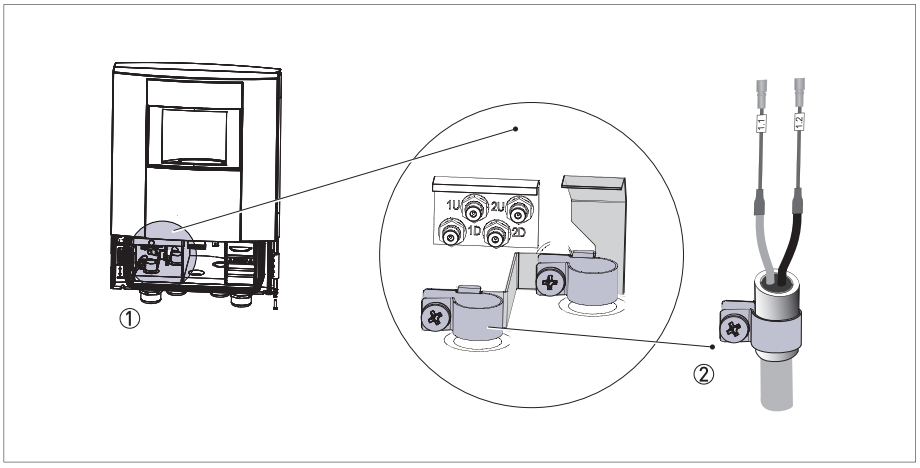


Figure 4-13: Inserting cable and secure with clamp on shielding bush

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

Wall version

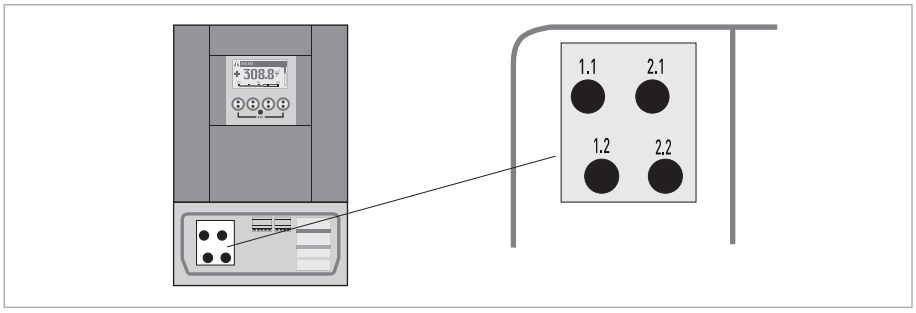


Figure 4-14: Connect signal cable

4.6 Modular inputs/outputs connections

INFORMATION!
- *For further information refer to Electrical connections signal converter on page 54.*
- *For the electrical connection of bus systems refer to the separate documentation for the respective bus systems.*

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

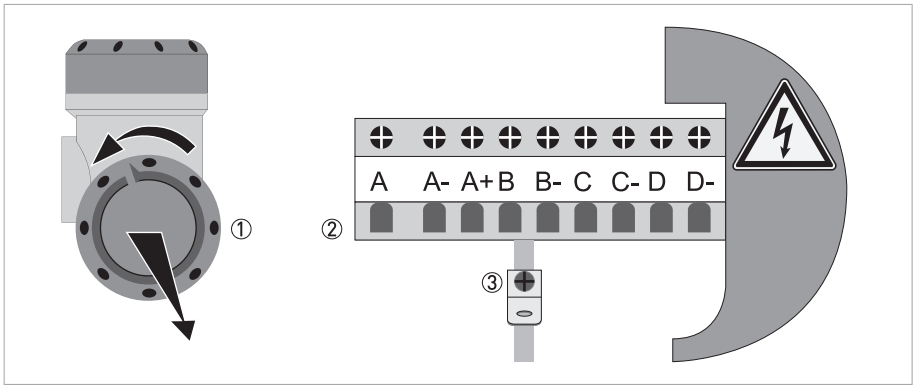


Figure 4-15: Terminal compartment for inputs and outputs of the field housing

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

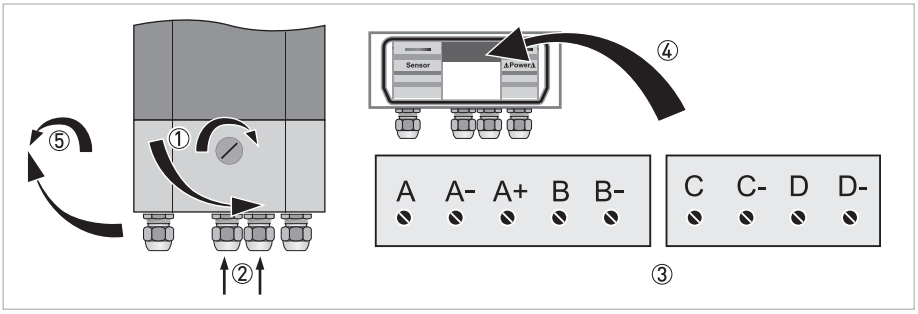


Figure 4-16: Terminal compartment for inputs and outputs of the wall-mounted housing

- 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).

4.7 Inputs and outputs, overview

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

This signal converter is available with the 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.

Bus systems

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

Ex option

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

4.7.2 Description of the CG-number

Figure 4-17: 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.

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

4.7.3 Fixed, non-alterable input/output versions

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

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

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-
Basic I/Os (standard)									
1 0 0		I_p + HART® passive ①		S_p / C_p passive ②		S_p passive		P_p / S_p passive ②	
	I_a + HART® active ①								
Ex i I/Os (option)									
2 0 0						I_a + HART® active		P_N / S_N NAMUR ②	
3 0 0						I_p + HART® passive		P_N / S_N NAMUR ②	
2 1 0		I_a active		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 1 0		I_a active		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 2 0		I_p passive		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 2 0		I_p passive		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 3 0		IIn_a active		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 3 0		IIn_a active		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
2 4 0		IIn_p passive		P_N / S_N NAMUR C_p passive ②		I_a + HART® active		P_N / S_N NAMUR ②	
3 4 0		IIn_p passive		P_N / S_N NAMUR C_p passive ②		I_p + HART® passive		P_N / S_N NAMUR ②	
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.

INFORMATION!
For additional information refer to Function description installation menu on page 95.

4.7.4 Alterable input/output versions

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

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

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

Modular 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

4.8 Description of the inputs and outputs

4.8.1 Control input

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

- All control inputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode: external power supply required:
  $U_{ext} \leq 32$ VDC
- Active mode: use of the internal power supply:
  $U_{nom} = 24$ VDC
- NAMUR mode: in accordance with EN 60947-5-6
  (Active control input to EN 60947-5-6 (NAMUR): signal converter monitors cable breaks and short circuits acc. to EN 60947-5-6. Errors indicated on LC display. Error messages possible via status output).
- For information on the adjustable operating states refer to *Function tables* on page 117.

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

4.8.2 Current output

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

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

INFORMATION!
For further information refer to Connection diagrams of inputs and outputs on page 72 and refer to *Technical data on page 177*.

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

4.8.3 Pulse output and frequency output

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

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

INFORMATION!
For further information refer to Connection diagrams of inputs and outputs on page 72 and refer to *Technical data on page 177*.

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

4.8.4 Status output and limit switch

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

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

INFORMATION!
For further information refer to Connection diagrams of inputs and outputs on page 72.

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

4.8.5 Current input

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

- All current inputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be adjusted.
- Passive mode:
  External power supply required: $U_{ext} \leq 32$ VDC
- Active mode:
  Use of the internal power supply: $U_{nom} = 24$ VDC
- For information on the adjustable operating states refer to *Function tables* on page 117.

INFORMATION!
For further information refer to Connection diagrams of inputs and outputs on page 72 and refer to *Technical data on page 177*.

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

4.9 Connection diagrams of inputs and outputs

4.9.1 Important notes

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

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

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

Description of the used abbreviations

I_a	I_p	Current output active or passive
P_a	P_p	Pulse/frequency output active or passive
P_N		Pulse/frequency output passive acc. to NAMUR EN 60947-5-6
S_a	S_p	Status output/limit switch active or passive
S_N		Status output/limit switch passive acc. to NAMUR EN 60947-5-6
C_a	C_p	Control input active or passive
C_N		Control input active acc. to NAMUR EN 60947-5-6: 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	IIn_p	Current input active or passive

4.9.2 Description of the electrical symbols

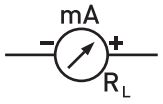
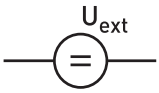
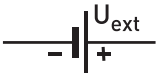
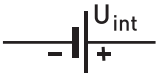
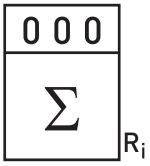
	mA meter 0...20 mA or 4...20 mA and other R_L is the internal resistance of the measuring point including the cable resistance
	DC voltage source (U_{ext}), external power supply, any connection polarity
	DC voltage source (U_{ext}), observe connection polarity according to connection diagrams
	Internal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

Table 4-1: Description of the electrical symbols

4.9.3 Basic inputs/outputs

CAUTION!
Observe connection polarity.

INFORMATION!
For further information refer to Description of the inputs and outputs on page 67 and refer to *HART® connection on page 93*.

Current output active HART®, basic I/Os

- $U_{int, nom}$ = 24 VDC nominal
- I ≤ 22 mA
- R_L ≤ 1 kΩ

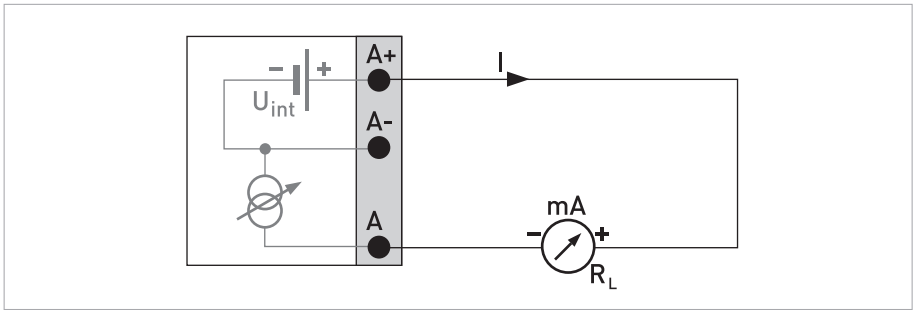


Figure 4-18: Current output active I_a

Current output passive HART®, basic I/Os

- $U_{int, nom}$ = 24 VDC nominal
- U_{ext} ≤ 32 VDC
- I ≤ 22 mA
- U_0 ≥ 1.8 V
- R_L ≤ (U_{ext} - U_0) / I_{max}

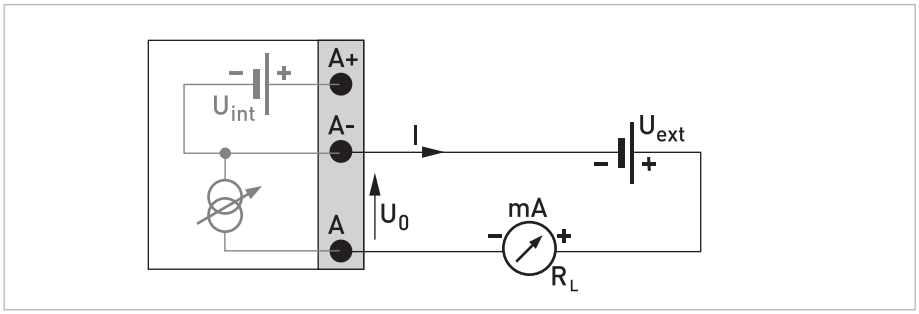


Figure 4-19: Current output passive I_p

INFORMATION!

- *For frequencies above 100 Hz, shielded cables are to be used in order to reduce effects from electrical interferences (EMC).*
- ***Field housing versions:** Shield connected via the cable terminals in the terminal compartment.*

INFORMATION!

Any connection polarity.

Pulse/frequency output passive, basic I/Os

- $U_{ext} \leq 32$ VDC
- f_{max} in operating menu set to $f_{max} \leq 100$ Hz:
  $I \leq 100$ mA
  open:
  $I \leq 0.05$ mA at $U_{ext} = 32$ VDC
  closed:
  $U_{0, max} = 0.2$ V at $I \leq 10$ mA
  $U_{0, max} = 2$ V at $I \leq 100$ mA
- f_{max} in the operating menu set to $100 \text{ Hz} < f_{max} \leq 10$ kHz:
  $I \leq 20$ mA
  open:
  $I \leq 0.05$ mA at $U_{ext} = 32$ VDC
  closed:
  $U_{0, max} = 1.5$ V at $I \leq 1$ mA
  $U_{0, max} = 2.5$ V at $I \leq 10$ mA
  $U_{0, max} = 5.0$ V at $I \leq 20$ mA
- If the following maximum load resistance $R_{L, max}$ is exceeded, the load resistance R_L must be reduced accordingly by parallel connection of R:
  $f \leq 100$ Hz: $R_{L, max} = 47$ kΩ
  $f \leq 1$ kHz: $R_{L, max} = 10$ kΩ
  $f \leq 10$ kHz: $R_{L, max} = 1$ kΩ
- The minimum load resistance $R_{L, min}$ is calculated as follows:
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$
- Can also be set as status output; for the electrical connection refer to status output connection diagram.

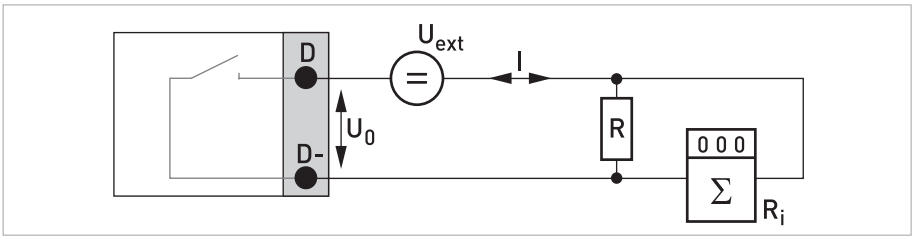


Figure 4-20: Pulse/frequency output passive P_p

INFORMATION!
Any connection polarity.

Status output / limit switch passive, basic I/Os

- $U_{ext} \leq 32$ VDC
- $I \leq 100$ mA
- $R_{L, max} = 47\ k\Omega$
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$
- open:
  $I \leq 0.05$ mA at $U_{ext} = 32$ VDC
  closed:
  $U_{0, max} = 0.2$ V at $I \leq 10$ mA
  $U_{0, max} = 2$ V at $I \leq 100$ mA
- The output is open when the device is de-energized.
- X stands for the terminals B, C or D. The functions of the connection terminals depend on the settings.

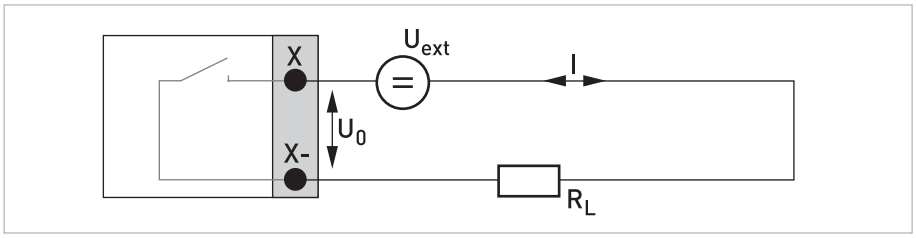


Figure 4-21: Status output / limit switch passive S_p

Control input passive, basic I/Os

- $8\ V \leq U_{ext} \leq 32$ VDC
- $I_{max} = 6.5$ mA at $U_{ext} \leq 24$ VDC
  $I_{max} = 8.2$ mA at $U_{ext} \leq 32$ VDC
- Switching point for identifying "contact open or closed":
  Contact open (off): $U_0 \leq 2.5$ V with $I_{nom} = 0.4$ mA
  Contact closed (on): $U_0 \geq 8$ V with $I_{nom} = 2.8$ mA
- Can also be set as a status output; for the electrical connection refer to status output connection diagram.

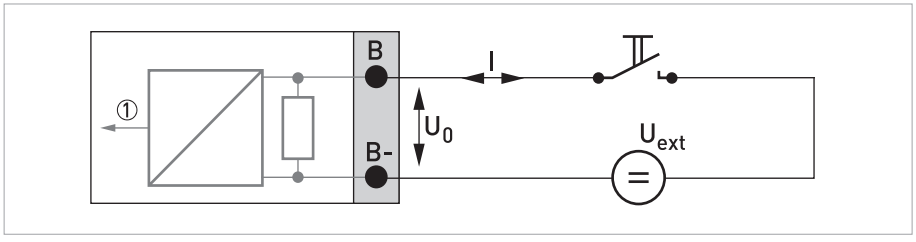


Figure 4-22: Control input passive C_p

① Signal

4.9.4 Modular inputs/outputs and bus systems

CAUTION!
Observe connection polarity.

INFORMATION!
- *For further information on electrical connection refer to Description of the inputs and outputs on page 67.*
- *For the electrical connection of bus systems, please refer to the supplementary documentation for the respective bus systems.*

Current output active (only current output terminals C/C- have HART® capability), modular I/Os

- $U_{int, nom}$ = 24 VDC
- I ≤ 22 mA
- R_L ≤ 1 kΩ
- X designates the connection terminals A, B or C, depending on the version of the signal converter.

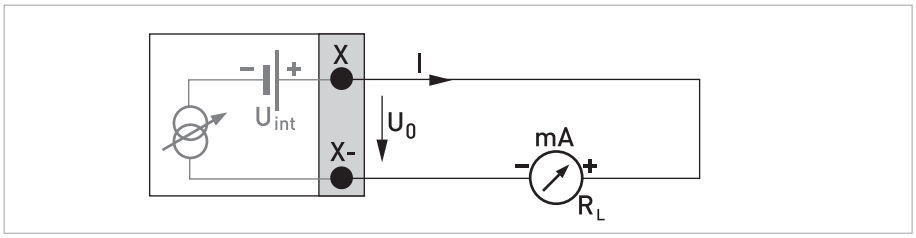


Figure 4-23: Current output active I_a

Current output passive (only current output terminals C/C- have HART® capability), modular I/Os

- U_{ext} ≤ 32 VDC
- I ≤ 22 mA
- U_0 ≥ 1.8 V
- $R_L \leq (U_{ext} - U_0) / I_{max}$
- X designates the connection terminals A, B or C, depending on the version of the signal converter.

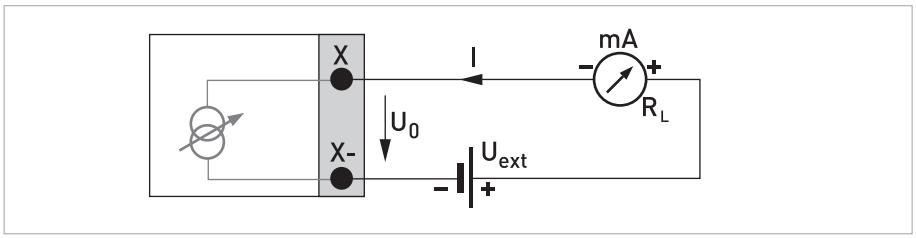


Figure 4-24: Current output passive I_p

INFORMATION!

- ***Field housing versions:*** *Shield connected via the cable terminals in the terminal compartment.*

Pulse/frequency output active, modular I/Os

- Any connection polarity
- U_{nom} = 24 VDC
- f_{max} in the operating menu set to $f_{max} \leq 100$ Hz:
  I ≤ 20 mA
  open:
  I ≤ 0.05 mA
  closed:
  $U_{0, nom}$ = 24 V at I = 20 mA
- f_{max} in operating menu set to 100 Hz < $f_{max} \leq 10$ kHz:
  I ≤ 20 mA
  open:
  I ≤ 0.05 mA
  closed:
  $U_{0, nom}$ = 22.5 V at I = 1 mA
  $U_{0, nom}$ = 21.5 V at I = 10 mA
  $U_{0, nom}$ = 19 V at I = 20 mA
- If the following maximum load impedance $R_{L, max}$ is exceeded, the load impedance R_L must be reduced accordingly by parallel connection of R:
  f ≤ 100 Hz: $R_{L, max}$ = 47 kΩ
  f ≤ 1 kHz: $R_{L, max}$ = 10 kΩ
  f ≤ 10 kHz: $R_{L, max}$ = 1 kΩ
- The minimum load impedance $R_{L, min}$ is calculated as follows:
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

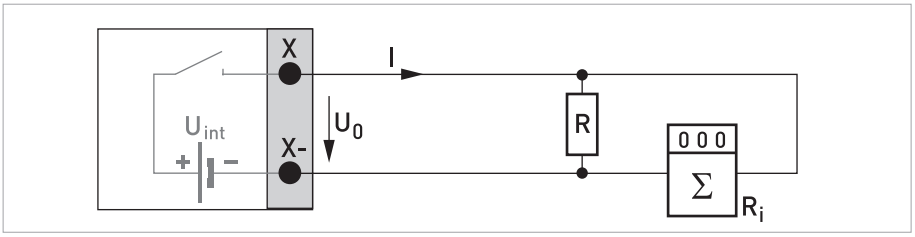


Figure 4-25: Pulse/frequency output active P_a

Pulse/frequency output passive, modular I/Os

- $U_{ext} \leq 32$ VDC
- f_{max} in the operating menu set to $f_{max} \leq 100$ Hz:
  $I \leq 100$ mA
  open:
  $I \leq 0.05$ mA at $U_{ext} = 32$ VDC
  closed:
  $U_{0, max} = 0.2$ V at $I \leq 10$ mA
  $U_{0, max} = 2$ V at $I \leq 100$ mA
- f_{max} in operating menu set to 100 Hz < $f_{max} \leq 10$ kHz:
  open:
  $I \leq 0.05$ mA at $U_{ext} = 32$ VDC
  closed:
  $U_{0, max} = 1.5$ V at $I \leq 1$ mA
  $U_{0, max} = 2.5$ V at $I \leq 10$ mA
  $U_{0, max} = 5$ V at $I \leq 20$ mA
- If the following maximum load impedance $R_{L, max}$ is exceeded, the load impedance R_L must be reduced accordingly by parallel connection of R:
  $f \leq 100$ Hz: $R_{L, max} = 47$ kΩ
  $f \leq 1$ kHz: $R_{L, max} = 10$ kΩ
  $f \leq 10$ kHz: $R_{L, max} = 1$ kΩ
- The minimum load impedance $R_{L, min}$ is calculated as follows:
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$
- Can also be set as status output; refer to status output connection diagram.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

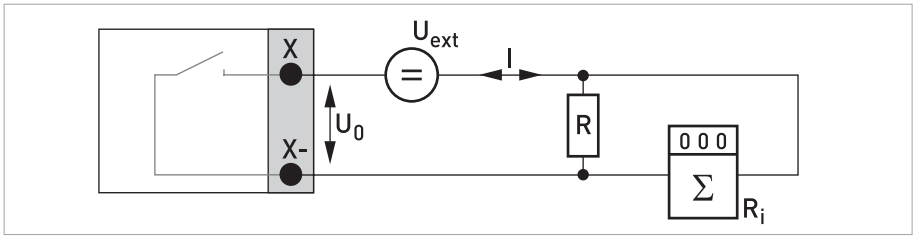


Figure 4-26: Pulse/frequency output passive P_p

INFORMATION!

- ***Field housing versions:*** *Shield connected via the cable terminals in the terminal compartment.*
- *Any connection polarity.*

Pulse and frequency output passive P_N NAMUR, modular I/O

- Connection in conformity with NAMUR EN 60947-5-6
- open:
  I_{nom} = 0.6 mA
  closed:
  I_{nom} = 3.8 mA
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

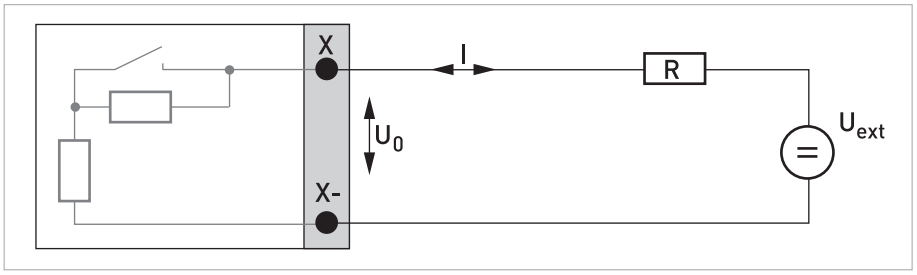


Figure 4-27: Pulse/frequency output passive P_N according to NAMUR EN 60947-5-6

CAUTION!
Observe connection polarity.

Status output / limit switch active, modular I/Os

- U_{int} = 24 VDC
- I ≤ 20 mA
- R_L ≤ 47 kΩ
- open:
  I ≤ 0.05 mA
  closed:
  $U_{0, nom}$ = 24 V at I = 20 mA
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

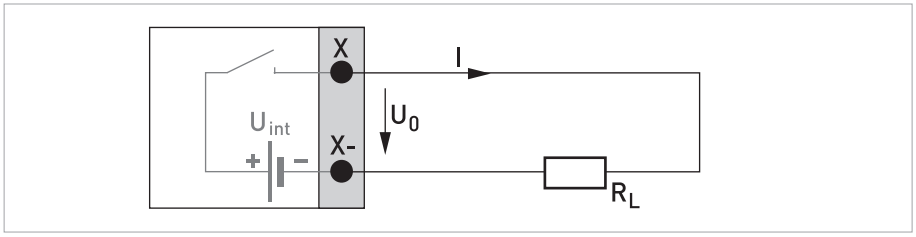


Figure 4-28: Status output / limit switch active S_a

Status output / limit switch passive, modular I/Os

- Any connection polarity.
- U_{ext} = 32 VDC
- I ≤ 100 mA
- $R_{L, max}$ = 47 kΩ
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$
- open:
  I ≤ 0.05 mA at U_{ext} = 32 VDC
  closed:
  $U_{0, max}$ = 0.2 V at I ≤ 10 mA
  $U_{0, max}$ = 2 V at I ≤ 100 mA
- The output is open when the device is de-energized.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

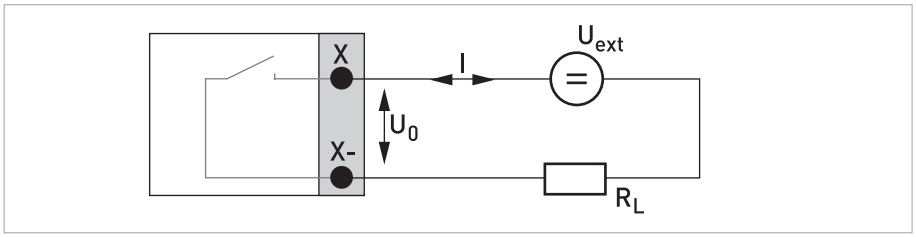


Figure 4-29: Status output / limit switch passive S_p

Status output / limit switch S_N NAMUR, modular I/Os

- Any connection polarity.
- Connection in conformity with NAMUR EN 60947-5-6
- open:
  I_{nom} = 0.6 mA
  closed:
  I_{nom} = 3.8 mA
- The output is open when the device is de-energized.
- X designates the connection terminals A, B or D, depending on the version of the signal converter.

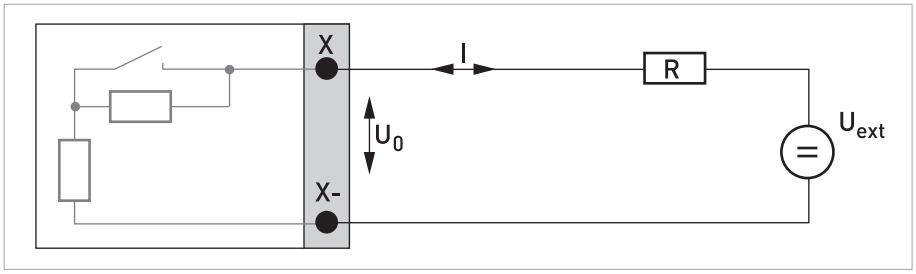


Figure 4-30: Status output / limit switch S_N according to NAMUR EN 60947-5-6

CAUTION!
Observe connection polarity.

Control input active, modular I/Os

- U_{int} = 24 VDC
- External contact open:
  $U_{0, nom}$ = 22 V
  External contact closed:
  I_{nom} = 4 mA
- Switching point for identifying "contact open or closed":
  Contact open (off): $U_0 \leq 10$ V with I_{nom} = 1.9 mA
  Contact closed (on): $U_0 \geq 12$ V with I_{nom} = 1.9 mA
- X designates the connection terminals A or B, depending on the version of the signal converter.

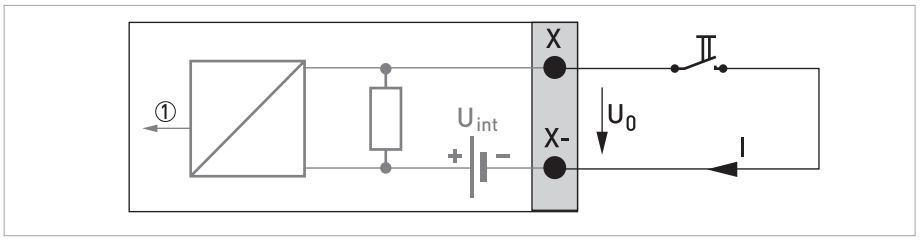


Figure 4-31: Control input active C_a

① Signal

Control input passive, modular I/Os

- 3 V ≤ U_{ext} ≤ 32 VDC
- I_{max} = 9.5 mA at $U_{ext} \leq 24$ V
  I_{max} = 9.5 mA at $U_{ext} \leq 32$ V
- Switching point for identifying "contact open or closed":
  Contact open (off): $U_0 \leq 2.5$ V with I_{nom} = 1.9 mA
  Contact closed (on): $U_0 \geq 3$ V with I_{nom} = 1.9 mA
- X designates the connection terminals A or B, depending on the version of the signal converter.

