OPTISONIC 6300 P Handbook

Portable ultrasonic clamp-on flowmeter for liquids

ER 2.0.x._

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:	
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
	X	all inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed	

Table 1-1: Description of changes

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

INFORMATION!
Compatibility and changes concerning communication interface and/or input and output connections are not applicable for the OPTISONIC 6300 P converter software.

Release date	Electronic Revision	Changes and compatibility	Documentation
2021-07	ER 2.0.1	Initial software version	MA OPTISONIC 6300 P R06

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 P portable clamp-on flow meter is specially designed for temporary liquid flow measurement in full pipe systems. The measurement system consists of transducers mounted in a sensor rail and a battery-powered portable converter and data logger. The system is controlled by a KROHNE Clamp-on APP installed on a smart device.

The OPTISONIC 6300 P is meant to be used temporarily for liquid flow and energy measurement. For example, the measured and calculated flow data is usable in process optimization, collecting additional process data, comparing flow data with existing flowmeters, verifying other flowmeters or flowmeter replacement during maintenance.

1.3 User cases:

The portable converter is designed to be used in non-hazardous area only

The standard operating mode of the portable clamp-on device is battery powered. Use the original power supply adapter to recharge the battery or supply the converter in residential, light-industrial and industrial environments. Use the 12 V car accessory plug to charge the battery in the car.

The portable transducers have a fixed 3 meters sensor signal cable. The extension signal cable set of 7 meters is