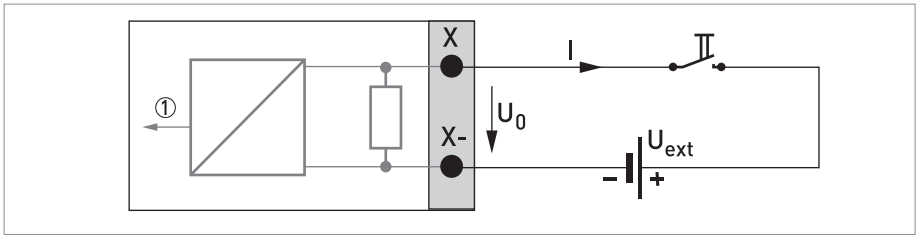


Figure 4-32: Control input passive C_p

① Signal

CAUTION!
Observe connection polarity.

Control input active C_N NAMUR, modular I/Os

- Connection acc. to NAMUR EN 60947-5-6
- Switching point for identifying "contact open or closed":
  Contact open (off): $U_{0,\,nom}$ = 6.3 V with I_{nom} < 1.9 mA
  Contact closed (on): $U_{0,\,nom}$ = 6.3 V with I_{nom} > 1.9 mA
- Detection of cable break:
  $U_0 \geq 8.1$ V with $I \leq 0.1$ mA
- Detection of cable short circuit:
  $U_0 \leq 1.2$ V with $I \geq 6.7$ mA
- X designates the connection terminals A or B, depending on the version of the signal converter.

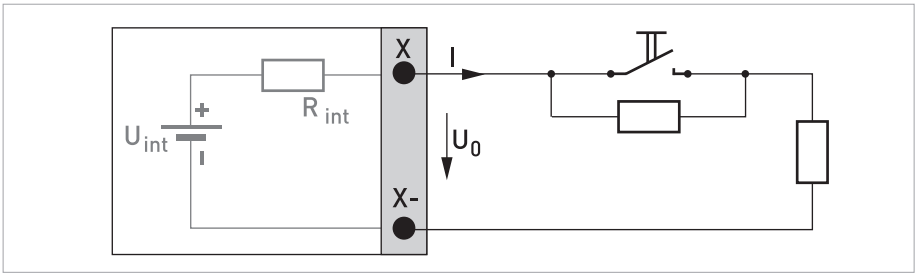


Figure 4-33: Control input active C_N according to NAMUR EN 60947-5-6

4.9.5 Ex i inputs/outputs

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

INFORMATION!
For further information on electrical connection refer to Description of the inputs and outputs on page 67.

CAUTION!
Observe connection polarity.

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

- $U_{int, nom}$ = 20 VDC
- I ≤ 22 mA
- R_L ≤ 450 Ω
- X designates the connection terminals A or C, depending on the version of the signal converter.

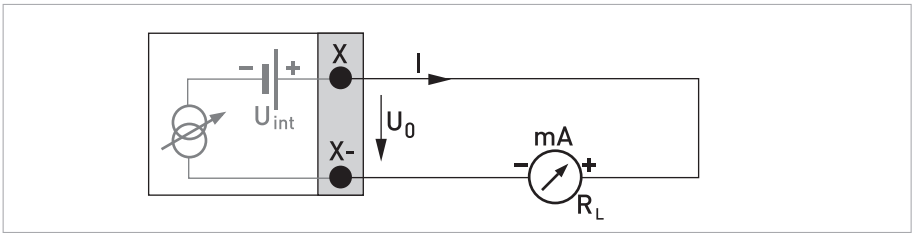


Figure 4-34: Current output active I_a Ex i

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

- Any connection polarity.
- U_{ext} ≤ 32 VDC
- I ≤ 22 mA
- U_0 ≥ 4 V
- $R_L \leq (U_{ext} - U_0) / I_{max}$
- X designates the connection terminals A or C, depending on the version of the signal converter.

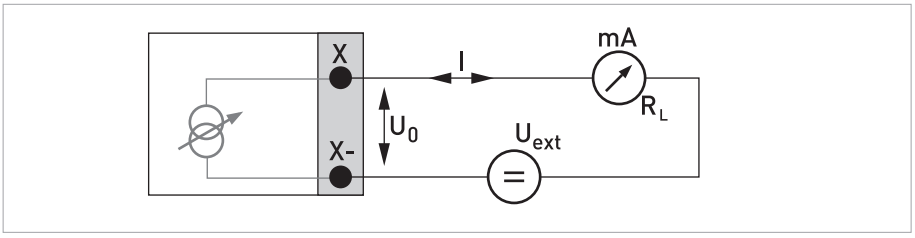


Figure 4-35: Current output passive I_p Ex i

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

INFORMATION!
housing versions: *Shield connected via the cable terminals in the terminal compartment.*

Pulse and frequency output passive P_N NAMUR, Ex i I/Os

- Any connection polarity.
- Connection acc. to NAMUR EN 60947-5-6
- open:
  I_{nom} = 0.43 mA
  closed:
  I_{nom} = 4.5 mA
- X designates the connection terminals B or D, depending on the version of the signal converter.

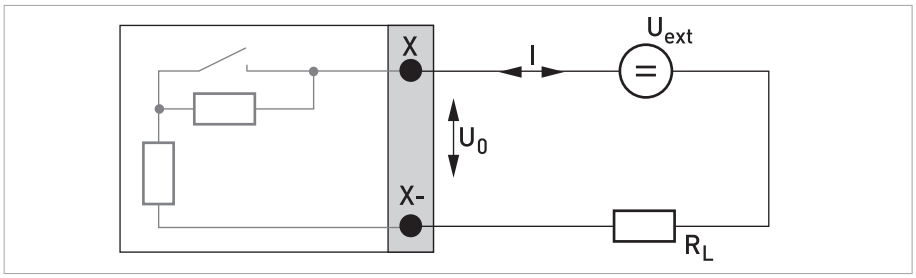


Figure 4-36: Pulse/frequency output passive P_N according to NAMUR EN 60947-5-6 Ex i

INFORMATION!
Any connection polarity.

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

- Connection acc. to NAMUR EN 60947-5-6
- open:
  I_{nom} = 0.43 mA
  closed:
  I_{nom} = 4.5 mA
- The output is closed when the device is de-energized.
- X designates the connection terminals B or D, depending on the version of the signal converter.

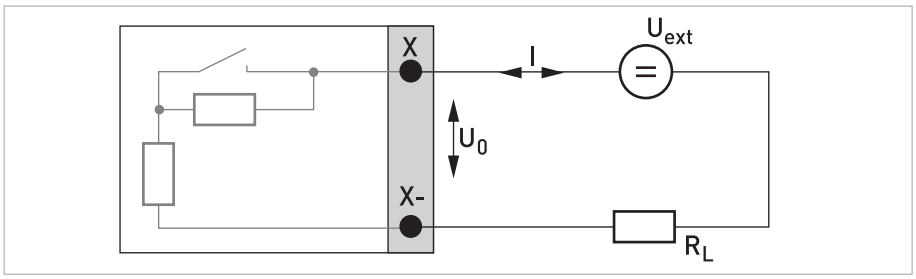


Figure 4-37: Status output / limit switch S_N according to NAMUR EN 60947-5-6 Ex i

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

INFORMATION!
Any connection polarity.

Control input passive, Ex i I/Os

- $5.5\ V \leq U_{ext} \leq 32$ VDC
- $I_{max} = 6$ mA at $U_{ext} \leq 24$ V
  $I_{max} = 6.5$ mA at $U_{ext} \leq 32$ V
- Switching point for identifying "contact open or closed":
  Contact open (off): $U_0 \leq 3.5$ V with $I \leq 0.5$ mA
  Contact closed (on): $U_0 \geq 5.5$ V with $I \geq 4$ mA
- X designates the connection terminals B, if available.

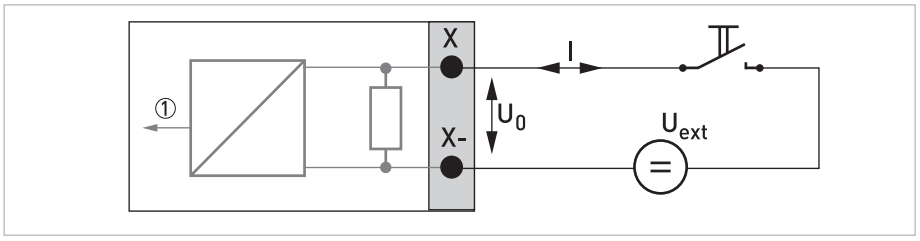


Figure 4-38: Control input passive C_p Ex i

① Signal

4.9.6 Current input active or passive

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

INFORMATION!
For further information on electrical connection refer to Description of the inputs and outputs on page 67.

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

Connection diagrams of Ex i inputs:

INFORMATION!
Any connection polarity.

Current input active, Ex i I/Os

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

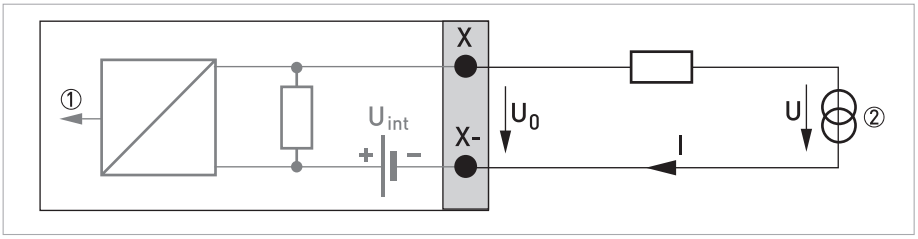


Figure 4-39: Current input active IIn_a

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

INFORMATION!
Any connection polarity.

Current input passive, Ex i I/Os

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

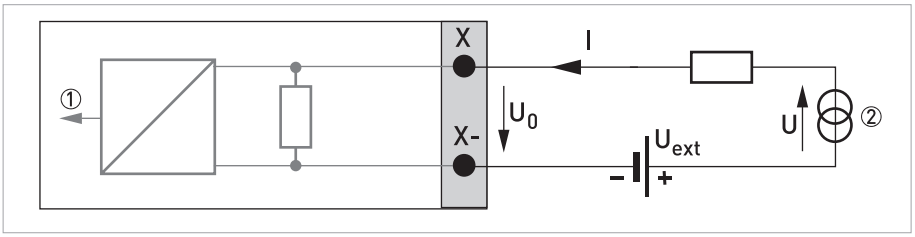


Figure 4-40: Current input passive IIn_p

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

Connection diagrams of modular current inputs

CAUTION!
Observe connection polarity.

INFORMATION!

- *For further information on electrical connection refer to Description of the inputs and outputs on page 67.*
- *For the electrical connection of bus systems, please refer to the supplementary documentation for the respective bus systems.*

Current input active, modular I/Os

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

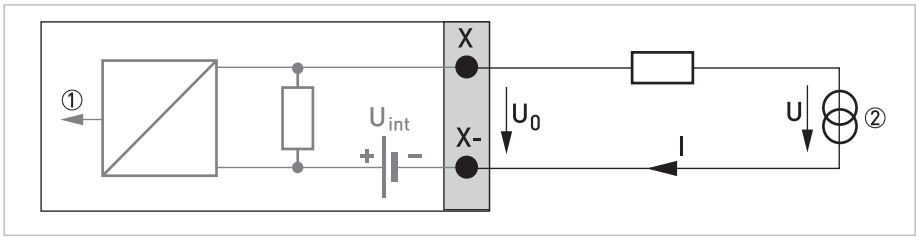


Figure 4-41: Current input active IIn_a

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

Current input passive, modular I/Os

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

CAUTION!
Observe connection polarity.

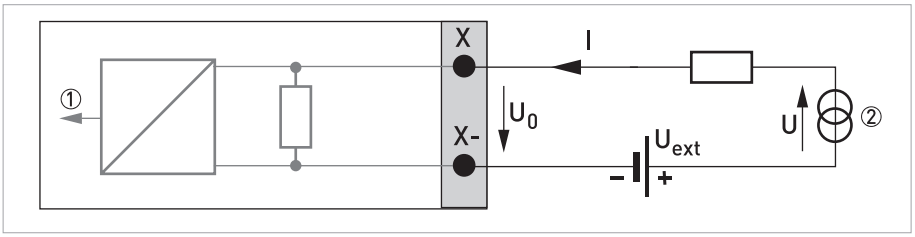


Figure 4-42: Current input passive IIn_p

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

4.9.7 HART® connection

INFORMATION!

- *In the basic I/O the current output at connection terminals A+/A-/A always has generic HART® capability.*

HART® connection active (point-to-point)

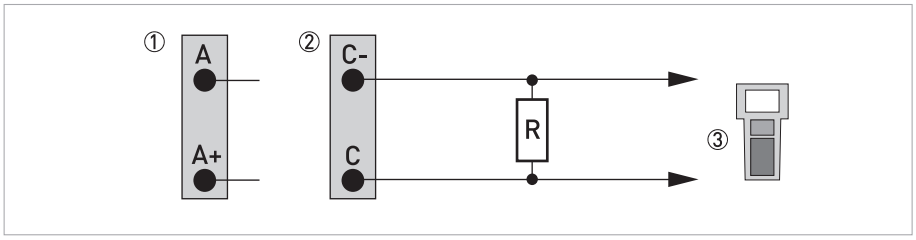


Figure 4-43: HART® connection active (I_a)

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

The parallel resistance to the HART® communicator must be R ≥ 230 Ω.

HART® connection passive (Multi-Drop mode)

- I: $I_{0\%} \geq 4$ mA
- Multi-Drop mode I: $I_{fix} \geq 4$ mA = $I_{0\%}$
- $U_{ext} \leq 32$ VDC
- R ≥ 230 Ω

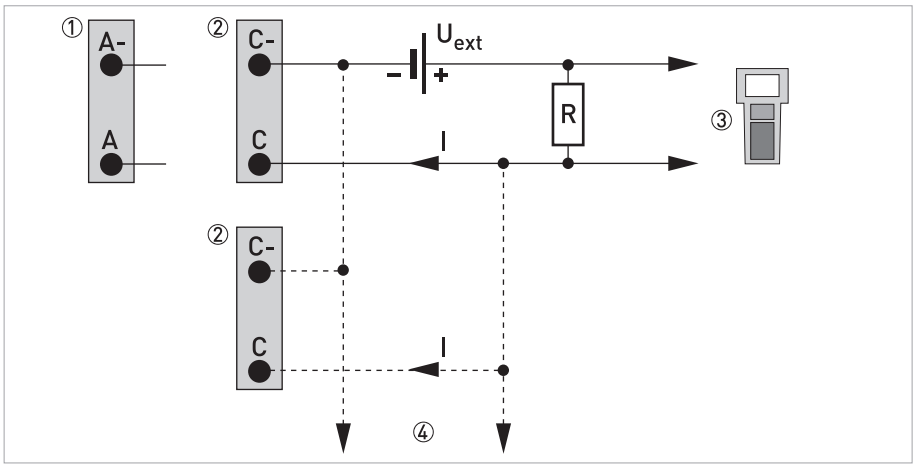


Figure 4-44: HART® connection passive (I_p)

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

5.1 Switching on the power

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

- The device must be mechanically safe and mounted in compliance with the regulations.
- The power connections must have been made in compliance with the regulations.
- The electrical terminal compartments must be secured and the covers have been screwed on.
- Check that the electrical operating data of the power supply are correct.

- Switching on the power.

5.2 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.

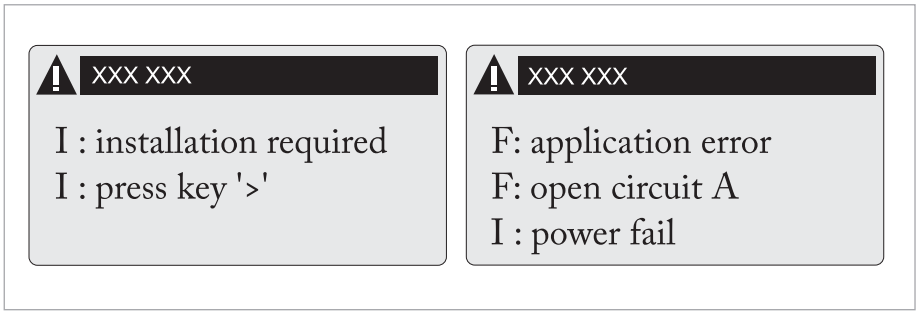


Figure 5-1: First and second page appear intermittently

- 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%.*

5.3 Function description installation menu

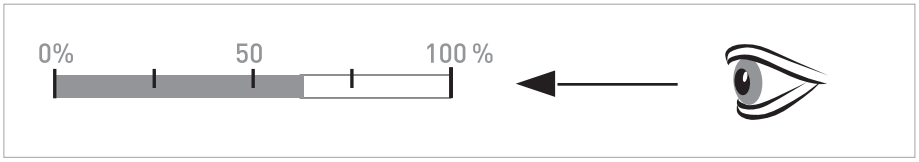
Menu No.	Display	Function description	Selection list, additional info
Power up	I: power fail	Standard indication that the converter has been powered off	
	I: installation required	Indication that the device has not been installed before	
	I: press key ">"	To access installation menu	Keep key ">" pressed until in display appears: "release key now"
X	**Installation**	Start installation device	
X1	language	Select preferred language	
X2	**GDC IR interface**	Connection IR interface	activate (the IR interface (adapter) and interrupt the optical keys)
X3	**units**	Selectable units	
X3.1	size	Unit for dimension	mm; inch
X3.2	volume flow	Unit for volume flow	L/s; L/min; L/h; m³/s; m³/min; m³/h; m³/d; ft³/s; ft³/min; ft³/h; gal/s; gal/min; gal/h; gal/d; IG/s; IG/min; IG/h; IG/d; bbl/h; bbl/d; free unit
X3.3	free unit	Sequences to set texts and factors	For text to be specified refer to *Set free units* on page 138
X3.4	[m^3/s]*factor	Conversion factor	specification of the conversion factor, based on m³/s.
X3.5	velocity	Unit for flow speed and velocity of sound (VoS)	m/s; ft/s
X3.6	density	Unit for density	kg/L; kg/m³; lb/ft³ lb/gal; free unit
X3.7	temperature	Unit for temperature	°C; °F; K
X4	**pipe configuration**	number of pipes (1-2) and number of paths (1-2), in case "2 paths" is selected, the measurement results will be averaged.	
X4.1	number of pipes	Selection 1 or 2 pipe(s)	1 pipe, 2 pipes
X4.2	number of paths	Selection 1 or 2 path(s)	1 path; 2 paths
X5	**pipe data**	Input menu	pipe 1 data
X5.2	diameter	Size for outer diameter of pipe	min-max: 20...4300 mm / 0.787...169.3 inch
X5.3	pipe material	Select pipe material from list	carbon steel; stainless steel; cast iron; aluminum; concrete; GRF/RFP; asbestos cement; PP/PVC; acrylics; polyamide; other
X5.4	VoS pipe material	Input menu	min-max: 1000.0...4500.0 m/s / 3280.8... 14764 ft/s
X5.5	wall thickness	Input menu	min-max: 1.000...200.0 mm / 0.039...7.874 inch
X5.6	liner material	Input menu	cement, epoxy, PP, LDPE, HDPE, PTFE, rubber, other, none
X5.7	VoS liner material	Input menu	min-max: 1000.0...4500.0 m/s / 3280.8...14764 ft/s
X5.8	liner thickness	Input menu	min-max: 0.100 - 20.00 mm / 0.004 - 0.787 inch
X5.9	fluid	Input menu	water; alkanes; alcohols; oil; acids; CxHx refined; CxHx light; refrigerant; solvents; caustic soda; other
X5.10	VoS fluid	Input menu	min-max: 500...2500 m/s / 1640.4...8202.1 ft/s
X5.11	density	Input menu	min-max: 0.1000...5.0000 kg/l / 6.2428 lb / ft³ to 312.14 lb/ft³

X5.12	glycol % vol.	Input menu	min-max: 0...100%
X5.13	dynamic viscosity	Input menu	min-max: 0.100 ...9999 cP (N s/m²)
X5.14	pipe temperature	Input application temperature	min-max: -40...+200°C
X6	**pipe data 2**	Input menu	pipe 2 data
X6._	Additionally X6.1 copy pipe data 1 is available. The other menu X6 items are exactly the same as the menu items X5 and will only be available, when number of pipe selection is 2 pipes in menu item X4.		
X7	**Install transducer 1**	Enters installation procedure for transducer 1	
X7.1	transducer set	Short code for transducer set, mentioned on sensor	Ta, Tb, Tc, none
X7.2.1	calibration number	Read calibration number	123456789
X7.2.2	number of traverses	Description of installation mode	1, 2 or 4 traverses
X7.2.3	mount transducers at	Advised transducer distance	+ xx.xx mm
X7.2.4	act.flow prelim.	Preliminary volume flow	± xx.xx m³/h
X7.2.5	check signal	Actual signal quality	0...100%
X7.2.6	actual distance	Input menu for transducer distances	Confirm or adjust min-max: -10.00...+9999 mm / -0.394...+393.7 inch
X7.2.7	optimize distance	Enter optimize loop	yes/no
X7.2.8	actual flow preliminary	Preliminary volume flow	± xx.xx m³/h
X7.2.9	path ready?	Select if installation is completed	yes/no
X7.2.11	end installation	Exit installation mode	yes/no
X8	**Install transducer 2**	is identical the menu items of X7	Ready?; or install next transducer?
X9	**Install transducer sets**		
X9.1/3/5	Tx serial number	Factory serial number of sensor	Ayy; 5 free units
X9.2/4/6	Tx calibration number x stands for: a; b; c	Set calibration number of sensor according to type sticker	9 free units

5.4 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 98

- 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.

5.5 Start measurement of large version

Before installation

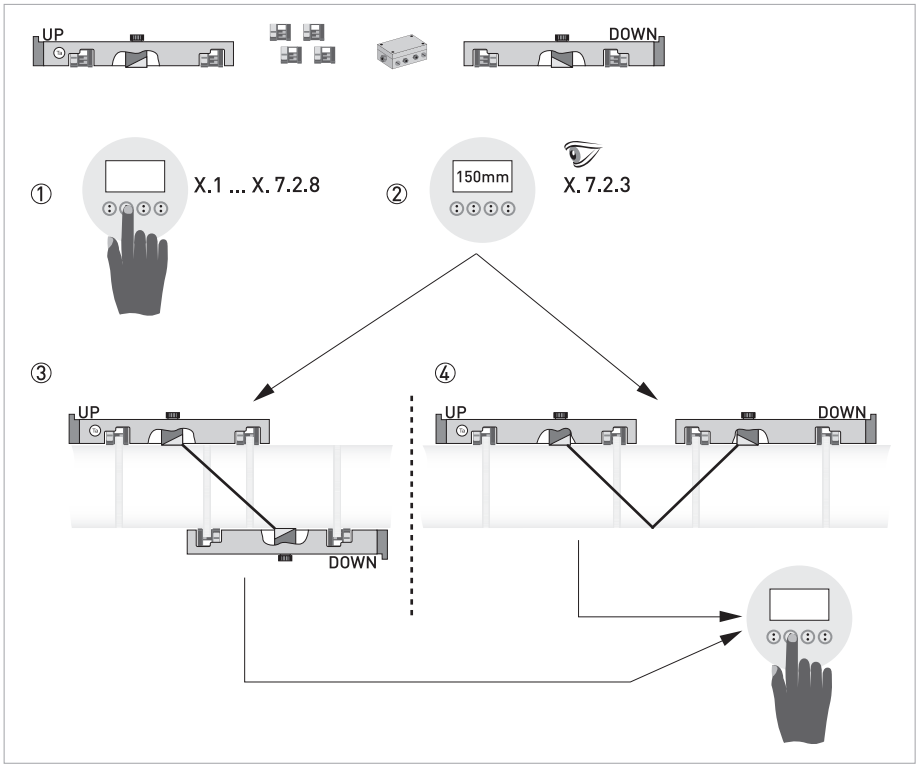


Figure 5-2: Procedure for installation of large version

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 94
  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 34.

After the mechanical installation of the rails, continue with the standard set up (configuration) refer to *Start measurement (standard setup)* on page 97.

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.

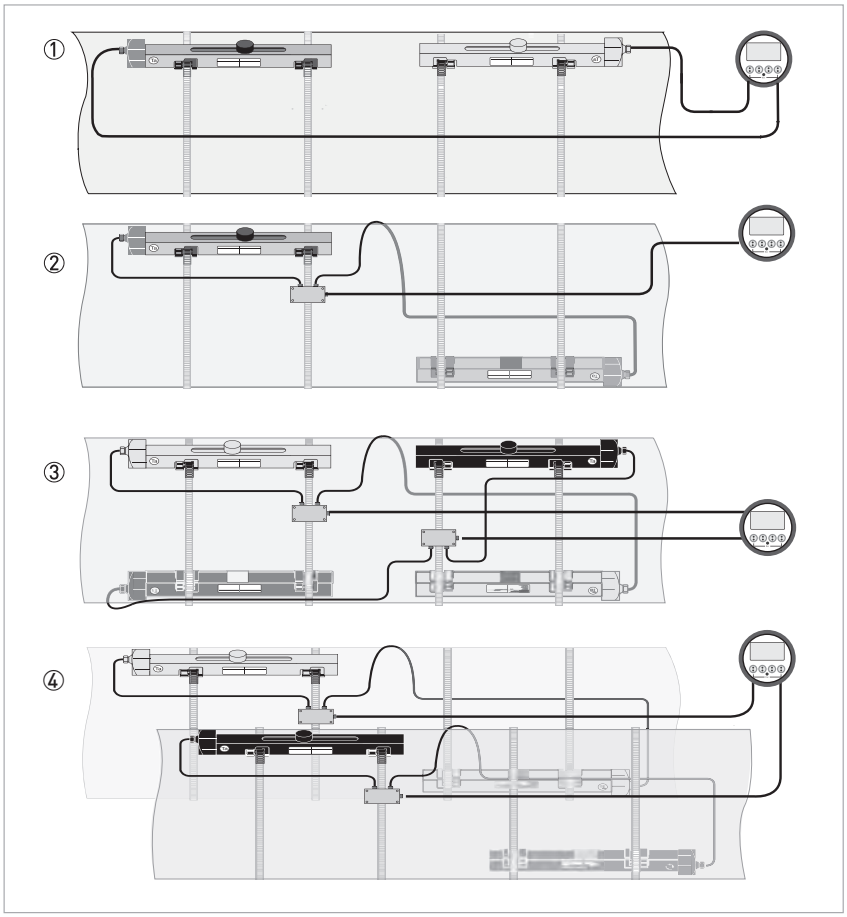


Figure 5-3: Device configurations for "Large" versions

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

6.1 Display and operating elements

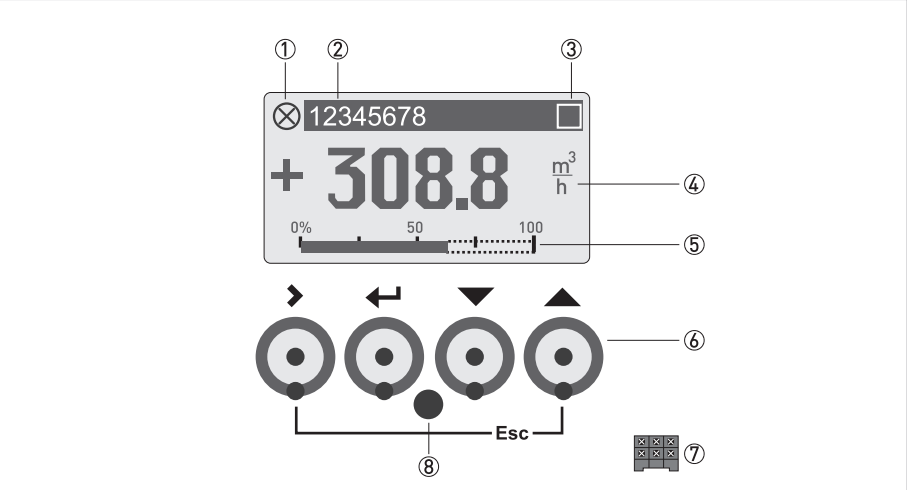


Figure 6-1: Display and operating elements (Example: flow indication with 2 measuring values)

① Indicates a possible status message in the status list
② Tag number (is only indicated if this number was entered previously by the operator)
③ Indicates when a key has been pressed
④ 1st measured variable in large representation
⑤ Bar graph indication
⑥ Operating keys, optical (see table below for function and representation in text)
⑦ Interface to the GDC bus (not present in all signal converter versions)
⑧ Infrared sensor (not present in all signal converter versions)

INFORMATION!

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

Key	Measuring mode	Menu mode	Submenu or function mode	Parameter and data mode
>	Switch from measuring mode to menu mode; press key for 2.5 s, "Quick Start" menu is then displayed	Access to displayed menu, then 1st submenu is displayed	Access to displayed submenu or function	For numerical values, move cursor (highlighted in blue) one position to the right
↵	Reset display; "Quick Access" function	Return to measuring mode but prompt whether the data should be saved	Press 1 to 3 times, return to menu mode, data saved	Return to submenu or function, data saved
↓ or ↑	Switch between display pages: measured value 1 + 2, trend page and status page	Select menu	Select submenu or function	Use cursor highlighted in blue to change number, unit, property and to move the decimal point
Esc (> + ↑)	-	-	Return to menu mode without acceptance of data	Return to submenu or function without acceptance of data

Table 6-1: Description of functionality of operating keys

6.1.1 Display in measuring mode with 2 or 3 measured values

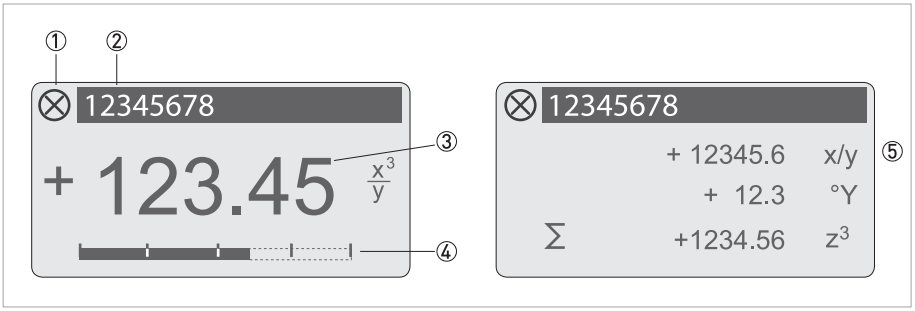


Figure 6-2: Example for display in measuring mode with 2 or 3 measured values

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

6.1.2 Display for selection of submenu and functions, 3 lines

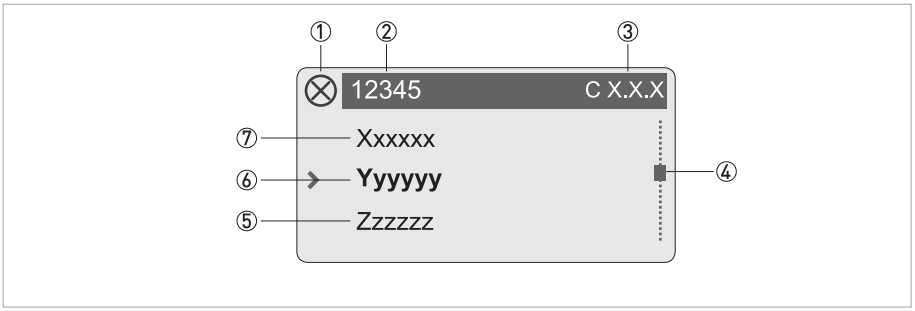


Figure 6-3: Display for selection of submenu and functions, 3 lines

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

6.1.3 Display when setting parameters, 4 lines

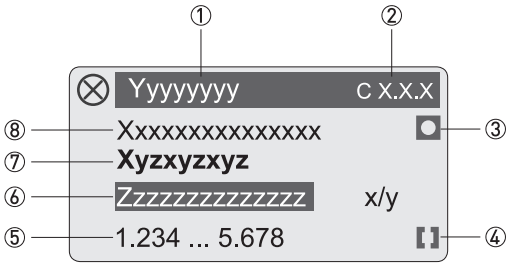


Figure 6-4: Display when setting parameters, 4 lines

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

6.1.4 Display when previewing parameters, 4 lines

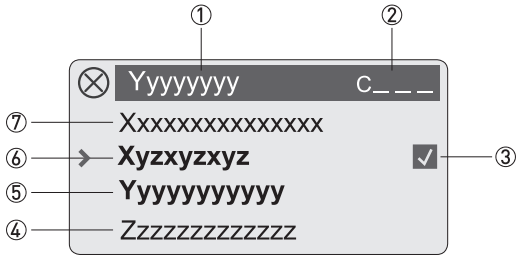


Figure 6-5: Display when previewing parameters, 4 lines

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

6.2 Menu overview

Measure mode		Select menu	↓ ↑	Select menu and/or submenu ↓ ↑				Select function and set data ↓ ↑ >
↵	Press > 2.5 s							
	X Installation		> ↵	X1 language			> ↵	
				X2 GDC IR interface				
				X3 units				
					> ↵	X3.1 size		
						X3.2 volume flow		
						X3.3 free unit		
						X3.4 [m^3/s]*factor		
						X3.5 velocity		
						X3.6 density		
						X3.7 temperature		
				X4 pipe configuration				
				select		X4.1 number of pipes		
						X4.2 number of paths		
				X5 pipe data	> ↵	X5.2 diameter		
						X5.3 pipe material		
						X5.4 VoS pipe material		
						X5.5 wall thickness		
						X5.6 liner material		
						X5.7 velocity of sound		
						X5.8 liner thickness		
						X5.9 fluid		
						X5.10 VoS fluid		
						X5.11 density		
						X5.12 glycol % vol.		
						X5.13 dynamic viscosity		
						X5.14 pipe temperature		
	↓ ↑			↓ ↑		↓ ↑		↓ ↑ >

Menu X6 pipe data 2 is shown when number of pipe = 2 is chosen at X4.1. With X6.1 copy pipe 1 data, the settings chosen for pipe 1 are copied to pipe 2. The selection options are identically as menu X5.

Measure mode		Select menu	↓ ↑	Select menu and/or submenu ↓ ↑				Select function and set data ↓ ↑ >
↵	Press > 2.5 s							
	X Installation		> ↵	X7 install transd. 1	> ↵	X7.1 transducer set	> ↵	
						X7.2.1 calibration number		
						X7.2.2 number of traverses		
						X7.2.3 mount transducers at		
						X7.2.4 act. flow, prelim.		
						X7.2.5 check signal		
						X7.2.6 actual distance		
						X7.2.7 optimize distance		
						X7.2.8 act.flow, prelim.		
						X7.2.9 path ready?		
						X7.2.11 end installation		
				Ready? or next transducer? X8 install transd. 2 X8.1 to X8.2.11 is identical to X7 to X7.2.11 ①				
				X9 transducer sets	> ↵	X9.1 Ta serial no.		
						X9.2 Ta calibration no.		
						X9.3 Tb serial no.		
						X9.4 Tb calibration no.		
						X9.5 Tc serial no.		
						X9.6 Tc calibration no.		
	↓ ↑			↓ ↑		↓ ↑		↓ ↑ >

① shows only when configuring a 2 pipe installation

INFORMATION!
*For the description of the **X Installation** menu parameters refer to Function description installation menu on page 95*

Measure mode		Select menu	↓ ↑	Select menu and/or submenu ↓ ↑				Select function and set data ↓ ↑ >
↵	Press > 2.5 s							
	A Quick Setup		> ↵	A1 Language			> ↵	
				A2 Tag				
				A3 reset	> ↵	A3.1 reset errors		
						A3.2 totalizer 1		
						A3.3 totalizer 2		
						A3.4 totalizer 3		
				A4 analog outputs (basic IO)		A4.1 measurement		
						A4.2 unit		
						A4.3 range		
						A4.4 low flow cutoff		
						A4.5 time constant		
				A5 digital outputs (basic IO)		A5.1 measurement		
						A5.2 pulse value unit		
						A5.3 value p. pulse		
						A5.4 low flow cutoff		
				A6 GDC IR interface				
	↓ ↑			↓ ↑		↓ ↑		↓ ↑ >

INFORMATION!
*For the description of the **Quick Setup A** menu parameters, refer to Menu A, Quick Setup on page 117*

Measuring mode		Select menu	↓ ↑	Select menu and/or submenu ↓ ↑				Select function and set data ↓ ↑ >
↵	Press > 2.5 s							
	B Test		> ↵	B1 simulation	> ↵	B1.1 volume flow	> ↵	
						B1.2 volume flow 2 ①		
						B1.3 velocity of sound		
						B1.4 Terminals A ②		
						B1.5 Terminals B ②		
						B1.6 Terminals C ②		
						B1.7 Terminals D ②		
				B2 actual values	> ↵	B2.1 act. volume flow		
						B2.2 act. volume flow 2 ①		
						B2.3 act. mass flow		
						B2.4 act. flow speed		
						B2.5 act. Reynolds number		
						B2.6 act. Reynolds no.2 ①		
						B2.7 act. vel. of sound		
						B2.7.1 path 1		
						B2.7.2 path 2 ①		
						B2.8 act. gain		
						B2.8.1 path 1		
						B2.8.2 path 2 ①		
						B2.9 act. SNR		
						B2.9.1 path 1		
						B2.9.2 path 2 ①		
						B2.10 act. signal quality		
						B2.10.1 path 1		
						B2.10.2 path 2 ①		
	↓ ↑			↓ ↑		↓ ↑		↓ ↑ >

① becomes active if "two pipes" or "two paths" is selected in menu X4.1 and X4.2
② depends on IO setting hardware

Measuring mode		Select menu	↓ ↑	Select menu and/or submenu ↓ ↑				Select function and set data ↓ ↑ >
↵	Press > 2.5 s							
	B Test		> ↵	B2 actual values	> ↵	B2.11 opt. transd. distance	> ↵	
						B2.11.1 path 1		
						B2.11.2 path 2 ①		
						B2.12 act. temperature A ②		
						B2.13 act. temperature B ②		
						B2.14 current input A ②		
						B2.15 current input B ②		
						B2.16 operating hours		
						B2.17 Date and Time		
				B3 information	> ↵	B3.1 Status Log		
						B3.2 Status Details		
						B3.3 C number		
						B3.4 process input		
						B3.4.1 sensor CPU		
						B3.4.2 sensor DSP		
						B3.4.3 sensor driver		
						B3.5 SW.REV. MS		
						B3.6 SW.REV. UIS		
						B3.7 RS485/Modbus ③		
						B3.8 Electronic Revision		
						B3.9 Change log		
	↓ ↑			↓ ↑		↓ ↑		↓ ↑ >

① becomes active if "two pipes" or "two paths" is selected in menu X4.1 and X4.2
② depends on IO setting hardware
③ only appears with Modbus interface

INFORMATION!
*For the description of the **Test B** menu parameters, refer to Menu B; test on page 119*

Measuring mode	Select menu	↓ ↑	Select menu and/or sub-menu ↓↑			Select function and set data ↓↑>
↵	Press > 2.5 s					
	C setup ①	> ↵	C1 process input ②	> ↵	C1.1 number of pipes	select
					C1.2 number of paths	
					C1.3 pipe data	C1.3.1 diameter
						C1.3.2 pipe material
						C1.3.3 VoS pipe material
						> ↵ C1.3.4 wall thickness
						C1.3.5 liner material
						C1.3.6 VoS liner material
						C1.3.7 liner thickness
						C1.3.8 fluid
						C1.3.9 VoS fluid
						C1.3.10 density
						C1.3.11 glycol % vol.
						C1.3.12 dynamic viscosity
						C1.3.13 pipe temperature
					C1.4 transducer data	C1.4.1 transducer set
						C1.4.2 number of traverses
						C1.4.3 actual distance
						C1.4.4 transducer set 2
						C1.4.5 number of traverses
						C1.4.6 acutal distance
						C1.4.7 tranducer set 3
						C1.4.8 number of traverses
						C1.4.9 actual distance
					C1.5 calibration	C1.5.1 zero calibration
						C1.5.2 GK
						C1.5.3 Reynolds correction
						C1.5.4 linearization
					C1.6 filter	C1.6.1 limitation
						C1.6.2 flow direction
						C1.6.3 time constant
						C1.6.4 low flow cutoff
	↓↑		↓↑		↓↑	↓↑>

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode	Select menu	↓ ↑	Select menu and/or sub-menu ↓ ↑				Select function and set data ↓ ↑ >
↵	C setup ①	> ↵	C1 process input	> ↵	C1.7 plausibility	> ↵	C1.7.1 error limit
							C1.7.2 counter decrease
							C1.7.3 counter limit
					C1.8 simulation		C1.8.1 volume flow
							C1.8.2 velocity of sound
					C1.9 information		C1.9.1 Sensor CPU
							C1.9.2 Sensor DSP
							C1.9.3 Sensor Driver
							C1.9.4 calibration date
							C1.9.5 serial no. sensor
							C1.9.6 V no. sensor
					C1.10 flow mode		Select: Standard Cold Heat
					C1.11 ...C1.16 ②		Option ②
					C1.17 diagnosis ②		C1.17.1 diagnostics 1
							C1.17.2 diagnostics 2
							C1.17.3 Proc: Empty Pipe
							C1.17.4 Proc: Signal Lost
							C1.17.5 Proc: Signal Unreliable
							C1.17.6 Config: Totaliser
							C1.17.7 Electr: IO Connection
							C1.17.8 Electr: Power Failure
							C1.17.9 Proc: Current Input
			C2 process input 2	* submenu C2.1…C2.8 is identical to submenu C1.1…C1.8 ①			
				C2.9 volume flow 1-2			select
				C2.10 diagnosis			C2.10.1 diagnostics 2
	↓ ↑		↓ ↑		↓ ↑		↓ ↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode	Select menu	↓ ↑	Select menu and/or sub-menu ↓↑	↓ ↑	Select function and set data ↓↑>
↵	Press > 2.5 s				
	C setup ①	> ↵	C3 transducer sets	> ↵	C3.1 Ta serial no.
					C3.2 Ta calibration no.
					C3.3 Tb serial no.
					C3.4 Tb calibration no.
					C3.5 Tc serial no.
					C3.6 Tc calibration no.
			C4 I/O	> ↵	C4.1 hardware
					C4.1.1 terminals A
					C4.1.2 terminals B
					C4.1.3 terminals C
					C4.1.4 terminals D
					C4.2. current out A
					C4.2.1 range 0...100%
					C4.2.2 extended range
					C4.2.3 error current
					C4.2.4 error condition
					C4.2.5 measurement
					C4.2.6 range
					C4.2.7 polarity
					C4.2.8 limitation
					C4.2.9 low flow cutoff
					C4.2.10 time constant
					C4.2.11 special functions
					C4.2.12 threshold
					C4.2.13 information
					C4.2.14 simulation
					C4.2.15 4 mA trimming
					C4.2.16 20 mA trimming
	↓↑		↓↑		↓↑	↓↑>

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode	Select menu	↓ ↑	Select menu and/or sub-menu ↓ ↑	↓ ↑	Select function and set data ↓ ↑ >
↵	Press > 2.5 s				
	C setup ①	> ↵	C4 I/O	> ↵	C4.3. status output B
					C4.3.3 invert signal
					C4.3.4 information
					or C4.3. control input B
					C4.3.2 invert signal
					C4.3.3 information
					C4.3.4 simulation
					or C4.3. limit switch B
					C4.3.2 threshold
					C4.3.3 polarity
					C4.3.4 time constant
					C4.3.5 invert signal
					C4.3.6 information
					C4.3.7 simulation
					C4.4. status output C
					C4.4.3 invert signal
					C4.4.4 information
					or C4.4. limit switch C
					C4.4.2 threshold
					C4.4.3 polarity
					C4.4.4 time constant
					C4.4.5 invert signal
					C4.4.6 information
					C4.4.7 simulation
	↓ ↑		↓ ↑		↓ ↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode	Select menu	↓ ↑	Select menu and/or sub-menu ↓ ↑		Select function and set data ↓ ↑ >
↵	Press > 2.5 s				
	C setup ①	> ↵	C4 I/O	> ↵	C4.5. pulse output D
					C4.5.1 pulse shape
					C4.5.2 pulse width
					C4.5.3 max. pulse rate
					C4.5.4 measurement
					C4.5.5 value p. pulse
					C4.5.6 polarity
					C4.5.7 low flow cutoff
					C4.5.8 time constant
					C4.5.9 invert signal
					C4.5.10 special functions
					C4.5.11 information
					C4.5.12 simulation
					or C4.5. frequencyoutput D
					C4.5.1 pulse shape
					C4.5.2 pulse width
					C4.5.3 100 % pulse rate
					C4.5.4 measurement
					C4.5.5 range
					C4.5.6 polarity
					C4.5.7 limitation
					C4.5.8 low flow cutoff
					C4.5.9 invert signal
					C4.5.10 time constant
					C4.5.11 special functions
					C4.5.12 information
					C4.5.13 simulation
					or C4.5. status output D
					C4.5.1 mode
					C4.5.3 invert signal
					C4.5.4 information
	↓ ↑		↓ ↑		↓ ↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode		↓ ↑	Select menu and/or sub-menu ↓↑	↓ ↑	Select function and set data ↓↑ >
↵	Press > 2.5 s				
	C setup ①	> ↵	C4 I/O	> ↵	or C4.5 limit switch D	> ↵	C4.5.1 measurement
							C4.5.2 threshold
							C4.5.3 polarity
							C4.5.4 time constant
							C4.5.5 invert signal
							C4.5.6 information
							C4.5.7 simulation
			C5 I/O totalizer		C5.1 totalizer 1		C5.1.1 funct. of totalizer
							C5.1.2 measurement
							C5.1.3 low flow cutoff
							C5.1.4 time constant
							C5.1.5 preset value
							C5.1.6 reset totalizer
							C5.1.7 set totalizer
							C5.1.8 stop totalizer
							C5.1.9 start totalizer
							C5.1.10 information
					C5.2 totalizer 2		C5.2.1...C5.2.10 are identical as the above C5.1.x items
					C5.3 totalizer 3		C5.3.1...C5.3.10 are identical as the above C5.1.x and C5.2.x items
			C6 I/O HART		C6.1 PV is		C6.1.1 current / frequency output X
					C6.2 SV is		C6.2.1 HART dynamic var.
					C6.3 TV is		C6.3.1 HART dynamic var.
					C6.4 4V is		C6.4.1 HART dynamic var.
					C6.5 HART Unit		
	↓↑		↓↑		↓↑		↓↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode		↓ ↑	Select menu and/or sub-menu ↓↑	↓ ↑	Select function and set data ↓↑ >
↵	Press > 2.5 s				
	C setup ①	> ↵	C7 device	> ↵	C7.1 device info	> ↵	C7.1.1 Tag
							C7.1.2 C number
							C7.1.3 device serial no.
							C7.1.4 electronic serial no.
							C7.1.5 information
							C7.1.6 Electronic Revision
					C7.2 display		C7.2.1 language
							C7.2.2 contrast
							C7.2.2 default display
							C7.2.4 Optical Keys
					C7.3 1 meas. page C7.4 2 meas. page _ stands for 3 or 4		C7._.1 function
							C7._.2 measurement 1.line
							C7._.3 range
							C7._.4 limitation
							C7._.5 low flow cutoff
							C7._.6 time constant
							C7._.7 format 1.line
							C7._.8 measurement 2.line
							C7._.9 format 2.line
							C7._.10 measurement 3.line
							C7._.11 format 3.line
					C7.5 graphic page		C7.5.1 select range
							C7.5.2 range
							C7.5.3 time scale
	↓↑		↓↑		↓↑		↓↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode		↓ ↑	Select menu and/or sub-menu ↓ ↑			↓ ↑	Select function and set data ↓ ↑ >
↵	Press > 2.5 s						
	C setup ①	> ↵	C7 device	> ↵	C7.6 special functions	> ↵	C7.6.1 reset errors
							C7.6.2 save settings
							C7.6.3 load settings
							C7.6.4 password quick setup
							C7.6.5 password setup
							C7.6.6 Set Date and Time
							C7.6.8 GDC IR interface
					C7.7 units		C7.7.1 size
							C7.7.2 volume flow
							C7.7.3 Text free unit
							C7.7.4 [m^3/s]*factor
							C7.7.5 mass flow
							C7.7.6 Text free unit
							C7.7.7 [kg/s]*factor
							C7.7.8 heat flow
							C7.7.9 Text free unit
							C7.7.10 [W]*factor
							C7.7.11 velocity
							C7.7.12 volume
							C7.7.13 Text free unit
							C7.7.14 [m^3]*factor
							C7.7.15 mass
							C7.7.16 Text free unit
							C7.7.17 [kg]*factor
							C7.7.18 heat
							C7.7.19 Text free unit
							C7.7.20 [J]*factor
							C7.7.21 density
							C7.7.22 temperature
	↓ ↑		↓ ↑		↓ ↑		↓ ↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

Measuring mode		↓ ↑	Select menu and/or sub-menu ↓↑	↓ ↑	Select function and set data ↓↑ >
↵	Press > 2.5 s				
	C setup ①	> ↵	C7 device	> ↵	C7.8 HART
					C7.8.1 HART
					C7.8.2 address
					C7.8.3 message
					C7.8.4 description
					C7.8.5 HART long tag
					C7.8.1 slave address
					C7.8.2 baudrate
					C7.8.3 parity
					C7.8.4 Data Format
					C7.8.5 transmission Delay
					C7.8.6 Stop Bits
					C7.8.7 information
					C7.9.1 reset totalizer 1
					C7.9.2 reset totalizer 2
					C7.9.3 reset totalizer 3 ②
	↓↑		↓↑		↓↑ >

① C1. .... process input 2 becomes active if "2 pipe" is selected in menu X4.
C2. ... process input 2 becomes active if "2 path"is selected.
② depends on module

INFORMATION!
*For the description of the **Setup C** menu parameters, refer to Menu C; setup on page 121*

6.3 Function tables

INFORMATION!

- *The following tables describe the functions of the standard device with HART® connection. The functions for Modbus, Foundation Fieldbus and Profibus are described in detail in the corresponding supplementary instructions.*
- *Depending on the device version, not all functions are available.*

6.3.1 Menu A, Quick Setup

No.	Function	Setting / Description
A1 Language		
A1	language	language selection depends on the device version.
A2 Tag		
A2	Tag	measuring point identifier (Tag no.) (also for HART® operation) appears in the LCD header (max. 8 digits).
A3 Reset		
A3	reset	
A3.1	reset errors	reset errors? Select: no/yes
A3.2	totalizer 1	reset totaliser? Select: No / Yes
A3.3	totalizer 2	reset totaliser? Select: No / Yes
A3.4 ①	totalizer 3	Reset Totaliser? Select: No / Yes
A4 Analog outputs (only for HART®)		
A4	analog outputs	applicable to all current outputs (terminals A, B and C), frequency outputs (terminals A, B and D), limit switch (terminals A, B, C, and / or D) and the 1st display page / line 1
A4.1	measurement	1) select measurement: Volume Flow / Velocity of Sound/ / Mass Flow / Flow Speed / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR
		2) use for all outputs? (also use this setting for Fct. A4.2...A4.5!) Setting: no (applies only to the main current output) / yes (applies to all analogue outputs)
A4.2	unit	selection of the unit from a list, depending on the measurement
A4.3	range	1) setting for main current output (range: 0...100%) setting: 0...x.xx (format and unit, depending on measurement, see A4.1 and A4.2 above)
		2) Use for all outputs? Make setting, see Fct. A4.1 above!
A4.4	low flow cutoff	1) setting for main current output (sets output value to "0") setting: x.xxx ± x.xxx% (Range: 0.0...20%) (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
		2) Use for all outputs? Make setting, see Fct. A4.1 above!
A4.5	time constant	1) setting for main current output (applicable to all flow measurements) setting: xxx.x s (range: 000.1...100 s)
		2) use for all outputs? Make setting, see Fct. A4.1 above!

No.	Function	Setting / Description

A5 Digital Outputs

A5	digital outputs	valid for all pulse outputs (terminals A, B and/or D) and totaliser 1.
A5.1	measurement	1) select measurement: volume flow / mass flow
		2) use for all outputs? (also use this setting for Fct. A5.2...A5.4!) setting: No (only for pulse output D) / Yes (for all digital outputs)
A5.2	pulse value unit	selection of the unit from a list, depending on the measurement.
A5.3	value p. pulse	1) setting for pulse output D (volume or mass value per pulse) setting: xxx.xxx in l/s or kg/s
		2) Use for all outputs? Make setting, see Fct. A5.1 above!
A5.4	low flow cutoff	1) setting for pulse output D (sets output value to "0") setting: x.xxx ± x.xxx% (range: 0.0…20%) (1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
		2) Use for all outputs? Make setting, see Fct. A5.1 above!

A6 GDC IR interface

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

① Depends on IO hardware module

6.3.2 Menu B; test

No.	Function	Setting / Description
B Test		
B1	simulation	Simulation
B1.1	volume flow	simulation of volume flow
B1.2	volume flow 2	simulation of volume flow 2
B1.3	velocity of Sound	simulation of velocity of sound
B1.4	Terminals A	sets simulated value of output on Terminal A
B1.5	Terminals B	sets simulated value of output on Terminal B
B1.6	Terminals C	sets simulated value of output on Terminal C
B1.7	Terminals D	sets simulated value of output on Terminal D
B2 actual values		
B2	actual values	display of actual values
B2.1	act. volume flow	displays current unfiltered volume flow
B2.2	act. volume flow 2	displays current unfiltered volume flow 2
B2.3	act. mass flow	displays current unfiltered mass flow
B2.4	act. flow speed	displays current unfiltered flow speed
B2.5	act. Reynolds number	displays current number
B2.6	act. Reynolds number 2	displays current number
B2.7	act. velocity of sound	displays current unfiltered velocity of sound
	B2.7.1 path 1	value path 1
	B2.7.2 path 2	value path 2
B2.8	act. gain	displays current unfiltered gain
	B2.8.1 path 1	value path 1
	B2.8.2 path 2	value path 2
B2.9	act. SNR	displays current unfiltered SNR
	B2.9.1 path 1	value path 1
	B2.9.2 path 2	value path 2
B2.10	act. signal quality	displays current signal quality
	B2.10.1 path 1	value path 1
	B2.10.2 path 2	value path 2
B2.11	opt. transd. distance	displays optimal transducer distance
	B2.11.1 path 1	value path 1
	B2.11.2 path 2	value path 2
B2.12	act. temperature A	displays current temperature A
B2.13	act. temperature B	displays current temperature B
B2.14	current input A	displays current A
B2.15	current input B	displays current B
B2.16	operating hours	displays device operating hours
B2.17	Date and Time	displays device date & time setting yyyy-mm-dd hh:mm

No.	Function	Setting / Description

B3 Information

B3	information	
B3.1	Status Log	log for errors and warnings
B3.2	Status Details	present errors and warnings in NE107 groups
B3.3	C number	displays C number of the installed electronics
B3.4	process input	displays information of the sensor electronics PCB
	B3.4.1 sensor CPU	displays information of the sensor CPU software
	B3.4.2 sensor DSP	displays information of the sensor DSP software
	B3.4.3 sensor driver	displays information of the sensor driver hardware
B3.5	SW. REV. MS	displays information of Main Software
B3.6	SW. REV. UIS	Displays information of User Interface
B3.7	Profibus "Bus interface"	only appears with Modbus
	B3.7._ Basic IO	displays information of the Basic IO
	B3.7._ Mod/Exi IO	displays information of the version, modular Exi and IO
	B3.7._ Profibus DP	displays information of the Profibus DP interface
	B3.7._ Profibus PA	displays information of the Profibus PA interface
	B3.7._ Foundation Field Bus	displays information of the Foundation Fieldbus interface
	B3.7._ Modbus	displays information of the Modbus interface
B3.8	Electronic Revision	Displays information of the Electronics Revision
B3.9	Change log	The last changes of parameters are listed in this menu point, together with date and time. As a reference a CRC (checksum) over all parameters is used. This reference can be used by the customer for their documentation. The preview shows the actual CRC.

6.3.3 Menu C; setup

No.	Function	Settings / descriptions
C setup		
C1 process Input		
C1.1	number of pipe(s)	1 or 2
C1.2	number of path(s)	1 or 2
C1.3	pipe data	Set the diameter and material of pipe, wall thickness, liner material, fluid and VoS material data, density, glycol %, (dyn.)viscosity, temperature etc.
	C1.3.1 diameter	size for outer diameter of pipe; min-max: 20 - 4300 mm / 0.787 - 169.3 inch
	C1.3.2 pipe material	carbon steel, stainless steel, cast iron, aluminum, concrete, GRF/RFP, asbestos cement, PP/PVC, acrylics, polyamide, other
	C1.3.3 VoS pipe material	min-max: 1000.0 - 4500.0 m/s / 3280.8 - 14764 ft/s
	C1.3.4 wall thickness	min-max: 1.000 - 100.0 mm / 0.039 - 3.937 inch
	C1.3.5 liner material	cement, epoxy, PP, LDPE, HDPE, PTFE, rubber, other, none
	C1.3.6 VoS liner material	min-max: 1000.0 - 4500.0 m/s / 3280.8 - 14764 ft/s
	C1.3.7 liner thickness	min-max: 0.100 - 20.00 mm / 0.004 - 0.787 inch
	C1.3.8 fluid	water, alkanes, alcohols, oil, acids, CxHx refined, CxHx light, refrigerant, solvents, caustic soda
	C1.3.9 VoS fluid	min-max: 500 - 2500 m/s / 1640.4 - 8202.1 ft/s
	C1.3.10 density	min-max: 0.1000 - 5.0000 kg/l / 6.2428 lb/ft3 to 312.14 lb/ft3
	C1.3.11 glycol % vol.	water/glycol mixture
	C1.3.12 dynamic viscosity	Sets the value of the dynamic viscosity for Reynolds calculation, min-max: 0.100 cP to 5000 cP (mPa*s)
	C1.3.13 pipe temperature	°C, °F, K
C1.4	transducer data	Set data transducer: 1-2 path(s), number of traverses, actual distance
	C1.4.1 transducer set	short code for transducer set, mentioned on sensor (Ta, Tb, Tc, none)
	C1.4.2 number of traverses	Compensation for errors made at different Reynolds numbers
	C1.4.3 actual distance	min-max: -10.00 - +999.0 mm / -0.394 - +39.33 inch
	C1.4.4 transducer set 2	see descriptions above
	C1.4.5 number of traverses	
	C1.4.6 actual distance	
	C1.4.7 transducer set 3	
	C1.4.8 number of traverses	
	C1.4.9 actual distance	
C1.5	Calibration	Set 1-2 pipes and 1-2 path(s), meter factor, Reynolds correction and linearization
	C1.5.1 zero calibration	Transit time offset at zero flow (cancel, manual, default, automatic min-max: -10.000 - +10.000 ps)
	C1.5.2 GK	set factor (min-max: 0.500 - 2.000) for correction of volume flow, mass flow, flow speed and Reynolds number
	C1.5.3 Reynolds correction	set Reynolds correction (on,off) for flow profile disturbances, effective on volume flow, mass flow
	C1.5.4 linearization	Compensation for errors made at different Reynolds numbers

No.	Function	Settings / descriptions
C1.6	filter	Set (depending on version) time constant, limitation, flow direction and low flow cutoff
	C1.6.1 limitation	set lower and upper limit for flow speed on all outputs (min-max: -100 - +100 m/s)
	C1.6.2 flow direction	select flow direction (normal, reverse)
	C1.6.3 time constant	within set time, measurements are averaged, displayed and sent to current output (min-max: 000.0 - 100.0 s)
	C1.6.4 low flow cutoff	beneath set flow speed, zero appears in display (min-max: 0.000 - 10.00 m/s / 0.000 - 32.81 ft/s)
C1.7	plausibility	Error filtering
	C1.7.1 error limit	with set limits, every erroneous measurement is counted (min-max: 000 - 100)
	C1.7.2 counter decrease	amount with which the counter decreases (min-max: 00 - 99)
	C1.7.3 counter limit	totalized correct measurements equal to set counter decrease, decrease error limit by 1 (min-max: 000 - 999)
C1.8	simulation	Simulation of volume flow and velocity of sound
	C1.8.1 volume flow	unit for volume flow; L/s, L/min,L/h, m3/s, m3/min, m3/h, m3/d, ft3/s, ft3/min, ft3/h, gal/s, gal/min,gal/h, gal/d, IG/s, IG/min, IG/h, IG/d, bbl/h, bbl/d, free unit
	C1.8.2 velocity of sound	unit for flow speed and velocity of sound (VoS); m/s, ft/s
C1.9	information	Set meter factor
	C1.9.1 Sensor CPU	Displays the ID of the CPU on the FrontEnd
	C1.9.2 Sensor DSP	Displays the ID of the DSP on the FrontEnd
	C1.9.3 Sensor driver	Displays the ID of the Sensor Driver on the FrontEnd
	C1.9.4 calibration date	Displays the date of calibration of the sensor
	C1.9.5 serial no. sensor	Displays the serial number of the measuring sensor
	C1.9.6 V no. Sensor	Displays the Order number of the measuring sensor
C1.10	flow mode standard (option, depends on module)	
C1.11 ①	temperature inputs	Temperatures standard, heat and cold
C1.12 ①	supply temperature	Temperatures supply; standard, heat and cold (fixed / automatic)
C1.13 ①	return temperature	Temperatures return: standard, heat and cold (fixed / automatic)
C1.14 ①	current inputs	Current inputs: standard, heat and cold (fixed / automatic)
C1.15 ①	flow sensor	Flow sensor: standard, heat and cold (fixed / automatic)
C1.16 ①	specific heat	Specific heat media: standard, heat and cold (fixed / automatic)

No.	Function	Settings / descriptions
C1.17 ①	diagnosis	
	C1.17.1 diagnostics 1	Sets the parameter to be assigned to cyclic value; none, flow speed (1-2-3), velocity of sound (1-2-3)
	C1.17.2 diagnostics 2	Sets the parameter to be assigned to cyclic value ; none, gain (1-2-3), SNR (1-2-3)
	C1.17.3 proc: Empty pipe	Change NE107 status signal for status group "Proc: Empty pipe"
	C1.17.4 proc: Signal Lost	Change NE107 status signal for status group "Proc: Signal Lost"
	C1.17.5 proc: Signal Unreliable	Change NE107 status signal for status group "Proc: Signal Unreliable"
	C1.17.6 Config: Totalizer	Change NE107 status signal for status group "Config: Totaliser"
	C1.17.7 Electr: IO Connection	Change NE107 status signal for status group "Electr: IO Connection"
	C1.17.8 Electr: Power Failure	Change NE107 status signal for status group "Electr: Power Failure"
	C1.17.9 Proc: Current Input	Change NE107 status signal for status group "Proc: Current Input"

① depends on module

No.	Function	Settings / descriptions
C2 Process Input 2 (only shows with a 2 pipe configuration)		
C2.1	Number of pipe(s)	1 or 2
C2.2	Number of path(s)	1 or 2
C2.3	Pipe data	Set the diameter and material of pipe, wall thickness, liner materia, fluid and VoS material data, density, glycol %, (dyn.)viscosity, temperature etc.
	C2.3.1 diameter	size for outer diameter of pipe; min-max: 20 - 4300 mm / 0.787 - 169.3 inch
	C2.3.2 pipe material	carbon steel, stainless steel, cast iron, aluminum, concrete, GRF/RFP, asbestos cement, PP/PVC, acrylics, polyamide, other
	C2.3.3 VoS pipe material	min-max: 1000.0 - 4500.0 m/s / 3280.8 - 14764 ft/s
	C2.3.4 wall thickness	min-max: 1.000 - 100.0 mm / 0.039 - 3.937 inch
	C2.3.5 liner material	cement, epoxy, PP, LDPE, HDPE, PTFE, rubber, other, none
	C2.3.6 VoS liner material	min-max: 1000.0 - 4500.0 m/s / 3280.8 - 14764 ft/s
	C2.3.7 liner thickness	min-max: 0.100 - 20.00 mm / 0.004 - 0.787 inch
	C2.3.8 fluid	water, alkanes, alcohols, oil, acids, CxHx refined, CxHx light, refrigerant, solvents, caustic soda
	C2.3.9 VoS fluid	min-max: 500 - 2500 m/s / 1640.4 - 8202.1 ft/s
	C2.3.10 density	min-max: 0.1000 - 5.0000 kg/l / 6.2428 lb/ft3 to 312.14 lb/ft3
	C2.3.11 glycol % vol.	water/glycol mixture
	C2.3.12 dynamic viscosity	Sets the value of the dynamic viscosity for Reynolds calculation, min-max: 0.100 cP to 5000 cP (mPa*s)
	C2.3.13 pipe temperature	°C, °F, K
C2.4	transducer data	Set data transducer: 1-2 path(s), number of traverses, actual distance
	C2.4.1 transducer set	short code for transducer set, mentioned on sensor (Ta, Tb, Tc, none)
	C2.4.2 number of traverses	Compensation for errors made at different Reynolds numbers
	C2.4.3 actual distance	min-max: -10.00 - +999.0 mm / -0.394 - +39.33 inch
C2.5	Calibration	Set 1-2 pipes and 1-2 path(s), meter factor, Reynolds correction and linearization
	C2.5.1 zero calibration	Transit time offset at zero flow (cancel, manual, default, automatic min-max: -10.000 - +10.000 ps)
	C2.5.2 GK	set factor (min-max: 0.500 - 2.000) for correction of volume flow, mass flow, flow speed and Reynolds number
	C2.5.3 Reynolds correction	set Reynolds correction (on,off) for flow profile disturbances, effective on volume flow, mass flow
	C2.5.4 linearization	Compensation for errors made at different Reynolds numbers
C2.6	Filter	Set (depending on version) time constant, limitation, flow direction and low flow cutoff
	C2.6.1 limitation	set lower and upper limit for flow speed on all outputs (min-max: -100 - +100 m/s)
	C2.6.2 flow direction	select flow direction (normal, reverse)
	C2.6.3 time constant	within set time, measurements are averaged, displayed and sent to current output (min-max: 000.0 - 100.0 s)
	C2.6.4 low flow cutoff	beneath set flow speed, zero appears in display (min-max: 0.000 - 10.00 m/s / 0.000 - 32.81 ft/s)

No.	Function	Settings / descriptions
C2.7	plausibility	Error filtering
	C2.7.1 error limit	with set limits, every erroneous measurement is counted (min-max: 000 - 100)
	C2.7.2 counter decrease	amount with which the counter decreases (min-max: 00 - 99)
	C2.7.3 counter limit	totalized correct measurements equal to set counter decrease, decrease error limit by 1 (min-max: 000 - 999)
C2.8	simulation	Simulation of volume flow and velocity of sound
	C2.8.1 volume flow 2	on,off
	C2.8.2 velocity of sound	unit for flow speed and velocity of sound (VoS); m/s, ft/s
C2.9	volume flow sum 1-2	sum of volume flow 2-1 / 1+2 / off
C2.10	diagnosis	
	C2.10.1 diagnostics 2	

No.	Function	Settings / descriptions

C3.0 transducer sets

C3.1	Ta serial no	displays serial number of transducer a
C3.2	Ta calibration no	displays calibration number of transducer a
C3.3	Tb serial no	displays serial number of transducer b
C3.4	Tb calibration no	displays calibration number of transducer b
C3.5	Tc serial no	displays serial number of transducer c
C3.6	Tc calibration no	displays calibration number of transducer c

No.	Function	Settings / descriptions

C4 I/O

Available options depends on the version installed		
C4.1	hardware	Configuration of connection terminals. Selection depends on signal converter version.
C4.1.1	Terminals A	Sets the output associated with terminal A Select: Off (switched off) / current output / frequency output / pulse output / status output / limit switch / control input / current input
C4.1.2	Terminals B	Sets the output associated with terminal B Select: Off (switched off) / current output / frequency output / pulse output / status output / limit switch / control input / current input
C4.1.3	Terminals C	Sets the output associated with terminal C Select: Off (switched off) / current output / status output / limit switch
C4.1.4	Terminals D	Sets the output associated with terminal D Select: Off (switched off) / frequency output / pulse output / status output / limit switch

No.	Function	Settings / descriptions
C4.2 Current Output X		
X stands for one of the connection terminals A, B, C or D		
C4.2.1	range 0%...100%	set current range for current output X
C4.2.2	extended range	min. and max. settings for current output X
C4.2.3	error current	error current setting for error current output X
C4.2.4	error condition	sets condition for error current output X
C4.2.5	measurement	masurement value for current output X; volume flow, velocity of sound, mass flow, flow speed, gain, SNR, diagn flow speed, diagn VoS, diagn gain, diagn SNR.
C4.2.6	range	measurement value range for current output A
C4.2.7	polarity	set response of current output A to measurement polarity
C4.2.8	limitation	limitation before applying the time constant.
C4.2.9	low flow cutoff	low flow cutoff for current output A
C4.2.10	time constant	time constant for current output A
C4.2.11	special functions	range change setting for current output A
C4.2.12	threshold	threshold value for range change setting for current output A
C4.2.13	information	displays information of current output I/O board
C4.2.14	simulation	sets simulated output of current output A
C4.2.15	4 mA trimming	trimming of current output A at 4 mA
C4.2.16	20 mA trimming	trimming of current output A at 20 mA min-max: 18.500 - 21.500 mA

C4.3 Control input B		
C4.3.1	mode	Off (control input switched off) / Hold All Outputs (hold current values, not display and totalisers) / Output Y (hold current values) / All Outputs To Zero (current values = 0%, not display and totalisers) / Output Y To Zero (current value = 0%) / All Totalisers (reset all totalisers to "0") / Totaliser "Z" Reset (set totaliser 1, (2 or 3) to "0") / Stop All Totalisers / Stop Totaliser "Z" (stops totaliser 1, (2 or 3) / Zero Outp.+Stop Tot. (all outputs 0%, stop all totalisers, not the display) / External Range Y (control input for external range of current output Y) - also make this setting on current output Y (no check if current output Y is available) / Error Reset (all resettable errors are deleted) Zero Calibration
C4.3.2	invert signal	Select: Off (activated output: switch closed) / On (activated output: switch open)
C4.3.3	information	Serial no. of the I/O board, software version no. and production date of the circuit board
C4.3.4	simulation	Sequence see B1._ Control Input

No.	Function	Settings / descriptions

C4_ Status Output B or C

_ stands for 3 or 4

Error message for pipe 1 and pipe 2 configuration	Out Of Specification (output set, signals status of category "Error in Device" or "Application Failure" or "Out Of refer to *Status messages and diagnostic information* on page 143)/ Application Failure (output set, signals status of category "Error in Device" or "Application Failure" refer to *Status messages and diagnostic information* on page 143) / Flow Polarity (polarity of the current flow) / Flow Over Range (over range of the flow) / Empty Pipe (when pipe empty, output activated) / Error in Device (output set, signals status of category "Error in Device" refer to *Status messages and diagnostic information* on page 143)	
	Totaliser 1 Preset (activates when totaliser X preset value is reached) / Totaliser 2 Preset (activates when totaliser X preset value is reached) / Totaliser 3 Preset (activates when totaliser X preset value is reached) / Output A (activated by the status of output Y, additional output data see below) / Output B (activated by the status of output Y, additional output data see below) / Output C (activated by the status of output Y, additional output data see below) / Output D (activated by the status of output Y, additional output data see below) / Off (switched off) / Power Overrange / Power Polarity / Calculated Flow Polarity	
C4._.1	mode	only if output is activated when error occurs and depending on pipe configuration 1 or 2 pipes.The output shows the following measuring conditions:
C4._.3	invert signal	Select: Off (activated output: switch closed) / On (activated output: switch open)
C4._.4	information	Serial no. of the I/O board, software version no. and production date of the circuit board
C4_ Limit switch B or C		
_ stands for 3 or 4		
C4._.1	measurement	select: Volume Flow / Mass Flow / Flow Speed,Power / Calculated Flow / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR
C4._.2	threshold	Set measured value polarity, please note flow direction in C1.6.2!
		xxx.x ±x.xxx (format and unit depend on the measurement, see above)
		(1st value = threshold / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C4._.3	polarity	Set polarity, please note Flow Direction
		Select: Both Polarities (plus and minus values are displayed) / Positive Polarity (display for negative values = 0) / Negative Polarity (display for positive values = 0) / Absolute Value (always displays positive, with both negative and positive values)
C4._.4	time constant	Range: 000.1…100 s
C4._.5	invert signal	Select: Off (activated output: switch closed) / On (activated output: switch open)
C4._.6	information	Serial no. of the I/O board, software version no. and production date of the circuit board
C4._.7	simulation	Sequence see B1._ Limit switch, simulation; on,off,cancel

No.	Function	Settings / descriptions

C4._ Pulse Output

C4._	pulse output X	X stands for one of the connection terminals A, B or D
C4._.1	pulse shape	Specify the pulse shape
		Select: Symmetric (about 50% on and 50% off) / Automatic (constant pulse with about 50% on and 50% off at 100% pulse rate) / Fixed (fixed pulse rate, setting see below Fct. C4.5.3 100% pulse rate)
C4.5.2	pulse width	Only available if set to "Fixed" in Fct. C4._.1
		Range: 0.05…2000 ms
		Note: max. setting value Tp [ms] ≤ 500 / max. pulse rate [1/s], gives the pulse width = time where the output is activated
C4.5.3	max. pulse rate	Pulse rate for 100% of the measuring range
		Range: 0.0…10000 1/s
		Limitation 100% pulse rate ≤ 100/s: I_{max} ≤ 100 mA Limitation 100% pulse rate > 100/s: I_{max} ≤ 20 mA
C4.5.4	measurement	(depends on pipe configuration: 1 or 2 pipes) Measurements for activating the output
		Select: Volume Flow / Mass Flow
C4.5.5	value p. Pulse	Set value for volume or mass per pulse.
		xxx.xxx, measured value in [l] or [kg] depending on settings in C7.7 (units).
		At max. pulse rate see above C4.5.3 "Pulse Output"
C4.5.6	polarity	Set polarity, please note Flow Direction
		Select: Both Polarities (plus and minus values are displayed) / Positive Polarity (display for negative values = 0) / Negative Polarity (display for positive values = 0) / Absolute Value (always displays positive, with both negative and positive values)
C4.5.7	low flow cutoff	Sets the measurement to "0" for low values
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C4.5.8	time constant	Range: 000.1…100 s
C4.5.9	invert signal	Select: Off (activated output: switch closed) / On (activated output: switch open)
C4.5.10	special functions	For ranging, off, phase shift
C4.5.11	information	Serial no. of the I/O board, software version no. and production date of the circuit board
C4.5.12	simulation	Sequence see B1._ Pulse Output X

No.	Function	Settings / descriptions

C4.5 Frequency output D

C4.5.1	pulse shape	Pulse shape of frequency
C4.5.2	pulse width	Pulse width of frequency
C4.5.3	100% pulse rate	Pulse rate for 100% of the measuring range for frequency output
		Range: 1…10000 Hz
		Limitation 100% Pulse Rate ≤ 100/s: Imax ≤ 100 mA Limitation 100% Pulse Rate > 100/s: Imax ≤ 20 mA
C4.5.4	measurement	Measurements for activating the output.
		Select measurement: Volume Flow / Mass Flow / Velocity of sound / flow speed / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR.
C4.5.5	range	0…100% of the measurement set in Fct. C4._.4
		x.xx…xx.xx _ _ _ (format and unit depend on the measurement, see above.
C4.5.6	polarity	Set measured value polarity, please note flow direction in C1.6.2!
		Select: Both Polarities (plus and minus values are displayed) / Positive Polarity (display for negative values = 0) / Negative Polarity (display for positive values = 0) / Absolute Value (always displays positive, with both negative and positive values
C4.5.7	limitations	Limitation before applying the time constant
		±xxx…±xxx%; range: -150…+150%
C4.5.8	low flow cutoff	Sets the measurement to "0" for low values
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value.
C4.5.9	time constant	Range: 000.1…100 s
C4.5.10 ②	invert signal	Select: Off (activated output: switch closed) / On (activated output: switch open)
C4.5.11	special functions	This function is only available at the terminal B frequency output. At the same time, 2 frequency outputs must be available: 1st output at terminal A or D / 2nd output at terminal B.
		The B output is operated as a slave output, controlled and set using master output A or D.
		Select: Off (no phase shift) / Phase Shift w.r.t. D or A (slave output is B and master output is D or A)
C4.5.12	information	Serial no. of the I/O board, software version no. and production date of the circuit board
C4.5.13	simulation	Sequence; see B1._ Status Output X
① Error message for pipe 1 and pipe 2 configuration		

② depends on IO setting / module hardware

No.	Function	Settings / descriptions

C5 I/O Totalisers

C5.1	totalizer 1	Set function of totaliser. _ stands for 1, 2, 3 (= totalizer 1, 2, 3) menu C5.2.1...C5.3.10 are identical to menu C5.3.x items Note: the basic version (standard) has only 2 totalisers!
C5.2	totalizer 2	
C5.3	totalizer 3	
C5._	C5._.1 funct. of totalizer	Totalizer function, Select: Absolute Total (counts positive + negative values) / +Totaliser (counts only the positive values) / -Totaliser (counts only the negative values) / Off (Totaliser is switched off)
	C5._.2 measurement	Selection of the measurement for Totaliser _
		Select: Volume Flow / Mass Flow
	C5._.3 low flow cutoff	Sets the measurement to "0" for low values
		Range: 0.0...20%
		(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	C5._.4 time constant	Range: 000.1...100 s
	C5._.5 preset value	If this value is reached, positive or negative, a signal is generated that can be used for a status output at which "Preset Totaliser X" has to be set.
		Preset value (max. 8 digits) x.xxxxx in selected unit, see C5.7.3, 10 and 13
	C5._.6 reset totalizer	Sequence see Fct. A3.1, A3.2 and A3.3
	C5._.7 set totalizer	Set Totaliser _ to the desired value
		Select: Break (exit function) / Set Value (opens the editor to make the entry)
		Query: Set Totaliser?
		Select: Select: No (exit function without setting the value) / Yes (sets the totaliser and exits the function)
	C5._.8 stop totalizer	Totaliser _ stops and holds the current value.
		Select: No (exits the function without stopping the totaliser) / Yes (stops the totaliser and exits the function)
	C5._.9 start totalizer	Start Totaliser _ after that totaliser is stopped
		Select: No (exits the function without starting the totaliser) / Yes (starts the totaliser and exits the function)
	C5._.10 information	Serial no. of the I/O board, software version no. and production date of the circuit board

No.	Function	Settings / descriptions

C6 I/O HART

C6	I/O HART	Selection or display of the 4 dynamic variables (DV) for HART®
		The HART® current output (terminal A basic I/Os) always has a fixed link to the primary variables (PV). Fixed links of the other DVs (1-3) are only possible if additional analogue outputs (current and frequency output) are available; if not, the measurement can be freely selected from the following list: in Fct. A4.1 "Measurement"
		_ stands for 1, 2, 3 or 4 X stands for connection terminals A...D
C6.1	PV is	Current output (primary variable)
C6.2	SV is	(secondary variable)
C6.3	TV is	(tertiary variable)
C6.4	4V is	(4th variable)
C6.5	HART Units	Changes units of DVs (dynamic variables) in the display
		Break: return with ↵ key
		HART® display: copies the settings for the display units to the settings for DVs
		Standard: factory settings for DVs
C6._.1	Current Output X	Shows the current analog measured value of the linked current output. The measurement cannot be changed!
C6._.1	Frequency Output X	Shows the current analog measured value of the linked frequency output, if present. The measurement cannot be changed!
C6._.1	HART Dynamic Var.	Measurements of the dynamic variables for HART®.
		Select: Volume Flow / Mass Flow / Diagnosis / Velocity / Totaliser 1 / Totaliser 2 / Totaliser 3 / Operating Hours

No.	Function	Settings / descriptions

C7 Device

C7.1	device info	-
	C7.1.1 Tag	Settable characters (max. 8 digits): A...Z; a...z; 0...9; / - , .
	C7.1.2 C Number	Displays the CG number of the installed electronics
	C7.1.3 device serial no.	Serial no. of the measuring sensor, cannot be changed
	C7.1.4 electronic serial no.	Displays the serial number of the electronics
	C7.1.5 information	Software version number
	C7.1.6 Electronic Revision ER	Displays the electronic revision of the electronics

No.	Function	Settings / descriptions

C7.2 Display

C7.2	display	-
	C7.2.1 language	Language selection depends on the device version.
	C7.2.2 contrast	Adjust display contrast for extreme temperatures. Setting: -9...0...+9
		This change takes place immediately, not just when setting mode is exited!
	C7.2.3 default display	Specification of the default display page that is returned to after a short delay period.
		Select: None (the current page is always active) / 1st Meas. Page (show this page) / 2nd Meas. Page (show this page) / Status Page (show only status messages) / Graphic Page (trend display of the 1st measurement)
	C7.2.4 Optical Keys	Activate or deactivate the optical keys

No.	Function	Settings / descriptions

C7.3 and C7.4 1st Meas. Page and 2nd Meas. Page

C7.3	1st meas. page	_ stands for 3 = 1st Meas. Page and 4 = 2nd Meas. Page
C7.4	2nd meas. page	
	C7._.1 function	Specify number of measured value lines (font size)
		Select: One Line / Two Lines / Three Lines
	C7._.2 measurement 1.line	Specify 1st Line Variable
		Select measurement:Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR.
	C7._.3 range	0…100% of the measurement set in Fct. C5._.2
		x.xx…xx.xx _ _ _ (format and unit depend on the measurement)
	C7._.4 limitation	Limitation before applying the time constant
		±xxx ... ±xxx%; range: -150…+150%
	C7._.5 low flow cutoff	Sets low flow values to "0"
		x.xxx ± x.xxx %; Range: 0.0…20 %
		(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	C7._.6 time constant	Range: 000.1…100 s
	C7._.7 format 1.line	Specify decimal places.
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font
	C7._.8 measurement 2.line	Specify 2nd Line Variable (only available if this 2nd line is activated)
		Select: Bar Graph (for measurement selected in the 1st line) Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR. Totalisers / Operating hours
	C7._.9 format 2.line	Specify decimal places
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font
	C7._.10 measurement 3.line	Specify 3rd Line Variable (only available if this 3rd line is activated)
		Select: Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR / Totalisers / Operating hours
	C7._.11 format 3.line	
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font

No.	Function	Settings / descriptions

C7.3 and C7.4 1st Meas. Page and 2nd Meas. Page

C7.3	1st meas. page	_ stands for 3 = 1st Meas. Page and 4 = 2nd Meas. Page
C7.4	2nd meas. page	
	C7._.1 function	Specify number of measured value lines (font size)
		Select: One Line / Two Lines / Three Lines
	C7._.2 measurement 1.line	Specify 1st Line Variable
		Select measurement:Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR.
	C7._.3 range	0…100% of the measurement set in Fct. C5._.2
		x.xx…xx.xx _ _ _ (format and unit depend on the measurement)
	C7._.4 limitation	Limitation before applying the time constant
		±xxx ... ±xxx%; range: -150…+150%
	C7._.5 low flow cutoff	Sets low flow values to "0"
		x.xxx ± x.xxx %; Range: 0.0…20 %
		(1st value = switching point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
	C7._.6 time constant	Range: 000.1…100 s
	C7._.7 format 1.line	Specify decimal places.
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font
	C7._.8 measurement 2.line	Specify 2nd Line Variable (only available if this 2nd line is activated)
		Select: Bar Graph (for measurement selected in the 1st line) Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR. Totalisers / Operating hours
	C7._.9 format 2.line	Specify decimal places
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font
	C7._.10 measurement 3.line	Specify 3rd Line Variable (only available if this 3rd line is activated)
		Select: Volume Flow / Mass Flow / Flow Speed / Velocity of Sound / Gain / SNR / diagn flow speed, diagn VoS, diagn gain, diagn SNR / Totalisers / Operating hours
	C7._.11 format 3.line	
		Select: Automatic (adaptation is automatic) / X (= none) …X.XXXXXXXX (max. 8 digits) depends on size of font

No.	Function	Settings / descriptions

C7.5 Graphic Page

C7.5	graphic page	-
	C7.5.1 select range	Graphic page always shows trend curve of the measurement of the 1st page / 1st line, see Fct. C7.3.2
		Select: Manual (set range in Fct. C7.5.2) ; Automatic (automatic depiction based on the measured values)
		Reset only after parameter change or after switching off and on.
	C7.5.2 range	Set the scaling for the Y axis. Only available if "Manual" is set in C7.5.1.
		±xxx ±xxx%; range: -100…+100%
		(1st value = lower limit / 2nd value = upper limit), condition: 1st value ≤ 2nd value
	C7.5.3 time scale	Set the time scaling for the X axis, trend curve
		xxx min; range: 0…100 min

C7.6 Special Functions

C7.6	special functions	-
	C7.6.1 reset errors	Reset Errors?
		Select: No / Yes
	C7.6.2 save settings	Save current settings. Select: Break (exit function without saving) / Backup 1 (save in storage location 1) / Backup 2 (save in storage location 2)
		Query: Continue To Copy? (cannot be done afterwards) Select: No (exit function without saving) / Yes (copy current settings to storage backup 1 or backup 2)
	C7.6.3 load settings	Load saved settings Select: Break (exit function without loading) / factory settings (restore factory settings) / backup 1 (load data from storage location 1) / backup 2 (load data from storage location 2)
		Query: Continue To Copy? (cannot be done afterwards) Select: No (exit the function without saving) / Yes (load data from the selected storage location)
	C7.6.4 password quick setup	Password required to change data in the quick setup menu.
		0000 (= to quick setup menu without password)
		xxxx (password required); range 4 digits: 0001…9999
	C7.6.5 password setup	Password required to change data in the setup menu
		0000 (= to quick setup menu without password)
		xxxx (password required); range 4 digits: 0001…9999
	C7.6.6 Set Date and Time	Set real time
	C7.6.8 GDC IR interface	After this function has been activated an optical GDC adapter can be connected to the LC display. If approximately 60 seconds pass without a connection being established or after the adapter is removed, then the function is exited and the optical keys are active once again.
		Break (exit function without connection)
		Activate (the IR interface adapter and interrupt the optical keys)
		If approximately 60 seconds pass without a connection being established, then the function is exited and the optical keys are active once again (if these were activated before).

No.	Function	Settings / descriptions

C7.7 Units

C7.7	units	
	C7.7.1 size	Sets displayed units for the pipe diameter
	C7.7.2 volume flow	m^3/h; m^3/min; m^3/s; L/h; L/min; L/s (L = litres); IG/s; IG/min; IG/h cf/h; cf/min; cf/s; gal/h; gal/min; gal/s; barrel/h; barrel/day Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.3 Text free unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.4 [m^3/s]*factor	Specification of the conversion factor, based on m^3/s:
		xxx.xxx refer to *Set free units* on page 138
	C7.7.5 mass flow	kg/s; kg/min; kg/h; t/min; t/h; g/s; g/min; g/h; lb/s; lb/min; lb/h; ST/min; ST/h (ST = Short Ton); LT/h (LT = Long Ton); Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.6 Text free unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.7 [kg/s]*factor	Specification of the conversion factor, based on kg/s:
		xxx.xxx refer to *Set free units* on page 138
	C7.7.8 heat flow	kW, MW, kBTU/h, MMBTU/h
	C7.7.9 Text free unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.10 [W]*factor	Specification of the conversion factor, based on W:
		kW, MW, kBTU/h, MMBTU/h
	C7.7.11 velocity	m/s; ft/s
	C7.7.12 volume	m^3; L; hL; mL; gal; IG; in^3; cf; yd^3; barrel Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.13 Text free unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.14 [m^3]*factor	Specification of the conversion factor, based on m^3:
		xxx.xxx refer to *Set free units* on page 138
	C7.7.15 mass	kg; t; mg; g; lb; ST; LT; oz; Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.16 Text Free Unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.17 [kg]*factor	Specification of the conversion factor, based on kg:
		xxx.xxx refer to *Set free units* on page 138
	C7.7.18 heat	MJ; GJ; MWh; GWh; kBTU; MMBTU Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.19 Text free unit	For text to be specified refer to *Set free units* on page 138:
	C7.7.20 [J]*factor	Specification of the conversion factor, based on J:
		xxx.xxx refer to *Set free units* on page 138
	C7.7.21 density	kg/L; kg/m^3; lb/cf; lb/gal; SG Free Unit (set factor and text in the next two functions, sequence see below)
	C7.7.22 temperature	Sets displayed units for temperature [°C - °F - K]

No.	Function	Settings / descriptions

C7.8 HART

C7.8	HART	I/O Bus connections
	C7.8.1 HART	Switch HART® communication on/off:
		Select: On (HART® activated) possible current range for current output 4...20 mA / Off (HART® not activated) possible current range for current output 0...20 mA
	C7.8.2 address	Set address for HART® operation:
		Select: 00 (Point-to-Point operation, current output has normal function, current = 4...20 mA) / 01...15 (Multi-Drop operation, current output has a constant setting of 4 mA)
	C7.8.3 message	Set required text:
		A...Z ; a...z ; 0...9 ; / - + , . *
	C7.8.4 description	Set required text:
		A...Z ; a...z ; 0...9 ; / - + , . *
	C7.8.5 HART long Tag	Up to 32 digits (on display max. 8 digits)

C7.8 RS485/Modbus

② Bus connections depends on hardware module

C7._	C7.8.1 slave address	1..247
	C7.8.2 baudrate	1200, 2400, 3600, 4800, 9600, 19200, 38400, 57600, 115200 bps
	C7.8.3 parity	Even, Odd, No
	C7.8.4 Data Format	Big Endian, Little Endian
	C7.8.5 transmission Delay	0...0.04 [s]
	C7.8.6 Stop Bits	1 Stop Bit, 2 Stop Bits
	C7.8.7 information	

C7.9 Quick Setup

C7.9	Quick Setup	Activate quick access in Quick Setup menu:
		Select: Yes (switched on) / No (switched off)
	C7.9.1 Reset Totaliser 1	Reset Totaliser 1 in Quick Setup menu?
		Select: Yes (activated) / No (switched off)
	C7.9.2 Reset Totaliser 2	Reset Totaliser 2 in Quick Setup menu?
		Select: Yes (activated) / No (switched off)
	C7.9.3 Reset Totaliser 3 ②	Reset Totaliser 3 in Quick Setup menu?
		Select: Yes (activated) / No (switched off)

② depends on IO setting / module hardware

6.3.4 Set free units

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

Table 6-2: Sequences to set texts and factors

6.4 Description of functions

6.4.1 Reset totaliser in the menu "Quick Setup"

INFORMATION!
It may be necessary to activate resetting of the totaliser in the menu "Quick Setup".

Key	Display	Description and setting
>	Quick Setup	Press and hold for 2.5 s, then release the key.
>	Language	-
2 x ↓	Reset	-
>	Reset Errors	-
↓	All Totaliser	Select desired totaliser. (Totaliser 3 is optional)
↓	Totaliser 1	
↓	Totaliser 2	
↓	Totaliser 3	
>	Reset Totaliser No	-
↓ or ↑	Reset Totaliser Yes	-
↵	Totaliser 1,2 (or 3)	Totaliser has been reset.
3 x ↵	Measuring mode	-

6.4.2 Deleting error messages in the menu "Quick Setup"

INFORMATION!
The detailed list of the possible error messages.

Key	Display	Description and setting
>	Quick Setup	Press and hold for 2.5 s, then release the key.
>	Language	-
2 x ↓	Reset	-
>	Reset Errors	-
>	Reset? No	-
↓ or ↑	Reset? Yes	-
↵	Reset Errors	Error has been reset.
3 x ↵	Measuring mode	-

6.4.3 Diagnosis messages

These settings make it possible to change the status signal of the respective diagnosis message (status group).

6.4.4 Optical keys

This function can deactivate the optical keys. In the display, the switched off state of the optical keys is represented by a lock ①.

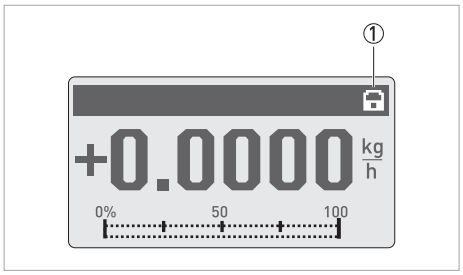


Figure 6-6: Indicator for optical keys in the display

① "Lock" indicate that optical keys are switched off

.

6.4.5 Graphic page

With this converter, the trend of the main measurement can be graphically displayed. The first measurement on display page 1 is always defined as the main measurement.

- Menu C7.5.1 defines the range for the trend indicator (manual or automatic).
- Menu C7.5.2 defines the range for manual setting.
- Menu C7.5.3 defines the time span for the trend indicator.

6.4.6 Save settings

This function allows all settings to be stored in a memory.

- Backup 1: Saves settings in backup memory area 1
- Backup 2: Saves settings in backup memory area 2

6.4.7 Load settings

This function allows the complete stored settings to be loaded again.

- Backup 1: Loading from backup - memory 1
- Backup 2: Loading from backup - memory 2
- Factory: Uploading the original factory settings

6.4.8 Passwords

To create a password for the Quick Set menu or Setup menu, you must enter a 4-digit code into the menu. You are then prompted for this password every time changes are to be made to the corresponding menus. There is a hierarchy. The Setup password can also be used to perform changes in the Quick Setup menu. Enter 0000 in each menu to disable the password.

6.4.9 Date and time

The signal converter has a real time clock which is used for all of the log functions in the device. This function C7.6.6 can be used to set the date and time of the real time clock.

6.4.10 Low flow cutoff

The low flow cutoff can be individually set for each output and each display line. If the low flow cutoff has been activated, the respective output or display is set to zero when the flow is below the low flow cutoff value entered.

The value can either be entered as a percentage of the nominal flow of the sensor or, in the case of a pulse output, as a discrete flow value.

Two values must be entered. The first is for the operating point of the sensor and the second is for hysterisis. Condition: 1st value > 2nd value

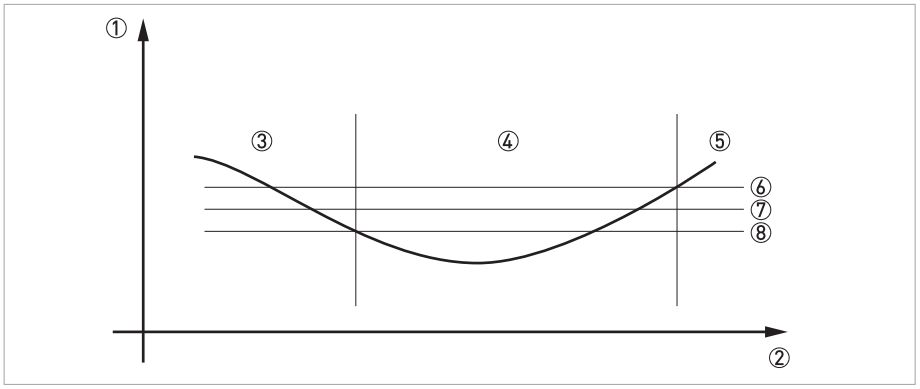


Figure 6-7: Indication of low flow cutoff

① Flow
② Time
③ Currently indicated flow
④ Display set to zero
⑤ Currently indicated flow
⑥ Positive hysteresis
⑦ Operating point
⑧ Negative hysteresis

6.4.11 Time constant

To better process widely fluctuating measured values in the device, the measured values are digitally filtered to stabilise the output. The time constant can be individually set for each output, the first line of the display and the density measurement. However, keep in mind that the degree of filtration affects the response time of the device in the event of rapid changes.

Short time constant	Fast response times
	Fluctuating reading
Long time constant	Slow response time
	Stable reading

The time constant corresponds to the elapsed time until 67% of the end value has been reached according to a step function.

6.4.12 Dual phase pulse output

A dual phase pulse or frequency output is possible. This operating mode requires 2 terminal pairs. Terminal pairs A and B or D and B can be used.

In this case, perform the following settings:

- C4.3.11: Phase shift to D or shift to A
- All functions for output B are set using output D or output A.
- C4.5.11: Setting phase shift from output B relative to D, if terminal pair D was selected in C4.3.11.
  Note that 0°, 90° or 180° are offered as options.
- C4.2.11: Setting phase shift from output B relative to A, if terminal pair A was selected in C4.3.11.
  Note that 0°, 90° or 180° are offered as options.

6.4.13 Timeouts in programming mode

Normal menu function: If no key has been pressed for 5 minutes in a normal menu function, the display automatically switches to measuring mode. All changes are lost.

Test function: In test mode, the test function is finished after 60 minutes.

GDC IR Interface: If the GDC-IR connection is activated, it is cancelled after 60 seconds if no connection is established. If the connection is interrupted, the display can be operated again after 60 seconds using the optical keys.

6.4.14 Function 5: Reynolds linearisation

Standard, as any deviation depends on a specific Reynolds number, the volume flow measurement result uses a Reynolds correction value which is set in the device.

Linearization on site

Optionally a field calibration with linearization settings can be done on site by trained factory service engineers

CAUTION!
Changes on settings of the converter in the service menu or usage of the service tool are to be done by trained service engineers. This additionally requires an accurate flow reference on-site

Linearization is factory set to "off".

On-site the dynamic viscosity at process temperature can be programmed (C1.3.12) to compensate for different Reynolds numbers. Also, the process temperature must be programmed (C1.3.13) and the liquid density (C1.3.10). As a result, better measurement accuracy can be achieved, provided that process conditions are ideal.

6.4.15 Output hardware

Depending on the hardware modules used (see CG number), it may be possible to change the output options on terminals A, B, C or D in the menus C4.1.x. For example, a pulse output to a frequency output or a status output to a control input.

The available options are determined by the hardware module used. It is not possible to change the type of output, e.g. from active to passive or to NAMUR.

6.5 Status messages and diagnostic information

The diagnostic messages are displayed in accordance with NAMUR standard NE 107. NE 107 states that there are up to 32 status groups which can have different status signals. NE 107 was implemented with 16 status groups with fixed status signals and 8 groups with variable status signals. To facilitate identification of the problem source, the status groups are then divided into the groups: Sensor, Electronics, Configuration and Process.

The variable status signal can be changed in menu **Mapping; C1.17.3 ...8**. Changing the status signal to "Information", switches off the message.

INFORMATION!
As status message always the name of the relevant status group and the status signal (F/S/M/C) is displayed.

Each status message (= status signal) has a specific symbol, determined by NAMUR, which is displayed with the message. The length of each message is limited to one line.

Symbol	Letter	Status signal	Description and consequence
	F	Failure	No measurement possible
	S	Out of specification	Measurements are available but are no longer sufficiently accurate and should be checked
	M	Maintenance required	Measurements are still accurate but this could soon change
	C	Function check	A test function is active. The displayed or transferred measured value does not correspond to the actual measured value.
	I	Information	No direct influence on the measurements

Table 6-3: Description of status messages

All status messages are saved in the status log (menu B3.1). Use the ↑ and ↓ keys to navigate through this list. Use the ↵ key to exit the list.

The status screen shows the status groups of all errors that have occurred since the last time the status screen was opened. All errors that are not current disappear after 2 seconds. They are shown in the list in brackets.

Legend

Fixed status signal

Variable status signal

Error type	Event group	Single event	Description	Actions to eliminate the event
F	F Electronics			
		System Error	Electronics error in internal bus communication or due to a hardware error	Perform cold start. If message reappears, contact manufacturer.
		System Error A		
		System Error C		
		HW Combination Error		
		BM Failure		
		DM Failure		
		Frontend Failure		
		Mproc Failure		
		DSP Failure		
		Sensor driver Failure		
		Fieldbus Failure		
		PROFIBUS Failure		
		Modbus Failure		
		IO 1 Failure		
		IO 2 Failure		
		Tot 1 Failure		
		Tot 2 Failure		
		Tot 3 Failure		
		IO A Failure		
		IO B Failure		
		IO C Failure		
F	F Configuration			
		BM Configuration	Error detected when starting device. Possible causes: inadmissible parameter settings or fault with electronics component.	Check settings of appropriate function or load factory settings. If the error persists, contact manufacturer.
		DM Configuration		
		Process Input Config. ①	Settings for process input invalid	Check settings for process input or load factory settings

Error type	Event group	Single event	Description	Actions to eliminate the event
		Fieldbus Config.		Check Fieldbus configuration or load factory settings
		PROFIBUS Config.		Check PROFIBUS settings or load factory settings
		Tot 1 FB2 Unit Error	Totaliser is out of operation due to inadmissible unit	Check unit in totaliser 1 FB2 or load factory settings
		Tot 2 FB3 Unit Error		Check unit in totaliser 2 FB3 or load factory settings
		Tot 3 FB4 Unit Error		Check unit in totaliser 3 FB4 or load factory settings.
		Modbus Config.		Check Modbus configuration or load factory settings
		Display Config.	Inadmissible settings for the display	Check display settings or load factory settings
		IO1 Configuration	Inadmissible settings for IO1	Check settings for IO1 or load factory settings
		IO2 Configuration	Inadmissible settings for IO2	Check settings for IO2 or load factory settings
		Tot 1 Configuration	Inadmissible settings for totaliser 1	Check settings for totaliser 1 or load factory settings
		Tot 2 Configuration	Inadmissible settings for totaliser 2	Check settings for totaliser 2 or load factory settings
		Tot 3 Configuration	Inadmissible settings for totaliser 3	Check settings for totaliser 3 or load factory settings
		IO A Configuration	Inadmissible settings for IO A	Check settings for IO A or load factory settings
		IO B Configuration	Inadmissible settings for IO B	Check settings for IO B or load factory settings
		IO C Configuration	Inadmissible settings for IO C	Check settings for IO C or load factory settings
		IO D Configuration	Inadmissible settings for IO D	Check settings for IO D or load factory settings
F	F Process			
C	C Sensor			
C	C Electronics			

C	C Configuration			
		Flow Simulation Active ①	Simulation of volume flow, mass flow.	Switch off measured value simulation
		VoS Simulation Active ①	Simulation of a certain velocity of sound (VoS)	Switch off measured value simulation
		Fieldbus Sim. Active	The simulation function in the Foundation Fieldbus module is active and being used	Check Fieldbus settings
		PROFIBUS Sim. Active	The simulation function in the PROFIBUS module is active and being used	Check PROFIBUS settings
		IO A Simulation Active	IO A simulation is active.	Switch off simulation.
		IO B Simulation Active	IO B simulation is active.	
		IO C Simulation Active	IO C simulation is active.	
		IO D Simulation Active	IO D simulation is active.	
C	C Process			
S	S Sensor			
S	S Electronics			
		Electr.Temp.A Out of Spec	Temperature of the signal converter electronics is out of range	Protect signal converter from process effects and sunlight
		Electr.Temp.C Out of Spec		
		Converter zero too large	Converter zero too large	Recalibrate the converter or contact manufacturer

S	S Configuration			
		PROFIBUS Uncertain		
		IO A Overrange	The output value is limited by a filter	Check the range setting of the output
		IO B Overrange		
		IO C Overrange		
		IO D Overrange		
S	S Process			
		Mass Flow Out of Range	The flow is out of range. The actual flow is higher than the displayed value.	Check process conditions
		Vol. Flow Out of Range		
		Velocity Out of Range ①		
M	M Installation required	Installation is needed	Use installation menu to install the converter and "end installation" with "yes"	
M	M Sensor			
		Crossed cabling	The measuring sensor signals are out of range. Flow measurements are not possible.	Check connection between measuring sensor and signal converter (remote version)
M	M Electronics			
		Backplane Data Faulty	The backplane data record is faulty	Check the correct installation of the signal converter electronics. After changing one parameter, the message should disappear within one minute. If not, contact the manufacturer.
		Factory Data Faulty	Factory settings are invalid	Contact manufacturer
		Backplane Difference	The data on the backplane differ from the data in the device	After changing one parameter, the message should disappear within one minute. If not, contact the manufacturer.
		PROFIBUS Baudrate	The PROFIBUS searches for the current Baudrate.	
M	M Configuration			
		Backup 1 Data Faulty	Error when checking the data record for Backup 1	Use C7.6.2 "Setup > Device > Special Functions > Save Settings" to save the data record. If the message continues to appear, contact the manufacturer.
		Backup 2 Data Faulty	Error when checking the data record for Backup 2	
M	M Process			
F	F Proc: Current Input			

S	S Electr: IO Connection			
		IO A Connection	Current output A cannot provide the necessary current. The current provided is too low. The current at Input A is below 0.5 mA or above 23 mA.	Check connection at A. Measure resistance of current loop at A. Check current at A.
		IO A Connection	Open circuit or short circuit at IO A	
		IO B Connection	Current output B cannot provide the necessary current. The current provided is too low. The current at Input B is below 0.5 mA or above 23 mA.	Check connection at B. Measure resistance of current loop at B. Check current at B.
		IO B Connection	Open circuit or short circuit at IO B	
		IO C Connection	Current output C cannot provide the necessary current. The current provided is too low.	Check connection at C. Measure resistance of current loop at C.
S	S Proc: Empty pipe			
		Empty pipe ①	All relevant paths have lost their signal. The most obvious reason is the absence of liquid in the sensor.	Fill the sensor with liquid to return to normal operation.
S	S Proc: Signal lost			
		Signal lost path 1 ①	No signal present in path 1 of the sensor	Remove the dampening or blockage in path 1 in the sensor
		Signal lost path 2 ①		
S	S Proc: Signal unreliable			
		Path 1 unreliable ①	The sensor signals do not reach the expected amplitude. This can influence the measuring accuracy.	Check the acoustic properties of the medium. Particles, air bubbles or inhomogeneity, may cause an instable signal. Check gain and SNR in this path.
		Path 2 unreliable ①		
		Time of flight unreliable		
S	S Config: Totaliser			
		Tot 1 FB2 Overflow	Totaliser has overflowed and started again at zero	Check totaliser format
		Tot 2 FB3 Overflow		
		Tot 3 FB4 Overflow		
		Tot 1 Overflow		
		Tot 2 Overflow		
		Tot 3 Overflow		
I	S Proc: System Control			

I	S Electr: Power Failure			
		Tot 1 Power Failure	Power failure has occurred. The totaliser state may be invalid.	Check the value of the totaliser.
		Tot 2 Power Failure		
		Tot 3 Power Failure		
		Power Failure Detected		
I	I Electr. Operation Info			
		Zero Calibr. Running ①	A zero calibration in progress	Wait until finished
		Sensor Starting up	Sensor starts up. This is normal operation at the beginning of measuring mode. Other error messages are suppressed.	After some moments, the converter will act and respond with the converter status.
		PROFIBUS: no data	No data exchange via PROFIBUS	
		Tot 1 Stopped	Totaliser 1 was stopped.	If totaliser is to continue counting, select "Yes" in Fct. C5.y.9 (Start Totaliser). for y = 1; 2; 3: 1 = totaliser 1; 2 = totaliser 2; 3 = totaliser 3
		Tot 2 Stopped	Totaliser 2 was stopped	
		Tot 3 Stopped	Totaliser 3 was stopped	
		Control In A Active		
		Control In B Active		
		Status Out A Active		
		Status Out B Active		
		Status Out C Active		
		Status Out D Active		
		Disp. 1 Overrange	The value in the 1st measurement line of the display page is limited	Check setting for 1st measurement line
		Disp. 2 Overrange	The value in the 2nd measurement line of the display page is limited	Check setting for 2nd measurement line
		Optical Interf. Active	The optical interface is being used. The optical keys are deactivated.	The keys are ready for operation again approximately 60 seconds after the end of the data transfer/removal of the optical interface

① Error message for pipe 1 and pipe 2 configuration

7.1 Periodic maintenance

7.1.1 Regreasing of transducers

If the sensor is installed to a piping system for longer periods of time, the mineral contact gel or the HT Pyrogel®can dry-up, which can result in lesser signal due to the bad contact between transducer surface and piping wall.

For detailed information refer to *General mechanical installation* on page 28.

7.2 Cleaning

Instructions for signal converter:

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.

7.3 Exchange of electronics unit

Before opening the converter housing:

WARNING!
Before commencing the work, refer to Before and after opening on page 152, then continue as follows:

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!

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!
Make notes of important specific data, before exchanging the electronics.
Menu settings are stored on the circuit board (or backplane), that is fixed to the housing. After exchange of electronics unit and power-up, the following start up screen appears:
Load all data?

- Select yes

➲ - if in the screen appears **"load sensor data"**, the electronics units were not fully compatible. You can proceed by selecting yes. Note that all settings need to be checked and changed. Only the sensor calibration data are loaded.
- if in the screen appears **"load no data"**, all data have been lost. Contact your local representative.

7.3.1 Before and after opening

WARNING!
the following instructions must always be carefully followed, if the housing of the signal converter has to be opened respectively closed again.

Before opening:

- Make absolutely sure that there is no explosion hazard (gas-free certificate!).
- Make sure that all connecting cables are safely isolated from all external sources!
- Allow the electronics to de-energize before opening the electronics compartment of the converter housing. Wait at least 35 minutes for T6 and 10 minutes for T5 before opening.

When the instructions above are strictly followed, the display cover (includes glass window) of the electronics compartment may be removed. First unscrew the head screw with internal hexagon socket set (size M4) of the interlocking device by a No. 3 Allen key, until the cover can rotate freely.

After opening:

- Before the cover is screwed back onto the housing, the screw-thread must be clean and well-greased with an acid and resin-free grease, e.g. PTFE grease.
- Screw the cover as tight as possible onto the housing by hand, until it cannot be opened by hand anymore. Fixate the screw of the interlocking device tight with the No. 3 Allen key.

7.3.2 Field version

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

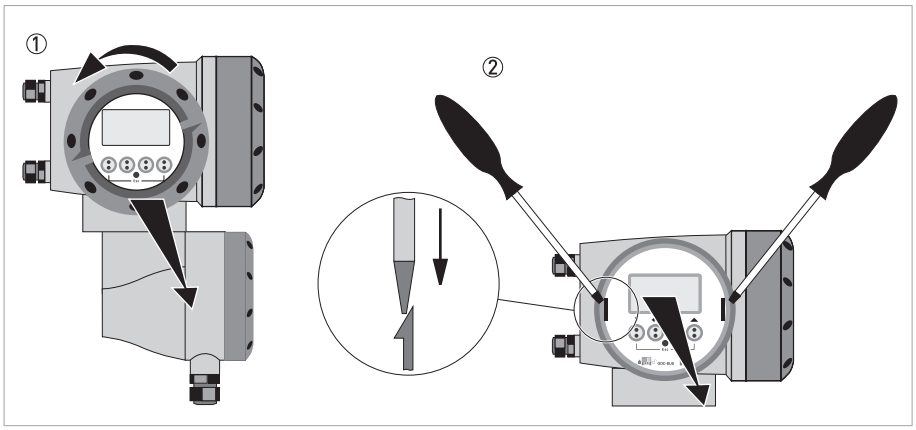


Figure 7-1: Unscrew the cover and remove the display

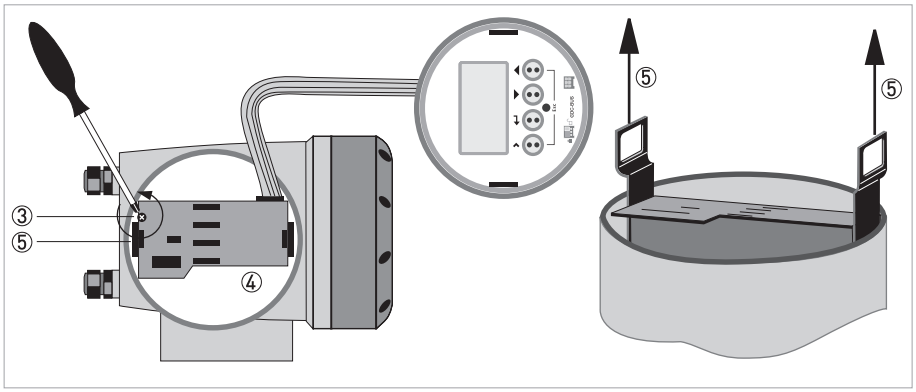


Figure 7-2: Pull out printed circuit board

Perform the following procedures:

- Unscrew the display cover of the electronics compartment by hand, by turning it counter clockwise ①.
- Remove the display by using two screwdrivers ②.
- Unscrew the two M4 screws ③ at the electronics unit ④.
- Pull the two metal pullers ⑤ at the left and right of the display, using a screwdriver or similar tool and partially pull out the electronics unit.

CAUTION!
Please pay attention that the same amount of force is applied on both pullers, otherwise the connector at the backside can be damaged.

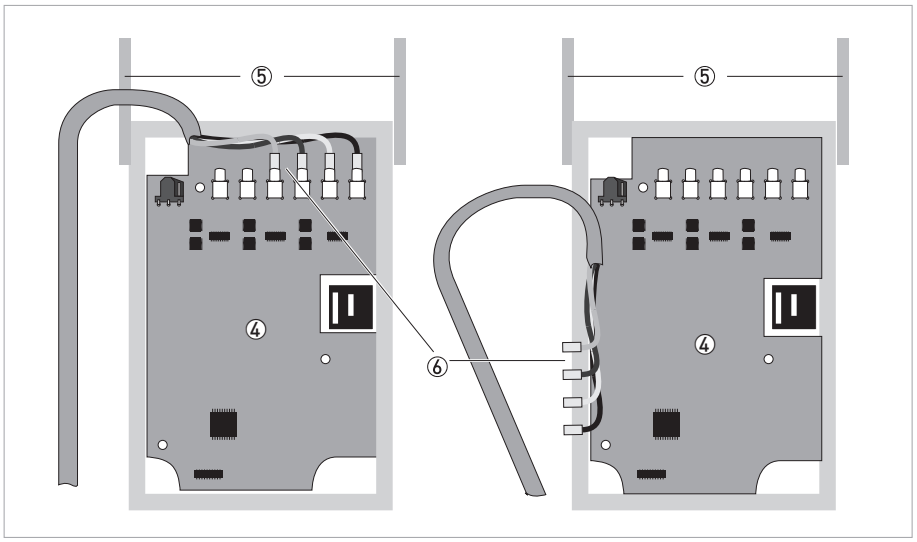


Figure 7-3: Electronics unit and MCX -connectors

DANGER!

Electrostatic discharge (ESD) can damage electronic parts. Make sure to discharge yourself by wearing a wrist strap. If no wrist strap is available, ground yourself by touching a metal surface that is grounded.

- Remove the MCX -connectors ⑥ from the electronics unit ④.
- Check compatibility between the removed and new electronics unit ④, by checking the power voltage.
- Slide the new electronics unit ④ partially back into the housing.
- Mount the MCX -connectors back onto the electronics unit ④.
- Push the metal pullers ⑤ back to their original position. Don't use excessive force, otherwise the connector at the backside can be damaged!
- Screw the electronics unit back to the housing.
- Re-install the display and make sure not to kink the display's flat ribbon cable.
- Replace cover and tighten by hand.
- Connect power.

7.3.3 Wall version

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

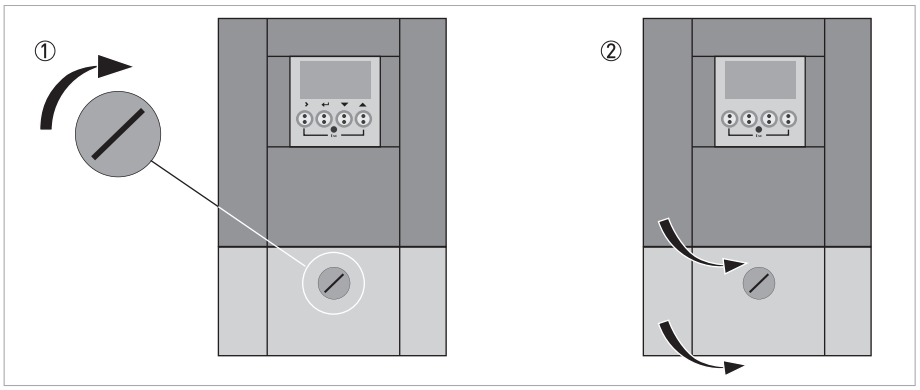


Figure 7-4: Unlock and open door

Perform the following procedures:

- Turn locking screw to the right ① to unlock the lower door.
- Open lower door.
- Push metal slider, positioned at the left upper angle, downwards.
- Open upper door ②.

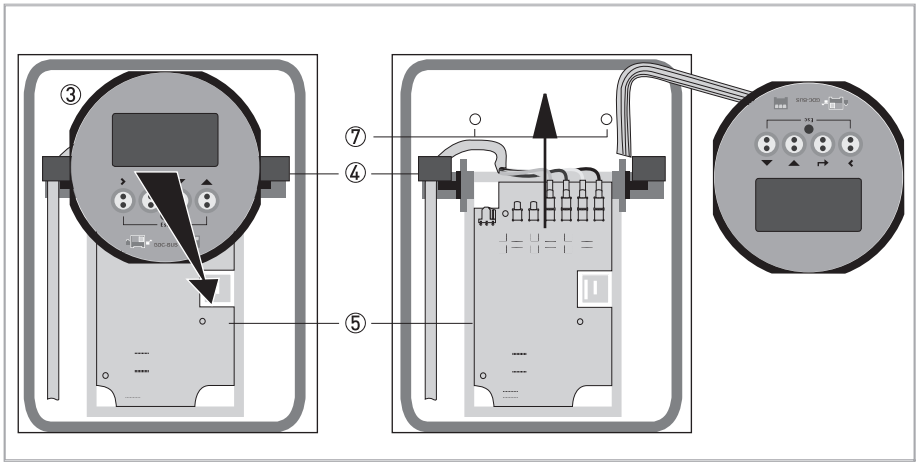


Figure 7-5: Remove the display

- Remove the display ③ by pressing the plastic holders on both sides ④ and carefully put the display aside.
- Unscrew the two M4 screws ⑦ at the electronics unit ⑤.

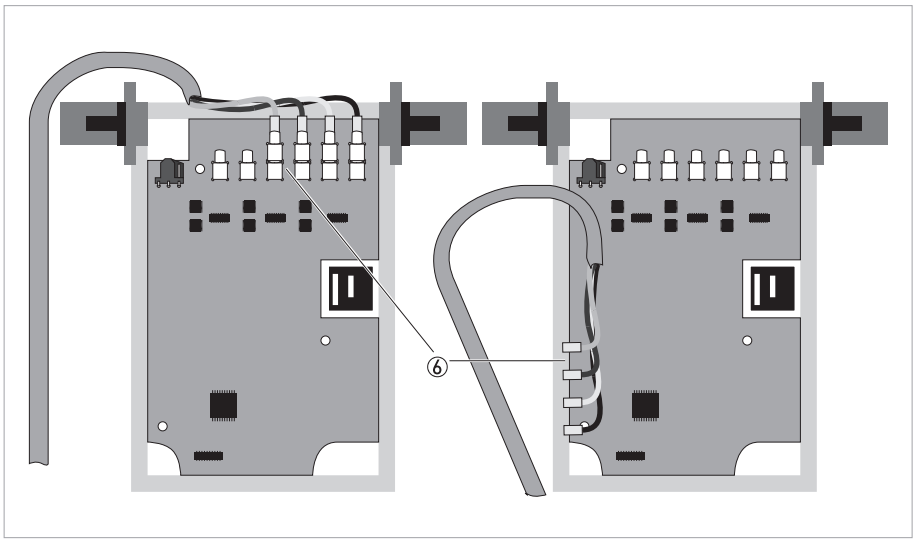


Figure 7-6: Release printed circuit board

- Remove the MCX - connectors ⑥ from the electronics unit.
- Carefully slide the electronics unit and lift it out of the housing.

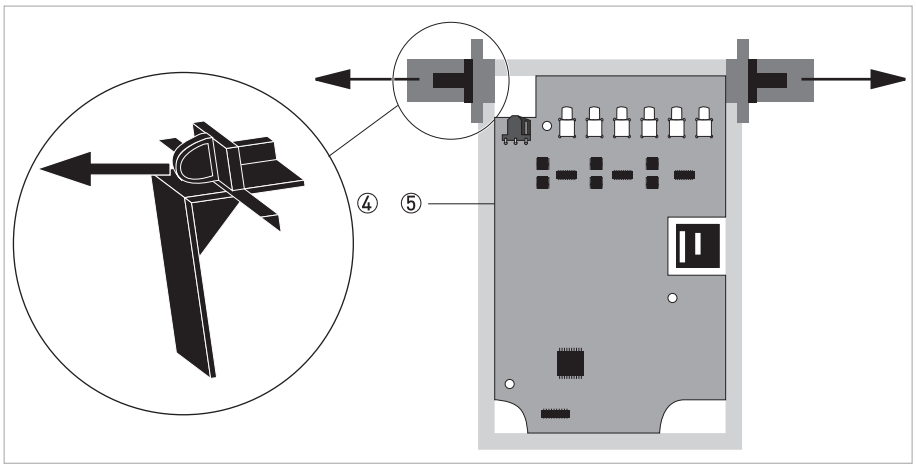


Figure 7-7: Remove holding brackets

- Remove the holding brackets ④ from the old electronics unit ⑤.
- Check compatibility between the removed and new electronics unit, by checking the power voltage.
- Click the holding brackets ④ onto the new electronics unit and slide the new electronics unit into the housing.
- Mount the MCX - connectors back onto the new electronics unit.
- Screw the new electronics unit back to the housing.
- Click the display back into the holders.
- Close and lock the upper door, push the metal slider upwards.
- Close and lock the lower door.
- Connect power.

CAUTION!

First program the Installation menu, refer to General instructions for programming on page 94 and check all important settings.

7.4 Replacing the mains fuse

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!

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.

Underneath codings for the mains fuse apply:

- **100...230 VAC power supply:**
  0.8AT/H/250 , breaking capacity 1500 A at 250 V
- **24 VAC/DC power supply:**
  2AT/H/250 , breaking capacity 1500 A at 250 V

The mains fuse is in accordance with IEC 60127-2. The size is diameter 5 x 20 mm / 0.79" length.

7.4.1 Field version

INFORMATION!
Please refer to Field version on page 153 for details how to open the housing and remove / reinstall the electronics.

Once the electronic unit is removed,

- Replace the fuse. The fuse holder with the mains fuse is located on the power board, which is the upper board.
- Reinstall the electronics unit back to the housing.
- Reinstall cover and tighten down by hand ① and connect power.

7.4.2 Wall version

INFORMATION!
Please refer to Wall version on page 155 for details how to open the housing and remove the electronics.

Once the electronic unit is removed,

- Replace the fuse. The fuse holder with the mains fuse is located on the power board, which is at the back.
- Mount the small printed circuit board back onto the sensor driver board.
- Put the electronics unit back to the housing.
- Click the display back into the holders.
- Close the housing and lock the doors.
- Connect power.

7.5 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

7.6 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

7.7 Returning the device to the manufacturer

7.7.1 General information

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

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

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

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

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

7.7.2 Form (for copying) to accompany a returned device

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

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

7.8 Disposal

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

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

7.9 Disassembly and recycling

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

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

Product description and data/info:

Measuring sensor (aluminum rail) for flow measurement

Depending on version: (values ± 5%)	Aluminum version					
L x W x H:	Small		Medium		Large ①	
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
	495 x 63 x 71	19.5 x 2.5 x 2,8	825 x 63 x 71	32.5 x 2.5 x 2,8	495 x 63 x 71 (x 2)	19.5 x 2.5 x 2,8 (x 2)
Volume:	0.0022 m³	135 inch³	0.0037 m³	226 inch³	0.0044 m³	270 inch³
Weight:	2.5 kg	5.5 lb	3.4 kg	7.5 lb	4.7 kg	10.4 lb
Weight; metal parts aluminum:	1.7 kg	3.7 lb	2.3 kg	5.0 lb	3.1 kg	6.9 lb
Weight; metal parts stainless steel:	0.73 kg	1.6 lb	0.99 kg	2.2 lb	1.36 kg	3.0 lb
Weight; plastic parts:	0.1 kg	0.2 lb	0.14 kg	0.3 lb	0.19 kg	0.4 lb

① the version consist of 2 rails with the same dimensions and weight.

INFORMATION!

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

Always disconnect the device and all cables before continuing disassembling.

INFORMATION!

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

- *Torx screwdriver T1 - 3*
- *Pozidriv screwdriver PZ1 - 2 - 3*
- *(Adjustable) wrench 10-11 / 18-19 mm*

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

CAUTION!

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

DANGER!

The device MUST be disconnected from mains power before disassembling.

Product description and data/info:

Measuring sensor (stainless steel rail) for flow measurement

Depending on version: (values ± 5%)	Stainless steel version			
L x W x H:	Small		Medium	
	[mm]	[inch]	[mm]	[inch]
	495 x 48 x 66	19.5 x 1.9 x 2,6	825 x 48 x 66	32.5 x 2.5 x 2,8
Volume:	0.0016 m³	96 inch³	0.0026 m³	159 inch³
Weight:	2.0 kg	4.4 lb	2.6 kg	5.7 lb
Weight; metal parts aluminum:	0.02 kg	0.04 lb	0.03 kg	0.06 lb
Weight; metal parts stainless steel:	1.92 kg	4.2 lb	2.5 kg	5.5 lb
Weight; plastic parts:	0.06 kg	0.13 lb	0.08 kg	0.17 lb

7.9.1 Remove the connection and/or other cable(s)

Connection cable materials consist of (several) metal conductor (usually copper), surrounded with a flexible plastic insulation.

Signal cables can be made from coaxial cables consisting of a one or two copper conductor(s) with a metal tabular shielding and surrounded with one or more insulation layer(s).

For more details refer to *Electrical connections signal converter* on page 54; refer to *Signal cable to flow sensor* on page 57 for the describtions of the different signal cable connections.

Standard aluminum sensor versions

- Remove the connection cable if this is still connected to the sensor rail.
- Unscrew the Allen screws M4 from the (blue) end cap and unscrew the cable gland M16.
- Slide the end cap and cable gland parts over the connection cable
- The inside connection terminal is now free to disconnect the cable(s)
- Disconnect the cable by pulling the connector from the terminal

Depending on the version (connected to a cable box or direct to the signal converter) the signale cable(s) can differ in length. When cable is still connected to the cable box it can be removed in a similar way as described for the aluminum sensor rail.

- Unscrew the Allen screws and dismount the cable glands
- Disconnect the cable by pulling the connector from the terminal

Stainless steel sensor versions

- The signal cable can be removed by unscrewing the connector on the sensor rail

Depending on the version of the signal converter (F, W or R version) the cable can be disconnected in the terminal compartment of the housing. For more details, refer to *Power supply* on page 55.

Disconnect cable from signal converter

- **Wall version**: open compartment door of the W housing
- Disconnect all cables from terminals
- Dismount the cable glands and pull the wiring out of the housing

- **Field version**: unscrew the cover of the sensor terminal compartiment
- Loosen the grounding clamps
- Disconnect all cables from terminals
- Dismount the cable glands and pull the wiring out of the housing

Reuse of cables and connectors

Electrical signal cables can be reused when there is no damage (breakage or visible damage traces) on the outer cable. The terminal cable connectors (both male and female) can be replaced when fitting to eachother is not sufficient anymore. Replacement of transducers is possible, please contact support center and/or refer to *Service* on page 151.

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Connectors (copper)	neglectible		2 cable glands per measuring set (option; cable box 3 cable glands) min: 0.06 kg / 1.33 lb max: 0.15 kg / 3.31 lb
Cable gland (nickel-plated copper)	0.03	0.067	
Standard cable: plastics/copper/steel mixture	0.8	1.76	approx. 6 m/18 ft standard cable (optionally cable lengths are posible up to 30 m/100 ft)
			7 gram / 0.25 ounce copper per m/ft

Cable (splitter) box

The connection of cables of the large sensor version is done with the use of a cable box. This is an aluminum box with three entries for cable connection with cable glands (nickel-plated brass) and a stainless steel connection bracket with terminals to connect the seperate wires of the signal cables. The stainless steel mounting bracket on the bottom of the cable box is mounted with 4 screws.

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Aluminum	0.56	1.25	Connection box housing
Connectors (copper)	negligible		
Cable gland (nickel-plated brass)	0.06	0.133	(3 cable glands)
Connection brackets 1.4301	0.22	0.49	
plastics/copper/steel mixture	negligible		epoxy insulation, steel ring, screws
Total weight	0.85	1.88	

7.10 Disassembling the OPTISONIC 6000 sensor rail

The OPTISONIC 6000 sensor is available in different versions and variants. In general the devices are available in stainless steel and aluminum housing. This handbook describes the standard version (as mentioned in refer to *Technical data* on page 177 and not specific custimized versions. Where available, additional data will be mentioned. For more specific data concerning versions, please contact the support centre.

INFORMATION!
Disconnect all electric cables from connection terminals (if still attached) refer to Remove the connection and/or other cable(s) on page 162.

Different version OPTISONIC 6000

The main difference in the separate versions of the OPTISONIC 6000 rail is the use of aluminum and stainless steel and the size (length) of the rail.

Overview

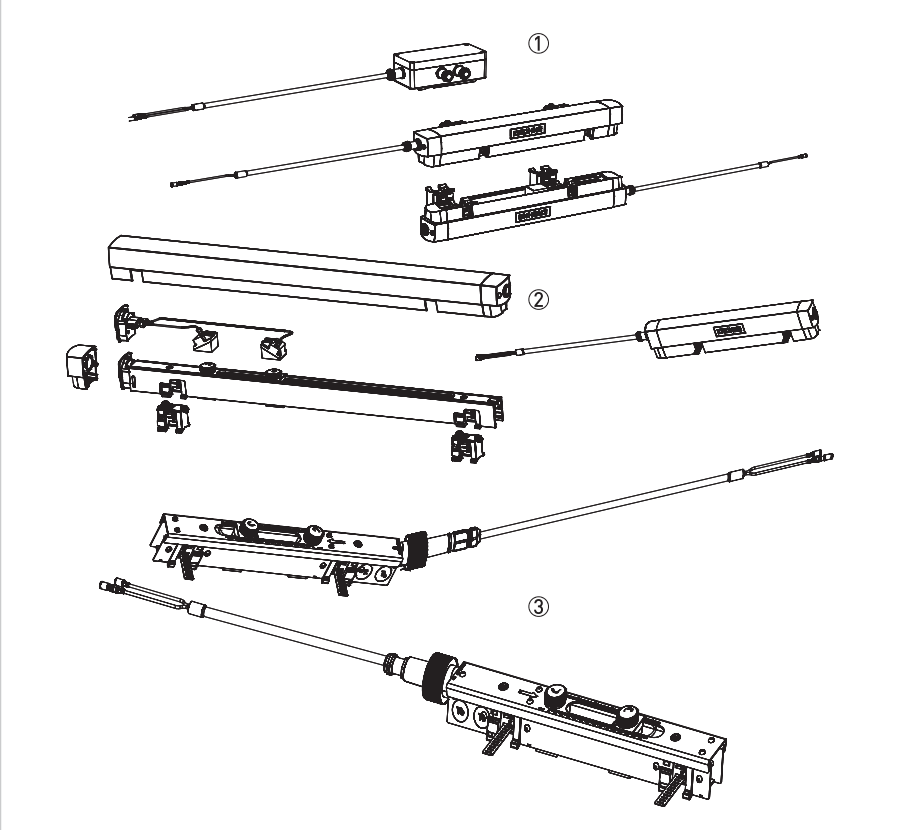


Figure 7-8: Different rail versions

Aluminum versions; at the top a Large version with 2 rails and a cable box ① and in the middle the Small and Medium version with the (easy to remove) top housing ②. On the bottom the stainless steel versions ③ with different connection.

- For aluminum versions, always start by sliding the top housing ② from the rest of the rail.

Standard aluminum sensor versions

- Remove the connection cable if this is still connected to the sensor rail.
- Unscrew the Allen screws M4 from the (blue) end cap and unscrew the cable gland M16.
- Slide the end cap and cable gland parts over the connection cable.
- The inside connection terminal is now free to disconnect the cable(s).
- Disconnect the cable by pulling the connector from the terminal.
- Remove the cable gland with wrench and unscrew the Allen bolts completely from the end-cap.
- The locking mechanism knob (stainless steel) on the other blue end-cap can be separated by removing the retaining e-clip on the mechanism inside the cap.
- Both the stainless steel fixing units can be removed by pressing the clips on the side, move up and slide out of the guiding plate.
- Cut the blue and/or green wire(s) close to the transducer/sensor(s) on the inside of the aluminum housing.
- Remove the transducer/sensor(s) from the transducer knob(s) by pressing and sliding them out of the locking cam and separate them from the housing.
- The remaining stainless steel parts in the aluminum housing can be separated with a small Allen key size 2-3.
- The grey terminal holder can be removed by unscrewing the M4 Allen screws and slide it with the wire out of the housing.

➲ The rail is dismounted and separated now in aluminum/stainless steel/plastic parts and can be recycled further.

Exploded view

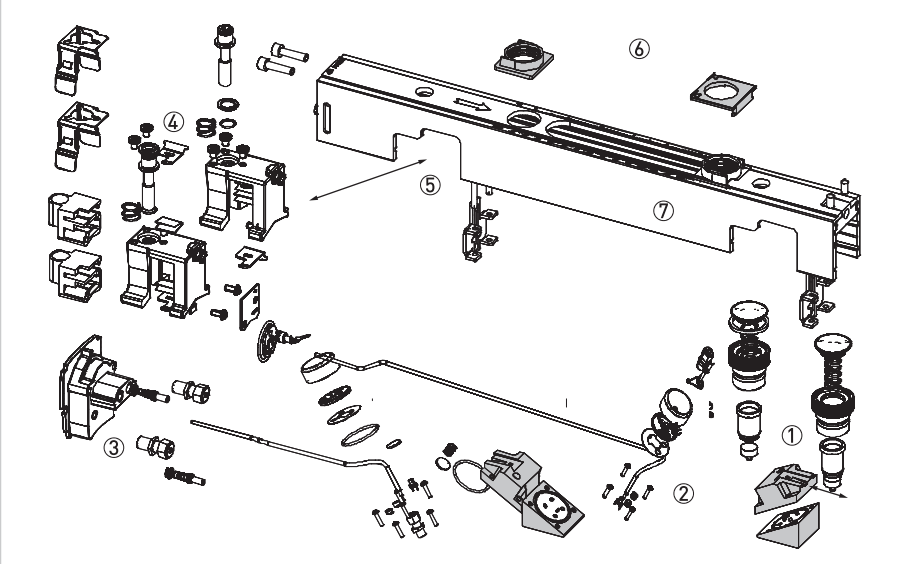


Figure 7-9: Disassembled device

① Transducer positioning knobs; transducer sliding from locking cam
② Transducer content with different parts and cable
③ Grey terminal holder with connector parts
④ Stainless steel fixing units; parts and positioning elements
⑤ Positioning of the fixating unit and guiding bracket
⑥ Aluminum housing of the rail
⑦ Plastic parts of the positioning knob(s)

Stainless steel sensor versions

- Remove the connection cable if this is still connected to the sensor rail.

It is not necessary to disassemble the device completely to separate all the materials. The device consist for 99% of steel (96% stainless steel). If complete disassembling is required parts can be separated by hand and/or using Allen key number 2 and 3.

- Both the stainless steel fixing unit can be removed by pressing the clips on the side, move up and slide out of the guiding plate.
- Both transducer/sensor(s) can be removed from the positioning knobs but only with force.
- Slide the transducer/sensor(s) with force out of the locking cams on the knobs.
- Cut the (green and blue) cables on the connector terminal.
- Remove the transducer/sensor(s) and plastic parts of the position knobs.
- All stainless steel parts in/on the stainless steel housing can be separated if wanted.

➲ The rail is dismounted and separated now in stainless steel / plastic parts and can be recycled further.

Exploded view

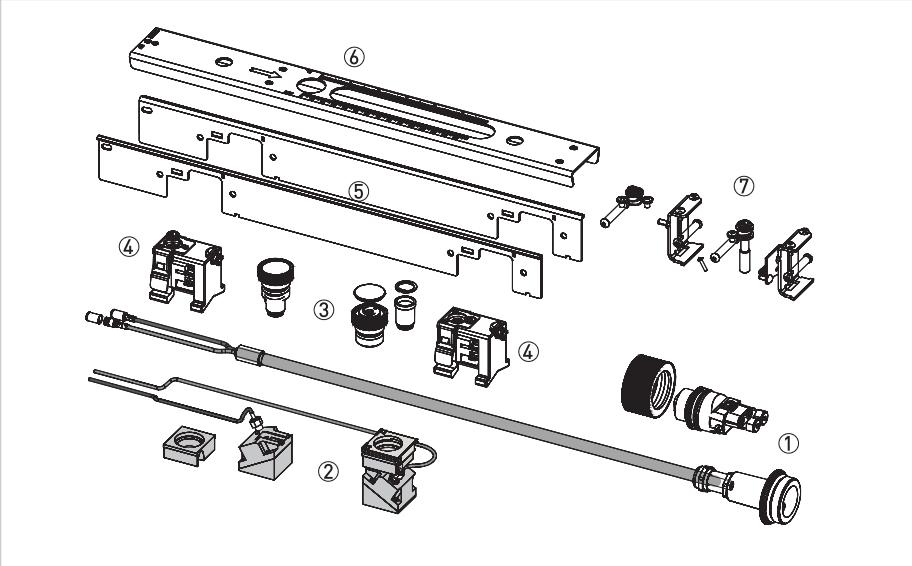


Figure 7-10: Disassembled device

① Connection cable and connector
② Transducers with cable
③ Positioning knobs
④ Stainless steel fixing units
⑤ Stainless steel housing parts (side)
⑥ Stainless steel housing parts (top)
⑦ Positioning parts used inside the rail housing

7.11 Overview of the sensor materials and components

The items mentioned in the listing below are the main parts of the device. Consult our product support service for full and detailed description of the materials and components.

The OS 6000 can be ordered in different versions. The next tables show the data of the standard versions in aluminum and stainless steel. Please contact our product support service for details on special versions with additional features.

Materials/components, which must be removed and treated separately

INFORMATION!
The device is RoHS compliant.
The OPTISONIC 6000 sensor (rail) in aluminum and stainless steel does not contain any electrical parts other than the transducer(s). If wanted, the device can be disassembled fully. However the content of plastics and metal mixtures other than aluminum or stainless steel is below 4% of the total weight.

Material/components, which can disturb recycling processes

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed Circuit Boards	negligible		connection plate for terminals
Electrolyte capacitor, battery, LCD	-		not present
Copper, nickle plated brass	negligible (< 1%)		cable glands, connection terminals
Silicon, plastics, PU	negligible (< 3%)		cabling and housing of transducers

Beneficial material/components, useful for recycling

INFORMATION!
Beneficial materials are aluminum and stainless steel. See for % and weight of material content the table ***Total weight of device*** *below.*

Aluminum version

Material (or material code)	Weight% of total	Additional information
Aluminum	67%	housing, rail and cover
Stainless steel	29%	eg. knobs, brackets, fixing units

Stainless steel version

Material (or material code)	Weight% of total	Additional information
Stainless steel	96%	eg. housing, rail knobs, brackets, fixing units
Aluminum	1%	negligible

Total weight of device

Total depending on version (± 5%)	[kg]	[lb]	Steel content
Smal aluminum version	2.5	5.5	aluminum content 67% (± 5%)
Medium aluminum version	3.4	7.5	
Large aluminum version	4.7	10.4	
Small version (stainless steel)	2.0	4.4	stainless steel content 96% (± 2%)
Medium version (stainless steel)	2.6	5.7	

7.12 Disassembling the signal converter

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

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

Product description and data/info:

Signal converter for flow measurement

Depending on version: (values ± 5%)		Type			
L x W x H:		Field version (F)		Wall version (W)	
		[mm]	[inch]	[mm]	[inch]
		205 x 300 x 277	8,0 x 11.8 x 10,9	198 x 138 x 299	7.8 x 5.4 x 11.8
Volume:		0.006 m³	370 inch³	0.008 m³	489 inch³
Total weight:	Aluminum (F) version	6.0 kg	13.5 lb	-	-
	Stainless steel (F) version	13.5 kg	29.8 lb	-	-
	Polyamide carbonate (W) version	-	-	2.4 kg	5.3 lb
Weight%; metal parts:		87		27%	
Weight%; plastic parts:		5%		47%	
Weight%; electronics; PC boards		8%		23%	

INFORMATION!

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

Always disconnect the device and all cables before continuing disassembling.

INFORMATION!

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

- *Torx screwdriver T1 - 3*
- *Pozidriv screwdriver PZ1 - 2 - 3*
- *(Adjustable) wrench 10-11 / 18-19 mm*

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

CAUTION!

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

DANGER!

The device MUST be disconnected from mains power before disassembling.

7.12.1 Polyamide W- (wall) version

Disassembling the device

- Open the bottom and top door of the wall housing ①, open and pull out the compartment covers of the sensor and power connection terminals.
- Disconnect all electric cables from connection terminals (if still attached) and remove the cable glands and stop plug ③.
- Remove the metal plate and locking mechanism from the inside of the bottom door
  You have to break-out by force to remove the knob ② and the M10 stud bolts ⑤ on the backside of housing.
- Remove the housing locking mechanism on the left side of the rear housing part and pull out the rubber seal ④.
- Remove the display unit and separate from electronic insert unit ⑥, pull off all electric cable/wire(s)
  (sensor connection cables and display wire connected to the circuit board).
- Unscrew both screws from electronic insert unit and lift the unit out of the backplane connector ⑦.
  Depending on the version, cut off the small PC board / connectors from the cable.
- Unscrew the four M3 bolts of the sensor connection terminal and pull it out with the leftover wire.
- Unscrew the M4 bolt of the earthing connector (mains terminal) and remove the complete PC board.
- Remove the small sealing ring and pull out the terminal block from the mains connector.

➲ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

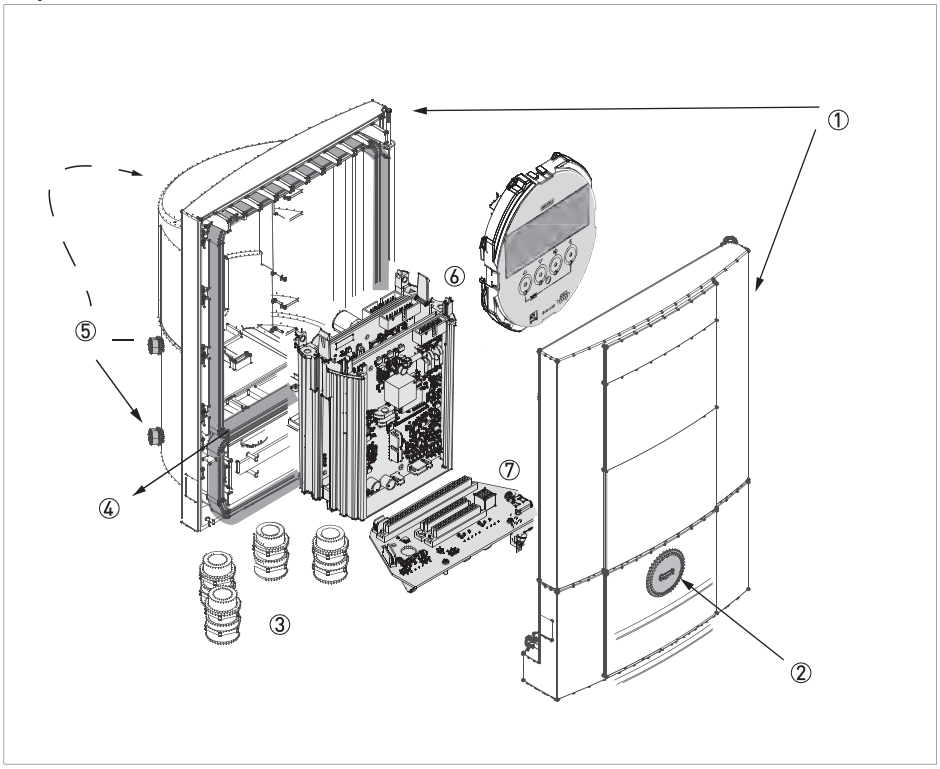


Figure 7-11: Disassembled (W) wall device

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

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

7.12.2 Aluminum or stainless steel F- (remote) version

Disassembling the device

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

➲ All main parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

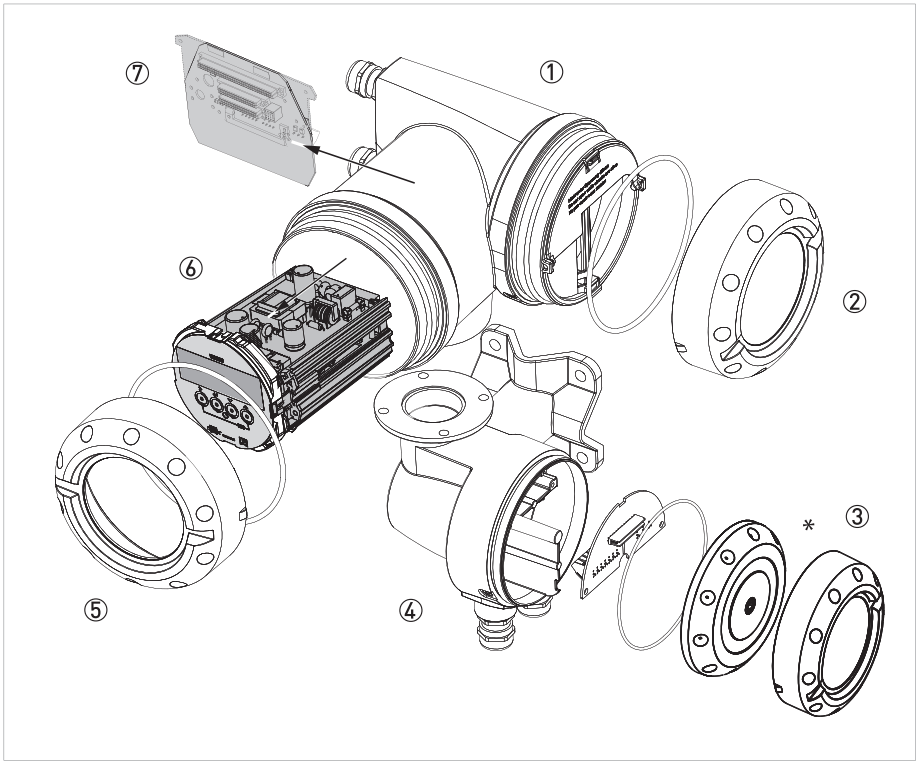


Figure 7-12: Disassembled (F) field device

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

7.13 Overview of the converter materials and components

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

The signal converter can be ordered in different versions. The next tables show the data of the regular (standard) versions in F (field) and W (wall).Please contact our support service for details of special versions with additional features on I/O and/or Ex. The Ex versions typically contain additional materials; e.g. PU potting material and additional rubber sealing rings. The glass content (in the electronics compartment cover) is usually higher because thicker glass is used.

Materials/components, which must be removed and treated separately

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed Circuit Boards	0.64	1.4	average size: 600 cm^2 /9.8 $inch^2$ (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally 20 cm^3 of electrolytic capacitors (depending on IO configuration)
Battery	-	-	
LCD screen/glass	0.09	0.2	screen size < 25 cm^2 the cover contains a glass screen 70 g/0.16 lb Note: for Ex versions ~300 g/0,66 lb
Noble/precious metal	-	-	

Table 7-1: Signal converter in field version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed Circuit Boards	0.56	1.22	average size: 600 cm^2 /9.8 $inch^2$ (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains totally 20 cm^3 of electrolytic capacitors (depending on IO configuration)
Battery	-	-	
LCD screen/glass	0.02	0.04	screen size < 25 cm^2
Noble/precious metal	-	-	

Table 7-2: Signal converter in wall version

Material/components, which can disturb recycling processes

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

Table 7-3: Signal converter in field version

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

Table 7-4: Signal converter in wall version

Beneficial material/components, useful for recycling

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	12.3 ①	27.2 ①	① data only applicable for stainless steel housing (incl. covers)
Aluminum	4.8 ②	10.6 ②	② data only applicable for aluminum housing (incl. covers)
Polyamide	0.36	0.79	plastic sreens and sections inside housing
PC boards	0.64	1.4	separate electronic units
Cabling	*	*	all cables are detachable from the device
Ferrite	negligible		
Copper, brass	negligible		

Table 7-5: Signal converter in field version

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	0.2	0.44	
Aluminum	negligible		
Polyamide	1.1	2.4	strap
PC boards	0.55	1.2	
Cabling	*	*	all cables are detachable from the device
Ferrite	negligible		
Copper, brass	negligible		

Table 7-6: converter in wall version

8.1 Measuring principle

- Like canoes crossing a river, acoustic signals are transmitted and received along a diagonal measuring path.
- A sound wave going downstream with the flow travels faster than a sound wave going upstream against the flow.
- The difference in transit time is directly proportional to the mean flow velocity of the medium.

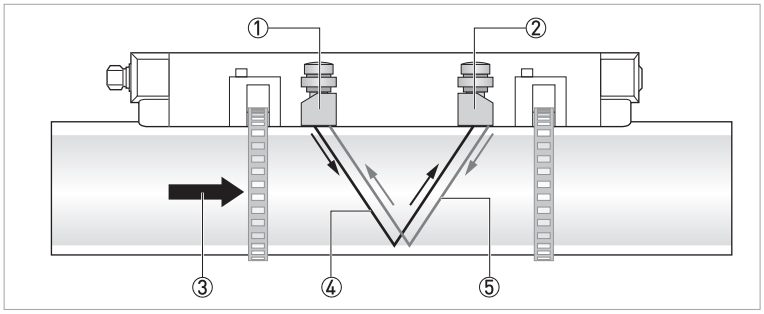


Figure 8-1: Measuring principle

① Transducer A
② Transducer B
③ Flow velocity
④ Transit time from transducer A to B
⑤ Transit time from transducer B to A

8.2 Technical data

INFORMATION!

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

Measuring system

Measuring principle	Ultrasonic transit time
Application range	Flow measurement of liquids
Measured value	
Primary measured value	Transit time
Secondary measured value	Volume flow, mass flow, flow speed, flow direction, speed of sound, gain, signal to noise ratio, diagnosis value, reliability of flow measurement, quality of acoustic signal. Optional: thermal power, thermal energy, temperature.

Design

The measurement system consists of a measuring sensor and a signal converter. It is only available as separate version.	
Signal converter	
Wall mounted housing (W); remote version	UFC 300 W (general purpose)
Field housing (F); remote version	UFC 300 F (option: Ex version)
Measuring sensor	
Standard	Small, medium or large version in aluminium.
Optional	Small or medium stainless steel version
	Small or medium XT (eXtended Temperature)
Diameter ranges	
Small	DN15...100 / ½...4"
	Outer diameter must be at least 20 mm / 0.79"
Medium	DN50...400 / 2...16"
Medium X - mode	DN200...1250 / 8...50"
Large	DN200...4000 / 8...160"
	Outer diameter must be smaller than 4300 mm / 169.29"
Signal converter	
Inputs/outputs	Current (incl. HART®), pulse, frequency and/or status output, limit switch and/or control input (depending on the I/O version).
Counters	Two internal counters with a maximum of 8 counter places (e.g. for counting volume and/or mass units).
Verification and self-diagnostics	Integrated verification, diagnostic functions: measuring device, process, measured values, device configuration, empty pipe detection, bar graph etc.
Communication interfaces	HART® 7, Foundation Fieldbus, Profibus, Modbus RS485 (option).

Display and user interface	
Graphic display	LCD; backlit white
	Size: 128x64 pixels; corresponds to 59 x 31 mm = 2.32" x 1.22"
	Display turnable in 90° steps
Operator elements	Four optical and mechanical push buttons for operator control of the signal converter without opening the housing
	Option: infrared interface (GDC)
Remote control	PACTware® including Device Type Manager (DTM)
	HART® hand-held communicator (Emerson), AMS (Emerson), PDM (Siemens).
	All DTM's and drivers are available at the internet homepage of the manufacturer
Display functions	
Operating menu	Programming of parameters at 2 measured value pages, 1 status page, 1 graphic page (measured values and descriptions adjustable as required).
Language of display texts	English, German, French, Russian.
Measurement functions	**Units:** Metric, British and US units selectable from list for volume/mass flow and counting, velocity, temperature.
	Measured values: Volume flow, mass flow, flow speed, velocity of sound, gain, signal to noise ratio, flow direction, diagnostics.
Diagnostic functions	**Standards:** VDI/NAMUR NE 107
	Status messages: output of status messages via display, current and/or status output, HART® or via other bus interface.
	Sensor diagnostics: per acoustic path velocity of sound, flow speed, gain, signal to noise ratio.
	Process diagnostics: empty pipe, signal integrity, cabling, flow conditions.
	Signal converter diagnostics: data bus monitoring, I/O connections, electronics temperature, parameter and data integrity.

Measuring accuracy

Reference conditions	Medium: water
	Temperature: 20°C / 68°F
	Pressure: 1 bar / 14.5 psi
	Straight inlet section: 10 DN
	Straight outlet section: 5 DN
Maximum measuring error	≥ DN50/2 inch < ± 1% of the actual measured flow rate; for 0.5…20 m/s / 1.64…65.6 ft/s < ± 5 mm/s / 0.2 inch/s for 0.1…0.5 m/s / 0.33…1.64 ft/s
	< DN50/2 inch < ± 3% of the actual measured flow rate; for 0.5…20 m/s / 1.64…65.6 ft/s < ± 15 mm/s / 0.6 inch/s for 0.1…0.5 m/s / 0.33…1.64 ft/s.
Repeatability	± 0.2%

Operating conditions

Temperature	
Process temperature	Standard version: -40...+120°C / -40...+248°F
	XT version: -40...+200°C / -40...+392°F
Ambient temperature	Sensor: -40...+70°C / -40...+158°F
	Standard (die-cast aluminum converter housing): -40...+65°C / -40...+149°F
	Option (die-cast stainless steel converter housing): -40...+60°C / -40...+140°F
	Ambient temperatures below -25°C / -13°F may affect the readability of the display
Protect the signal converter from external heat sources such as direct sunlight, as higher temperatures reduce the life cycle of all electronic components.	
Storage temperature	-50...+70°C / -58...+158°F
Pipe specifications	
Material	Metal, plastic, ceramic, asbestos cement, internal / external coated pipes (coatings and liners fully bonded to pipe wall).
Pipe wall thickness	< 200 mm / 7.87"
Liner thickness	< 20 mm / 0.79"
Media properties	
Physical condition	Liquid, single phase (well mixed, rather clean).
Viscosity	< 200 cSt (general guideline)
	For higher viscosities please contact your local representative
Permissible gas content (volume)	≤ 2%
Permissible solid content (volume)	≤ 5%
Flow range	0.1...20 m/s (turn down 200:1)

Installation conditions

Installation	For detailed information refer to *Installation and safety instructions* on page 21.
Measurement configuration	Single path, single pipe or dual path/dual pipe.
Inlet run	≥ 10 DN straight length
Outlet run	≥ 5 DN straight length
Dimensions and weights	For detailed information refer to *Dimensions and weight* on page 188.

Materials

Sensor	**Standard (small / medium / large version)**
	Rail cover: coated aluminum
	Rail construction: anodised aluminum
	Transducer: PSU/PA
	Cable connection: 1.4404; NPB
	Option stainless steel (small / medium version)
	Rail construction: 1.4404 / AISI 316L
	Transducer: PSU/PA
	Cable connection: 1.4404; NPB
	Option stainless steel eXtended Temperature (small / medium version)
	Rail construction: 1.4404 / AISI 316L
	Transducer XT: PAI 4203/PA
	Cable connection: 1.4404; PSU with FKM O-ring
Connection box	Coated aluminum
Coupling media	Coupling grease: mineral gel (standard); high temperature vacuum gel (XT)
	Coupling pads (recommended for high temperatures): FKM
Converter	**Standard**
	F version: die-cast aluminum; standard coating
	W version: polyamide-polycarbonate
	Option
	F version: stainless steel 316 L / 1.4408
	Coating: standard and offshore coating

Electrical connections

Description of used abbreviations; Q = flow rate; I_{max} = maximum current; U_{in} = input voltage; U_{int} = internal voltage; U_{ext} = external voltage; $U_{int, max}$ = maximal internal voltage	
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	Standard: 100...230 VAC (15%/ +10%); 50/60 Hz
	Option: 24 VDC (tolerance range: -55%/ +30%) 24 VAC/DC (AC: -15%/ +10%; 50/60 Hz,DC; -25%/ +30%)
Power consumption	AC: 22 VA
	DC: 12 W
Signal cable	Double shielded, 2 internal coax cables.
	Standard length: 5 meters/16 ft
	Optional lengths: 10...30 meters/33...98 ft; in steps of 5 meter; larger cable lengths on request; maximum length 30 meters/98 ft
Cable entries	For the large rail a cable connection box will be provided for cable lengths over 10 meters
	Standard: M20 x 1.5 (8...12 mm)
	Option: ½" NPT; PF ½

Inputs and outputs

General	All in- and outputs are galvanically isolated from each other and from all other circuits.		
	All operating data and output values can be adjusted.		
Description of used abbreviations	U_{ext} = external voltage; R_L = load + resistance; U_o = terminal voltage; I_{nom} = nominal current. Safety limit values (Ex i): U_i = max. input voltage; I_i = max. input current;P_i = max. input power rating; C_i = max. input capacity; L_i = max. input inductivity.		
Current output			
Output data	Measurement of volume flow, mass flow, flow speed, velocity of sound, gain, SNR, diagnostics (flow speed, VoS, SNR, gain), NAMUR NE 107, HART® communication.		
Temperature coefficient	Typically ± 30 ppm/K		
Settings	**Without HART®**		
	Q = 0%: 0…20 mA; Q = 100%: 10…20 mA		
	Error identification: 0…22 mA		
	With HART®		
	Q = 0%: 4…20 mA; Q = 100%: 10…20 mA		
	Error identification: 3.5…22 mA		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex-i**
Active	$U_{int,nom}$ = 24 VDC I ≤ 22 mA R_L ≤ 1 kΩ		$U_{int,nom}$ = 20 VDC I ≤ 22 mA R_L ≤ 450 Ω
			U_0 = 21 V I_0 = 90 mA P_0 = 0.5 W C_0 = 90 nF / L_0 = 2 mH C_0 = 110 nF / L_0 = 0.5 mH
Passive	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 1.8 V R_L ≤ (U_{ext} - U_0) / I_{max}		U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 4 V R_L ≤ (U_{ext} - U_o) / I_{max}
			U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I ~ 0 mH
HART®			
Description	HART® protocol via active and passive current output		
	HART® version: V7		
	Universal HART® parameter: completely integrated		
Load	≥ 230 Ω at HART® test point: please observe maximum value for current output!		
Multidrop	Yes, current output = 10% e.g. 4 mA		
	Multidrop addresses adjustable in operation menu 0...63		
Device drivers	DD for FC 375/475, AMS, PDM, DTM for FDT.		

<table>
<tr><td colspan="4">Pulse or frequency output</td></tr>
<tr><td>Output data</td><td colspan="3">Volume flow, mass flow.</td></tr>
<tr><td>Function</td><td colspan="3">Adjustable as pulse or frequency output</td></tr>
<tr><td>Pulse rate/frequency</td><td colspan="3">0.01...10000 pulses/s or Hz</td></tr>
<tr><td rowspan="2">Settings</td><td colspan="3">For Q = 100%: 0.01...10000 pulses per second or pulses per unit volume</td></tr>
<tr><td colspan="3">Pulse width: setting automatic, symmetric or fixed (0.05...2000 ms).</td></tr>
<tr><td>Operating data</td><td>Basic I/Os</td><td>Modular I/Os</td><td>Ex-i</td></tr>
<tr><td rowspan="3">Active</td><td rowspan="3">-</td><td>U_{nom} = 24 VDC</td><td rowspan="3">-</td></tr>
<tr><td>f_{max} ≤ 100 Hz:
I ≤ 20 mA
$R_{L, max}$ = 47 kΩ
open: I ≤ 0.05 mA
closed:
$U_{0,nom}$ = 24 V at I = 20 mA</td></tr>
<tr><td>f_{max} in operating menu set to:
100 Hz < f_{max} ≤ 10 kHz:
I ≤ 20 mA
R_L ≤ 10 kΩ for f ≤ 1 kHz
R_L ≤ 1 kΩ for f ≤ 10 kHz
open: I ≤ 0.05 mA
closed:
$U_{0,nom}$ = 22.5 V at I = 1 mA
$U_{0,nom}$ = 21.5 V at I = 10 mA
$U_{0,nom}$ = 19 V at I = 20 mA</td></tr>
<tr><td rowspan="3">Passive</td><td colspan="2">U_{ext} ≤ 32 VDC</td><td rowspan="3">-</td></tr>
<tr><td colspan="2">f_{max} in operating menu set to:
f_{max} ≤ 100 Hz:
I ≤ 100 mA
$R_{L, max}$ = 47 kΩ
$R_{L, min}$ = (U_{ext} - U_0) / I_{max}
open:
I ≤ 0.05 mA at U_{ext} = 32 VDC
closed:
$U_{0, max}$ = 0.2 V at I ≤ 10 mA
$U_{0, max}$ = 2 V at I ≤ 100 mA</td></tr>
<tr><td colspan="2">f_{max} in operating menu set to:
100 Hz < f_{max} ≤ 10 kHz:
I ≤ 20 mA
$R_{L,}$≤ 10 kΩ for f ≤ 1 kHz
$R_{L,}$≤ 1 kΩ for f ≤ 10 kHz
$R_{L, min}$ = (U_{ext} - U_0) / I_{max}
open:
I ≤ 0.05 mA at U_{ext} = 32 VDC
closed:
$U_{0, max}$ = 1.5 V at I ≤ 1 mA
$U_{0, max}$ = 2.5 V at I ≤ 10 mA
$U_{0, max}$ = 5.0 V at I ≤ 20 mA</td></tr>
<tr><td rowspan="2">NAMUR</td><td rowspan="2">-</td><td rowspan="2">Passive to
EN 60947-5-6
open: I_{nom} = 0.6 mA
closed: I_{nom} = 3.8 mA</td><td>Passive to
EN 60947-5-6
open: I_{nom} = 0.43 mA
closed: I_{nom} = 4.5 mA</td></tr>
<tr><td>U_I = 30 V
I_I = 100 mA
P_I = 1 W
C_I = 10 nF
L_I ~ 0 mH</td></tr>
</table>

Status output / limit switch			
Function and settings	Adjustable as automatic measuring range conversion, display of flow direction, 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/Os**	**Modular I/Os**	**Ex-i**
Active	-	U_{int} = 24 VDC $I \leq 20$ mA $R_{L, max}$ = 47 kΩ open: $I \leq 0.05$ mA closed: $U_{0, nom}$ = 24 V at I = 20 mA	-
Passive	$U_{ext} \leq 32$ VDC $I \leq 100$ mA $R_{L, max}$ = 47 kΩ $R_{L, min} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05$ mA at U_{ext} = 32 VDC closed: $U_{0, max}$ = 0.2 V at $I \leq 10$ mA $U_{0, max}$ = 2 V at $I \leq 100$ mA	U_{ext} = 32 VDC $I \leq 100$ mA $R_{L, max}$ = 47 kΩ $R_{L, min} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05$ mA at U_{ext} = 32 VDC closed: $U_{0, max}$ = 0.2 V at $I \leq 10$ mA $U_{0, max}$ = 2 V at $I \leq 100$ mA	-
NAMUR	-	Passive to EN 60947-5-6 open: I_{nom} = 0.6 mA closed: I_{nom} = 3.8 mA	Passive to EN 60947-5-6 open: I_{nom} = 0.43 mA closed: I_{nom} = 4.5 mA
			U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I = 0 mH

Control input			
Function	Hold value of the outputs (e.g. for cleaning work), set value of the outputs to "zero", counter and error reset, stop counter, range conversion, zero calibration.		
	Start of dosing when dosing function is activated		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex-i**
Active	-	U_{int} = 24 VDC Terminals open: $U_{0, nom}$ = 22 V Terminals bridged: I_{nom} = 4 mA On: $U_0 \geq$ 12 V with I_{nom} = 1.9 mA Off: $U_0 \leq$ 10 V with I_{nom} = 1.9 mA	-
Passive	8 V ≤ U_{ext} ≤ 32 VDC I_{max} = 6.5 mA at U_{ext} ≤ 24 VDC I_{max} = 8.2 mA at U_{ext} ≤ 32 VDC Contact closed (On): $U_0 \geq$ 8 V with I_{nom} = 2.8 mA Contact open (Off): $U_0 \leq$ 2.5 V with I_{nom} = 0.4 mA	3 V ≤ U_{ext} ≤ 32 VDC I_{max} = 9.5 mA at U_{ext} ≤ 24 V I_{max} = 9.5 mA at U_{ext} ≤ 32 V Contact closed (On): $U_0 \geq$ 3 V with I_{nom} = 1.9 mA Contact open (Off): $U_0 \leq$ 2.5 V with I_{nom} = 1.9 mA	5.5 V ≤ U_{ext} ≤ 32 VDC I_{max} = 6 mA at U_{ext} ≤ 24 V I_{max} = 6.5 mA at U_{ext} ≤ 32 V Contact closed (On): $U_0 \geq$ 5.5 V or I ≥ 4 mA Contact open (Off): $U_0 \leq$ 3.5 V or I ≤ 0.5 mA
			U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I = 0 mH
NAMUR	-	Active to EN 60947-5-6 Contact open: $U_{0, nom}$ = 8.7 V Contact closed (On): I_{nom} = 7.8 mA Contact open (off): $U_{0, nom}$ = 6.3 V with I_{nom} = 1.9 mA Identification for open terminals: $U_0 \geq$ 8.1 V with I ≤ 0.1 mA Identification for short circuited terminals: $U_0 \leq$ 1.2 V with I ≥ 6.7 mA	-

MODBUS			
Description	Modbus RTU; Master/Slave; RS485		
Address range	1…247		
Supported function codes	01, 02, 03, 04, 05, 08, 16, 43.		
Supported Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud.		
Low-flow cutoff			
On	0...±9.999 m/s; 0...20.0%, settable in 0.1% steps, separately for each current and pulse output.		
Off	0...±9.999 m/s; 0...19.0%, settable in 0.1% steps, separately for each current and pulse output.		
Time constant			
Function	Can be set together for all flow indicators and outputs, or separately for: current, pulse and frequency output, and for limit switches and the 3 internal counters.		
Time setting	0…100 seconds; settable in 0.1 second steps		
Current input			
Function	For connection of temperature sensors 0(4)...20 mA for heat/cold measurement		
Operating data	Basic I/Os	Modular I/Os	Ex i
Active	-	U_{int} = 24 VDC $I \leq 22$ mA $I_{max} \leq 26$ mA (electronically limited) $U_{0, min}$ = 19 V at $I \leq 22$ mA	U_{int} = 20 VDC $I \leq 22$ mA $U_{0, min}$ = 14 V at $I \leq 22$ mA
			No HART®
		No HART®	U_0 = 24.1 V I_0 = 99 mA P_0 = 0.6 W C_0 = 75 nF / L_0 = 0.5 mH
			No HART®
Passive	-	$U_{ext} \leq 32$ VDC $I \leq 22$ mA $I_{max} \leq 26$ mA (electronically limited) $U_{0, min}$ = 5 V at $I \leq 22$ mA	$U_{ext} \leq 32$ VDC $I \leq 22$ mA $U_{0, min}$ = 4 V at $I \leq 22$ mA
			No HART®
		No HART®	U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I = 0 mH
			No HART®

Approvals and certificates

CE	
This device fulfils the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directives and standards and the approved certifications, please refer to the EU Declaration of Conformity or the website of the manufacturer.
NAMUR	NE 04, 21, 43, 53, 80, 107.
Other approvals and standards	
Non-Ex	Standard
Hazardous areas	
Ex zone 1 - 2	For detailed information, please refer to the relevant Ex documentation.
	According to European directive 2014/34/EU (ATEX 100a)
IECEx	**Sensor:**
	Approval number sensor: IECEx KIWA 17.0017X
	Converter (F version only):
	Approval number converter: IECEx KIWA 18.0003X
ATEX	**Sensor:**
	Approval number: KIWA 17ATEX0034 X
	Converter (F version only):
	Approval number: KIWA 18ATEX0007 X
NEPSI	Approval number: GYJ151306 / GYJ151307
Class I, DIV 1/2.	Option (F version): Approval number; c**QPS**us LR1338-9
Protection category according to IEC 60529	**Signal converter**
	W (wall version) IP65/66, NEMA 4/4X
	F (field version) IP66/67, NEMA 4X/6
	Flow sensors
	Aluminum: IP66/67, NEMA 4X/6
	Stainless steel version: IP68
Shock resistance	IEC 60068-2-27
	30 g for 18 ms
Vibration resistance	IEC 60068-2-64
	1 g up to 2000 Hz

8.3 Dimensions and weight

8.3.1 Housing

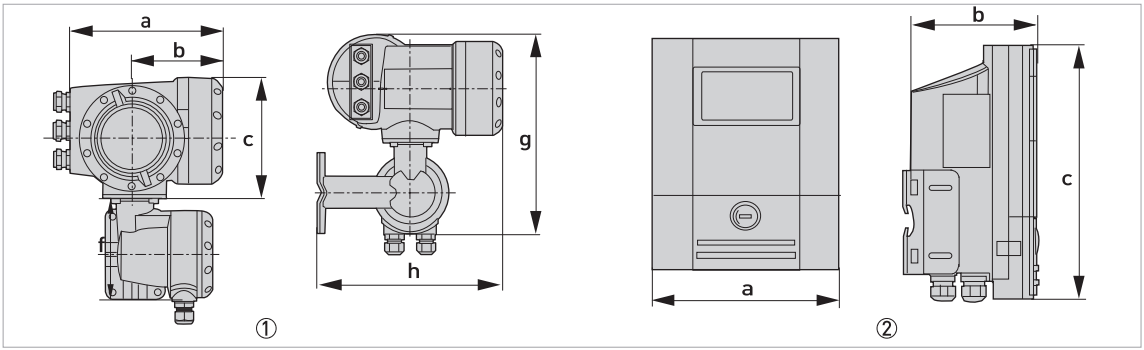


Figure 8-2: Dimensions of housing

① Field housing (F) - remote version
② Wall-mounted housing (W) - remote version

Version	Dimensions [mm]					Weight [kg]
	a	b	c	g	h	
F	202	120	155	296	277	6.0
W	198	138	299	-	-	2.4

Table 8-1: Dimensions and weight in mm and kg

Version	Dimensions [inch]					Weight [lb]
	a	b	c	g	h	
F	7.75	4.75	6.10	11.60	10.90	13.2
W	7.80	5.40	11.80	-	-	5.3

Table 8-2: Dimensions and weight in inch and lb

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

8.3.2 Clamp-on sensor and cable box

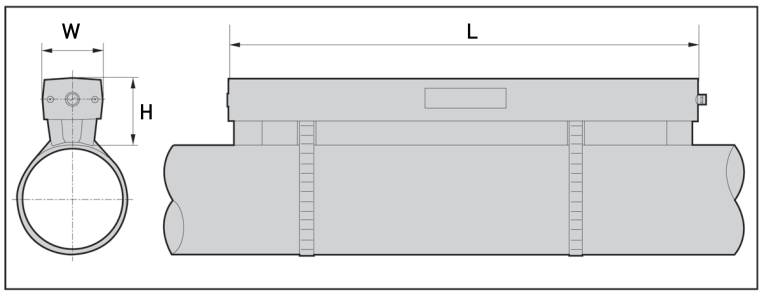


Figure 8-3: Dimensions clamp-on sensor

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 8-3: 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 8-4: Dimensions and weight clamp-on sensor (inch - lb)

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

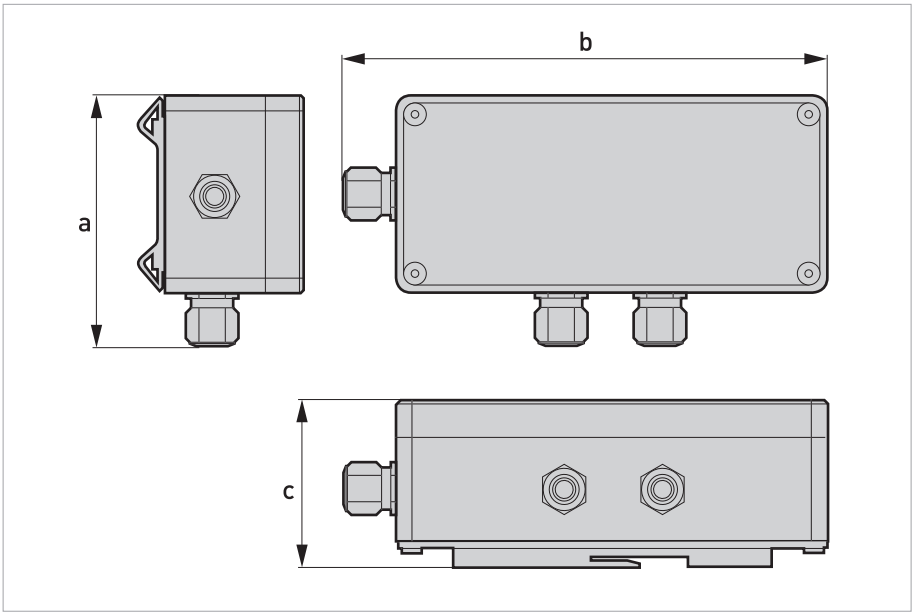


Figure 8-4: Dimension cable box

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

Table 8-5: Dimensions and weight 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 8-6: Dimensions and weight cable box (inch - lb)

8.3.3 Mounting plate of field housing

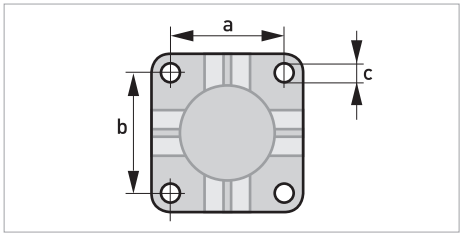


Figure 8-5: Dimensions for mounting plate of field housing

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

Table 8-7: Dimensions in mm and inch

8.3.4 Mounting plate of wall-mounted housing

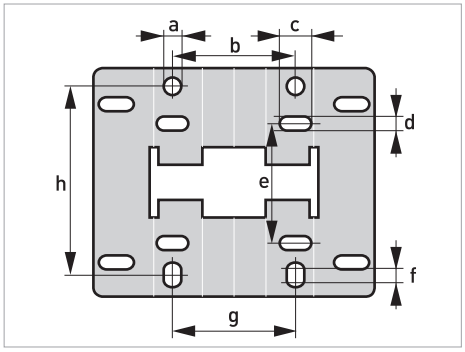


Figure 8-6: Dimensions of mounting plate of wall-mounted housing

	[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 8-8: Dimensions in mm and inch

9.1 General description

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

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

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

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

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

9.2 Identification codes and revision numbers

Manufacturer ID:	69 (0x0045)
Device:	0x45af
Device Revision:	1
DD Revision	1
DD Revision (NAMUR)	01.11
HART® Universal Revision:	7
FC 375/475 system SW.Rev.:	≥ 3.9 (HART App 6.1)
AMS version:	≥ 12.0
PDM version:	≥ 9.1

Table 9-1: Identification codes and revision numbers

9.3 Connection variants

The signal converter is a 4-wire device with 4...20 mA current output and HART® interface. Depending on the version, the settings and the wiring, the current output can operate as passive or active output.

- **Multi-drop mode is supported**
  In a multi-drop communication system, more than 2 devices are connected to a common transmission cable.
- **Burst mode is not supported**
  In the Burst mode a slave device transfers cyclic pre-defined response telegrams, to get a higher rate of data transfer.

INFORMATION!

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

There are two ways of using the HART® communication:

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

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

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

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

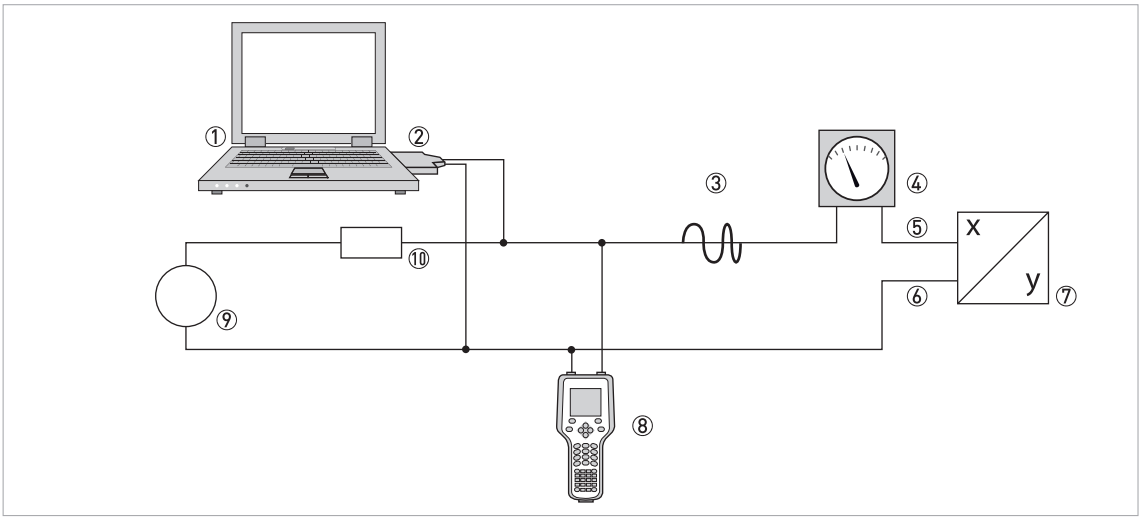


Figure 9-1: Point-to-Point connection

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

9.3.2 Multi-drop connection (2-wire connection)

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

The current outputs of the devices must be passive!

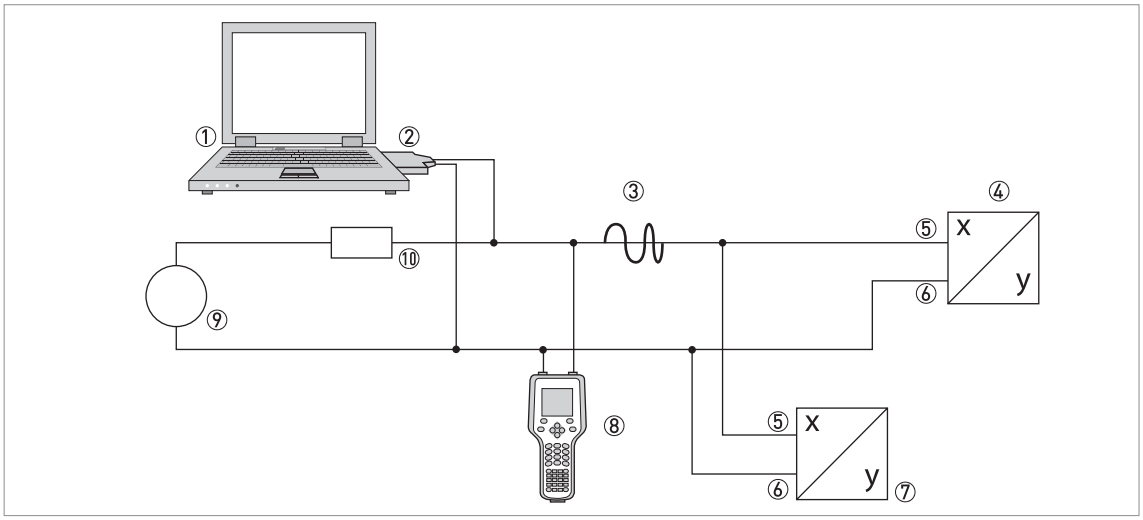


Figure 9-2: Multi-Drop connection (2-wire connection)

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

9.3.3 Multi-drop connection (3-wire connection)

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

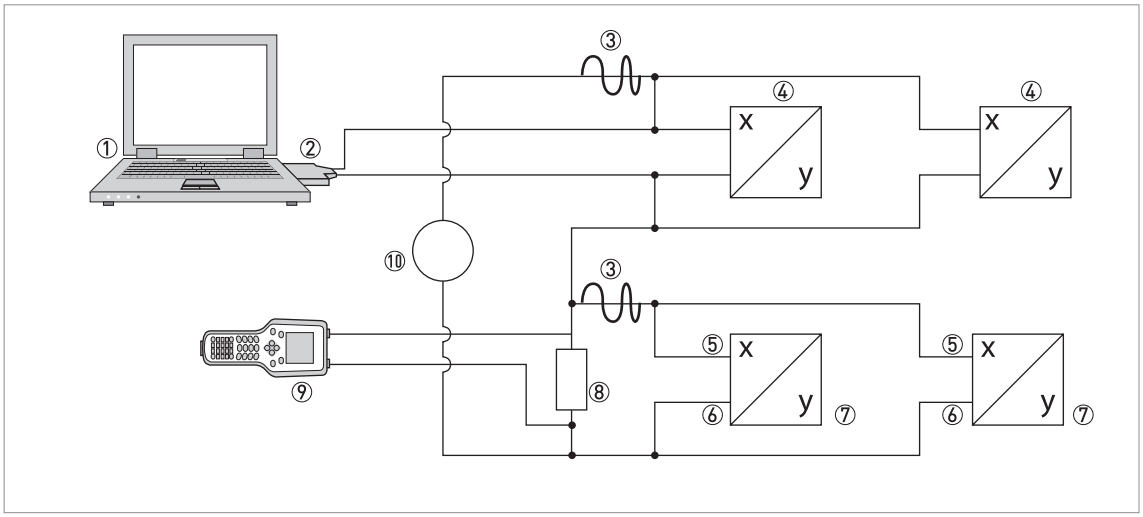


Figure 9-3: Multi-Drop connection (3-wire connection)

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

9.4 Inputs/outputs and HART dynamic variables and device variables

The signal converter is available with various in-/output combinations.

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

PV = Primary Variable; SV = Secondary Variable; TV = Tertiary Variable; QV = Quarternary Variable

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

Table 9-2: Connection of the terminals to the HART® dynamic variables

The signal converter can provide up to 14 measurement-related values. These values are accessible as so-called HART® device variables and can be connected to the HART® dynamic variables. The availability of these variables depends on the device versions and the settings.

Code = device variable code

HART® device variable	Code	Type	Explanations
Volume Flow	0	linear	-
Velocity of sound	1	linear	
Mass Flow	2	linear	
Flow Speed	3	linear	
Gain	4	linear	
SNR	5	linear	
Heat flow	6	linear	
Cold flow	7	linear	
Volume Flow 2	8	linear	Only active in 2 pipe system
Volume sum	9	linear	-
Diagnostic Gain 1	10	linear	Availability depends on diagnosis value setting.
Diagnostic SNR 1	11	linear	
Diagnostic Gain 2	12	linear	
Diagnostic SNR 2	13	linear	

HART® device variable	Code	Type	Explanations
Temperature A	14	linear	-
Temperature B	15	linear	
Totaliser 1 Volume Flow	16	totaliser	
Totalizer 1 Mass Flow	17	totaliser	
Totaliser 1 Energy	18	totaliser	
Totaliser 1 Volume Flow 2	19	totaliser	
Totaliser 2 Volume Flow	20	totaliser	
Totaliser 2 Mass Flow	21	totaliser	
Totaliser 2 Volume Flow 2	22	totaliser	
Totaliser 2 Volume sum	23	totaliser	
Totaliser 3 Volume Flow	24	totaliser	
Totaliser 3 Mass Flow	25	totaliser	
Totaliser 3 Energy	26	totaliser	
Totaliser 3 Volume sum	27	totaliser	
Operating hours	28	linear	

Table 9-3: Description of the HART® device variables

The dynamic variables connected to the linear analogue outputs (for current and/or frequency) are assigned by selecting the measurement for the related outputs. Only linear device variables can be assigned in this case.

For dynamic variables not connected to linear analogue outputs both linear and totaliser device variables can be assigned.

9.5 Remote operation

In addition to the local user interface panel the device may be operated remotely via the communication interface. There are different operating tools including small handhelds and large integrated maintenance systems. For adaptation to different devices two main technologies are used: The Device Description (DD) and the Field Device Tool Device Type Manager (FDT DTM). Both a DD and a DTM contain the description of a device's user interface, parameter database and communication interface. After being installed in an operating tool they allow access to device specific data. In the DD environment an operating tool is usually referred to as "host"; in the FDT DTM environment it is called "frame application" or "FDT container".

A DD is sometimes also referred to as EDD for Enhanced Device Description. This emphasizes some enhancements in specification like e.g. GUI support but doesn't imply a new technology.

For improving interoperability between DD hosts standard menu entry points have been specified:

- Root Menu
  Default top level menu for DD host applications with limited display space (e.g. handhelds).
- Process Variables Root Menu
  Provides process measurements and set points. For GUI based DD host applications.
- Diagnostic Root Menu
  Shows device state and diagnostic information. For GUI based DD host applications.
- Device Root Menu
  Provides access to all field device capabilities. For GUI based DD host applications.
- Offline Root Menu
  Provides access to all field device capabilities that can be manipulated while the host application is not connected to the field device.

For detailed information about the standard menus refer to *HART Menu Tree* on page 204.

The support of the standard menu entry points by the different DD hosts is described next.

9.5.1 Online/offline operation

DD hosts have different characteristics and support different operating modes for configuring devices, online and offline mode.

In online mode the host application can currently communicate with the device. The device can immediately check and perform configuration changes and update dependent parameters in case.

In offline mode the host application works only with a copy of the device's configuration data set and the DD needs to imitate the device's checks and updates.

Unfortunately the DD isn't informed by the host whether it is running in online or offline mode. In order to avoid interference between update functionality of the DD and the device there is a local parameter "Online Mode?" in the "Detailed Setup / HART" menu which can be set accordingly by the user.

9.5.2 Parameters for the basic configuration

There are parameters, such as measurement of counters, selection of diagnosis values and setting of pressure and temperature correction, which require a warm start of the device following data changes before other parameters may be written. Depending on the operating mode of the host system (online/offline mode) these parameters need to be treated differently.

In online mode the settings should be changed with the corresponding online methods only, in order to perform the warm start immediately and update dependent parameters automatically afterwards.

In the menu tree these methods are located below the related parameters (e.g. in a counter menu the method "Select Measurement" below the parameter "Measurement").

In offline mode the parameter "Online Mode?" in the "Detailed Setup / HART" menu should be set to "no" before the configuration settings are changed as desired. Before writing the entire offline configuration data set to the device the method "Prepare Parameter Download" in the "Detailed Setup / HART" menu should be executed. This method writes the parameters for basic configuration to the device and performs a warm start afterwards.

INFORMATION!
The Emerson Field Communicator and Simatic PDM execute this method automatically before sending a configuration or performing a "Download to Device" respectively.

9.5.3 Units

There are separate physical units settings for configuration parameters and HART® dynamic/device variables. The units settings for configuration parameters are the same as on the device's local display. They are available in the menu "Detailed Setup / Device / Units". For each HART® dynamic/device variable the physical unit can be set individually. They are available in the menu "Detailed Setup / Process Input / HART". The different units settings can be aligned with the method "Align HART Units" in the menu "Detailed Setup / Process Input / HART".

9.6 Field Communicator 375/475 (FC 375/475)

The Field Communicator is a hand terminal from Emerson Process Management that is designed to configure HART® and Foundation Fieldbus devices. Device Descriptions (DDs) are used to integrate different devices into the Field Communicator.

9.6.1 Installation

The HART® Device Description for the signal converter must be installed on the Field Communicator. Otherwise only the functions of a generic DD are available to the user and the entire device control is not possible. A "Field Communicator Easy Upgrade Programming Utility" is required to install the DDs on the Field Communicator.

The Field Communicator must be equipped with a system card with "Easy Upgrade Option". For details consult the Field Communicator User's Manual.

9.6.2 Operation

The Field Communicator supports the DD Root Menu for online access to the device. The Root Menu is implemented as a combination of the other standard menus Process Variables Root Menu, Diagnostic Root Menu and Device Root Menu.

INFORMATION!
For more detailed information see HART Menu Tree Field Communicator HART Application on page 204.

Operating the signal converter via the Field Communicator is very similar to manual device control using the keyboard. The help attribute of each parameter contains its function number as a reference to the local device display and the handbook.

Parameter protection for custody transfer is the same as on the device's local display. Other specific protective functions such as the passwords for the quick setup menu and the setup menu are not supported with HART®.

The Field Communicator always saves a complete configuration for the exchange with AMS. However, in the offline configuration and when sending to the device, the Field Communicator only takes into account a partial parameter set (like the standard configuration of the old HART® Communicator 275).

9.7 Asset Management Solutions (AMS®)

The Asset Management Solutions Device Manager (AMS®) is a PC program from Emerson Process Management which is designed to configure and manage HART®, PROFIBUS and Foundation Fieldbus devices. Device Descriptions (DDs) are used to integrate different devices into the AMS®.

9.7.1 Installation

If the signal converter Device Description has not yet been installed on the AMS® system, a so-called Installation Kit HART® AMS® is required. It is available for download from the website.

For installation with the Installation Kit refer to the "AMS Intelligent Device Manager Books Online" section "Basic Functionality / Device Information / Installing Device Types".

INFORMATION!
Please read the "readme.txt", which is also contained in the Installation Kit.

9.7.2 Operation

AMS supports the Process Variables Root Menu, Diagnostic Root Menu and Device Root Menu for online access to the device.

INFORMATION!
For more detailed information see Menu Tree AMS on page 205.

Operating the signal converter via the AMS Device Manager is similar to manual device control using the keyboard. The help attribute of each parameter contains its function number as a reference to the local device display and the handbook.

Parameter protection for custody transfer and service is the same as on the device's local display. Other specific protective functions such as the passwords for the quick setup menu and the setup menu are not supported with HART®.

When copying configurations in AMS, unit parameters need to be transferred first. Otherwise related parameters may be not transferred correctly. When the compare view has been opened during a copy process, go at first to the units section of the device menu ("Detailed Setup / Device / Units") and transfer all unit parameters. Note that read-only parameters need to be transferred individually!

9.8 Process Device Manager (PDM)

The Process Device Manager (PDM) is a Siemens PC program designed to configure HART® and PROFIBUS devices. Device Descriptions (DDs) are used to integrate different devices into the PDM.

9.8.1 Installation

If the signal converter Device Description has not yet been installed on the PDM system, a so-called Device Install HART® PDM is required for the signal converter. This is available for download from the website.

For installation with the Device Install, see the PDM manual, Section 13 - Integrating devices.

INFORMATION!
Please read the "readme.txt", which is also contained in the Installation Kit.

9.8.2 Operation

PDM supports the Process Variables Root Menu, Diagnostic Root Menu and Device Root Menu for online access to the device and the Offline Root Menu for offline configuration.

INFORMATION!
For more detailed information see Menu Tree PDM on page 206.

The classic approach for PDM is the offline operation with the PDM parameter table and the transfer of entire configuration data sets with the "Download to Device" and "Upload to PG/PC" functions. The parameter "Online Mode?" in the "Detailed Setup / HART" table section of the parameter table should be set to "no". However PDM also supports online operation from the "Device" and the "View" sections of the menu bar which is more similar to manual device control using the keyboard. Usually offline and online configuration data sets are separated in PDM. Still there is some interdependency e.g. regarding evaluation of parameter and menu conditionals: If e.g. the "Access Level" is changed in an online menu the offline configuration data set needs to be updated with "Upload to PG/PC" before the related online menus actually become accessible.

The help attribute of each parameter contains its function number as a reference to the local device display and the handbook.

Parameter protection for custody transfer and service is the same as on the device's local display. Other specific protective functions such as the passwords for the quick setup menu and the setup menu are not supported with HART®.

9.9 HART Menu Tree

9.9.1 HART Menu Tree - Field Communicator HART Application

The Field Communicator supports the standard EDDL Root Menu.

In the signal converter HART DD is implemented as a combination of other standard EDDL menus:

- Process Variables Root Menu (details on page 207)
- Diagnostic Root Menu (details on page 207)
- Device Root Menu (details on page 208)
- Offline Root Menu (details on page 213)

The menus are located in the Field Communicator user interface as follows:

1 Offline	
2 Online	1 Process Variables (Process Variables Root Menu)
	2 Diag/Service (Diagnostic Root Menu)
	3 Quick Setup (Device Root Menu)
	4 Detailed Setup (Device Root Menu)
	5 Service (Device Root Menu)
3 Utility	
4 HART Diagnostics	

Table 9-4: Field Communicator HART Application

9.9.2 HART Menu Tree AMS - Device's context menu

AMS supports the following standard EDDL menus:

- Process Variables Root Menu (details on page 207)
- Diagnostic Root Menu (details on page 207)
- Device Root Menu (details on page 208)
- Offline Root Menu (details on page 213)

The menus are located in the AMS user interface as follows:

Configure/Setup	Configure/Setup (Device Root Menu)
Compare	
Clear Offline	
Device Diagnostics	Device Diagnostics (Diagnostic Root Menu)
Process Variables	Process Variables (Process Variables Root Menu)
Scan Device	
Calibration Management	
Rename	
Unassign	
Assign / Replace	
Audit Trail	
Record Manual Event	
Drawings / Notes...	
Help...	

Table 9-5: Device's context menu

9.9.3 HART Menu Tree PDM - Menu Bar and Working Window

PDM supports the following standard EDDL menus:

- Process Variables Root Menu (details on page 207)
- Diagnostic Root Menu (details on page 207)
- Device Root Menu (details on page 208)
- Offline Root Menu (details on page 213)

The menus are located in the PDM user interface as follows:

File	
Device	Communication path
	Download to Device...
	Upload to PG/PC...
	Update Diagnostic Status
	Quick Setup (Device Root Menu)
	Detailed Setup (Device Root Menu)
	Service (Device Root Menu)
View	Process Variables (Process Variables Root Menu)
	Diag/Service (Diagnostic Root Menu)
	Toolbar
	Status Bar
	Update
Options	
Help	

Table 9-6: Menu Bar

Parameter Group Overview	(Offline Root Menu)
Parameter Table	

Table 9-7: Working Window

9.9.4 Process Variables Root Menu

Process Variables		
	Process Values	Volume Flow / Velocity of sound / Mass Flow / Flow speed / Heat Flow / Cold Flow / Volume Flow 2 / Volume Flow 12 / Temperature A / Temperature B / Operating hours
	Totalizer	Volume Totalizer 1 / Mass Totalizer 1 / Energy Totalizer 1 / Volume 2 Totalizer 1 / Volume Totalizer 2 / Mass Totalizer 2 / Volume 2 Totalizer 2 / Volume 12 Totalizer 2 / Volume Totalizer 3 / Mass Totalizer 3 / Energy Totalizer 3 / Volume 12 Totalizer 3
	Diagnosis Values	Gain / SNR / Diag. Gain 1 / Diag. SNR 1 / Diag. Gain 2 / Diag. SNR 2
	In-/Outputs, HART Dynamic Variables	Primary / Secondary / Tertiary / Quaternary / Time and simulation

Table 9-8: Process Variables Root Menu

9.9.5 Diagnostic Root Menu

Device Status		
	Condensed Status (NE 107)	
	HART Standard Status	
	Write Protect	
	Additional	F Configuration / F Electronics / C Configuration / S Process / S Configuration / S Electronics / M Configuration / M Electronics / M Sensor / Proc: Signal Lost / Proc: Empty Pipe / Electr: IO Connection / Proc: Current Input / Electr: Power Failure / Installation required / Config: Totaliser / Proc: Signal Unreliable / Electr: Operation Info. / Config: No Meas.Value / Show single events
Simulation		
	volume flow	
	velocity of sound	
	simulation IO	Simulation current output A / Simulation frequency output A / Simulation pulse output A / Simulation status output A / Simulation limit switch A / Simulation control input A / Simulation current output B / Simulation frequency output B / Simulation pulse output B / Simulation status output B / Simulation limit switch B / Simulation control input B / Simulation current output C / Simulation status output C / Simulation limit switch C / Simulation frequency output D / Simulation pulse output D / Simulation status output D / Simulation limit switch D
Actual Values		
	act. volume flow / act. volume flow 2 / act. mass flow / act. flow speed / act. Reynolds number 1 / act. Reynolds no. 2 / act. vel. of sound path 1 / act. vel. of sound path 2 / act. gain path 1 / act. gain path 2 / act. SNR path 1 / act. SNR path 2 / act. signal quality path 1 / act. signal quality path 2 / opt. transd. distance path 1 / opt. transd. distance path 2 / operating hours	
Information		
	C number / Sensor CPU / Sensor DSP / Sensor Driver / SW.REV. MS / SW.REV. UIS / Electronic Revision	
Test/Reset		
	Reset errors / Warmstart / Device reset / Reset Configuration Changed Flag	

Table 9-9: Diagnostic Root Menu

9.9.6 Device Root Menu

Quick Setup				
	General	language / tag / polling address		
	Reset	reset errors / reset totalizer 1 / reset totalizer 2 / reset totalizer 3		
	Status Mapping	Electr: Power Failure / Config: Totaliser / Proc: Signal Unreliable / Proc: Signal Lost / Proc: Empty Pipe / Electr: IO Connection / Proc: Current Input / Reset to default		
Detailed Setup				
	Process Input	General	number of pipes / number of paths / flow mode / temperature inputs / supply temperature / return temperature / current inputs / flow sensor / specific heat	
		pipe data	diameter / pipe material / VoS pipe material / wall thickness / liner material / VoS liner material / liner thickness / fluid / VoS fluid / glycol % vol. / density / dynamic viscosity / pipe temperature	
		transducer data	transducer set 1 / numb. traverses 1 / actual distance 1 / transducer set 2 / numb. traverses 2 / actual distance 2	
		calibration	zero calibration / GK / Reynolds correction / linearization	
		filter	limitation min / limitation max / flow direction / time constant / LFC threshold / LFC hysterese	
		plausibility	error limit / counter decrease / counter limit	
		simulation	volume flow / velocity of sound	
		information	Sensor CPU / Sensor DSP / Sensor Driver / calibration date / serial no. sensor / V no. sensor	
		diagnosis	diagnostics 1 / diagnostics 2	
		HART	Snsr s/n	
			no. of Device Variables	
			Volume Flow	Unit Volume Flow / Format Volume Flow / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Flow / Update Time
			Velocity of sound	Unit Velocity of sound / Format Velocity of sound / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Velocity of sound / Update Time
			Mass Flow	Unit Mass Flow Format Mass Flow / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Mass Flow / Update Time
			Flow speed	Unit Flow speed / Format Flow speed / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Flow speed / Update Time
			Gain	Unit Gain / Format Gain / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Gain / Update Time
			SNR	Unit SNR / Format SNR / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class SNR / Update Time
			Heat Flow	Unit Heat Flow / Format Heat Flow / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Heat Flow / Update Time

Detailed Setup				
	Process Input	HART	Cold Flow	Format Cold Flow / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Cold Flow / Update Time
			Volume Flow 2	Unit Volume Flow 2 / Format Volume Flow 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Flow 2 / Update Time
			Volume Flow 12	Unit Volume Flow 12 / Format Volume Flow 12 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Flow 12 / Update Time
			Diag. Gain 1	Unit Diag. Gain 1 / Format Diag. Gain 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Diag. Gain 1 / Update Time
			Diag. SNR 1	Unit Diag. SNR 1 / Format Diag. SNR 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Diag. SNR 1 / Update Time
			Diag. Gain 2	Unit Diag. Gain 2 / Format Diag. Gain 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Diag. Gain 2 / Update Time
			Diag. SNR 2	Unit Diag. SNR 2 / Format Diag. SNR 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Diag. SNR 2 / Update Time
			Temperature A	Unit Temperature A / Format Temperature A / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Temperature A / Update Time
			Temperature B	Unit Temperature B / Format Temperature B / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Temperature B / Update Time
			Volume Totalizer 1	Unit Volume Totalizer 1 / Format Volume Totalizer 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Totalizer 1 / Update Time
			Mass Totalizer 1	Unit Mass Totalizer 1 / Format Mass Totalizer 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Mass Totalizer 1 / Update Time
			Energy Totalizer 1	Unit Energy Totalizer 1 / Format Energy Totalizer 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Energy Totalizer 1 / Update Time

Detailed Setup				
	Process Input	HART	Volume 2 Totalizer 1	Unit Volume 2 Totalizer 1 / Format Volume 2 Totalizer 1 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume 2 Totalizer 1 / Update Time
			Volume Totalizer 2	Unit Volume Totalizer 2 / Format Volume Totalizer 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Totalizer 2 / Update Time
			Mass Totalizer 2	Unit Mass Totalizer 2 / Format Mass Totalizer 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Mass Totalizer 2 / Update Time
			Volume 2 Totalizer 2	Unit Volume 2 Totalizer 2 / Format Volume 2 Totalizer 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume 2 Totalizer 2 / Update Time
			Volume 12 Totalizer 2	Unit Volume 12 Totalizer 2 / Format Volume 12 Totalizer 2 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume 12 Totalizer 2 / Update Time
			Volume Totalizer 3	Unit Volume Totalizer 3 / Format Volume Totalizer 3 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume Totalizer 3 / Update Time
			Mass Totalizer 3	Unit Mass Totalizer 3 / Format Mass Totalizer 3 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Mass Totalizer 3 / Update Time
			Energy Totalizer 3	Unit Energy Totalizer 3 / Format Energy Totalizer 3 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Energy Totalizer 3 / Update Time
			Volume 12 Totalizer 3	Unit Volume 12 Totalizer 3 / Format Volume 12 Totalizer 3 / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Volume 12 Totalizer 3 / Update Time
			Operating hours	Unit Operating hours / Format Operating hours / Time constant / Upper Sensor Limit / Lower Sensor Limit / Minimum Span / Family / Class Operating hours / Update Time
	process input 2	General	number of pipes / number of paths / volume flow sum	
		pipe data	diameter / pipe material / VoS pipe material / wall thickness / liner material / VoS liner material / liner thickness / fluid / VoS fluid / glycol % vol. / density / dynamic viscosity / pipe temperature	
		transducer data	transducer set 2 / numb. traverses 2 / actual distance 2	
		calibration	zero calibration / GK / Reynolds correction / linearization	
		filter	limitation min / limitation max / flow direction / time constant / LFC threshold / LFC hysterese	
		plausibility	error limit / counter decrease / counter limit	
		simulation	volume flow 2	
		diagnosis	diagnostics 2	

Detailed Setup			
	transducer sets		Ta serial no. / calibration number / Tb serial no. / calibration number / Tc serial no. / calibration number
	I/O	hardware	terminals A / terminals B / terminals C / terminals D
		current out A	range 0% / range 100% / extended range min / extended range max / error current / error condition / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / special function / threshold / hysteresis / information / Simulation current output A
		frequency out A	pulse shape / pulse width / 100% pulse rate / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / invert signal / information / Simulation frequency output A
		pulse output A	pulse shape / pulse width / max. pulse rate / measurement / value p. pulse / polarity / LFC threshold / LFC hysteresis / time constant / invert signal / information / Simulation pulse output A
		status output A	mode / output B / invert signal / information / Simulation status output A
		limit switch A	measurement / threshold / hysteresis / polarity / time constant / invert signal / information / Simulation limit switch A
		control input A	mode / invert signal / information / Simulation control input A
		current in A	range 0% / range 100% / extended range min / extended range max / measurement / range min / range max / time constant / information
		current out B	range 0% / range 100% / extended range min/ extended range max / error current / error condition / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / special function / threshold / hysteresis / information / Simulation current output B
		frequency out B	pulse shape / pulse width / 100% pulse rate / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / invert signal / information / Simulation frequency output B
		pulse output B	pulse shape / pulse width / max. pulse rate / measurement / value p. pulse / polarity / LFC threshold / LFC hysteresis / time constant / invert signal / special function / information / Simulation pulse output B
		status output B	mode / output A / invert signal / SW.REV.MS / information / Simulation status output B
		limit switch B	measurement / LFC threshold / LFC hysteresis / polarity / time constant / invert signal / SW.REV.MS / information / Simulation limit switch B
		control input B	mode / invert signal / SW.REV.MS / information / Simulation control input B
		current in B	range 0% / range 100% / extended range min / extended range max / measurement / range min / range max / time constant / information
		current out C	range 0% / range 100% / extended range min/ extended range max / error current / error condition / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / special function / threshold / hysteresis / information / Simulation current output C
		status output C	mode / output A / invert signal / SW.REV.MS / Simulation status output C
		limit switch C	measurement / threshold / hysteresis / polarity / time constant / invert signal / SW.REV.MS / Simulation limit switch C

Detailed Setup			
	I/O	frequency out D	pulse shape / pulse width / 100% pulse rate / measurement / range min / range max / polarity / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant /invert signal / phase shift w.r.t. B / SW.REV. MS / information / Simulation frequency output D
		pulse output D	pulse shape / pulse width / max. pulse rate / measurement / value p. pulse / polarity / LFC threshold / LFC hysteresis / time constant / invert signal / phase shift w.r.t. B / SW.REV. MS / information / Simulation pulse output D
		status output D	mode / output A / invert signal / SW.REV.MS / information / Simulation status output D
		limit switch D	measurement / threshold / hysteresis / polarity / time constant / invert signal / SW.REV.MS / information / Simulation limit switch D
	I/O Totalizer	totalizer 1	funct. of totalizer / measurement / LFC threshold / LFC hysteresis / time constant / preset value / reset totalizer / set totalizer / start totalizer / stop totalizer / SW.REV. MS / information
		totalizer 2	funct. of totalizer / measurement / LFC threshold / LFC hysteresis / time constant / preset value / reset totalizer / set totalizer / start totalizer / stop totalizer / SW.REV. MS / information
		totalizer 3	funct. of totalizer / measurement / LFC threshold / LFC hysteresis / time constant / preset value / reset totalizer / set totalizer / start totalizer / stop totalizer / information
	I/O HART	Mapping of Dynamic Variables	PV is / SV is / TV is / QV is
		PV Analog Channel	
		SV Analog Channel	
		TV Analog Channel	
		QV Analog Channel	
	device	device info	tag / C number / device serial no. / electronic serial no. / SW.REV. MS / Electronic Revision
		display	language / default display / Optical Keys
		1. meas. page	function / measurement 1.line / range min / range max / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / format 1.line / measurement 2.line / format 2.line / measurement 3.line / format 3.line
		2. meas. page	function / measurement 1.line / range min / range max / limitation min / limitation max / LFC threshold / LFC hysteresis / time constant / format 1.line / measurement 2.line / format 2.line / measurement 3.line / format 3.line
		graphic page	select range / range / range +/- / time scale
		special functions	reset errors / Warmstart
		units	size / volume flow / Text free unit / [m³/s]*factor / unit / Text free unit / [kg/s]*factor / unit / Text free unit / [W]*factor / velocity / volume / Text free unit / [m³]*factor / mass / Text free unit / [kg]*factor / heat / Text free unit / [J]*factor / density / temperature / unit % / unit dB / unit Hz / unit mA/ unit h / unit s

Service				
	Service Access	Access Level HART / Enable Service Access / Disable Service Access		
	service	signal data	window path 1	method / window size / window weight / window minimum / window start / window end
			detection path 1	method / trigger level / trigger margin / dead time
			window path 2	method / window size / window weight / window minimum / window start / window end
			detection path 2	method / trigger level / trigger margin / dead time
			pulse form	
			averaging	mode / min. stacking / max. stacking
			tracking	
			SNR	
			ping time	
			DSP sets	DSP set 1 / DSP set 2 / DSP set 3 /
		service calibration	zero instrument	path 1 / path 2
		service info	detected C-No. / device serial no. / serial no. sensor / V no. sensor	

Table 9-10: Device Root Menu

9.9.7 Offline Root Menu

Identification		
	Tag	
	Long Tag	
	Descriptor	
	Message	
	Date	
	Device	
		Manufacturer
		Device Type
		HART Device ID
		Final Assembly Number
		Device serial number
		C number
		Electronic serial number
Detailed Setup	Refer to Device Root Menu -> Detailed Setup (Without methods that require online access to the device).	
Service	Refer to Device Root Menu -> Service (Without methods that require online access to the device).	

Table 9-11: Offline Root Menu

KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

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

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

KROHNE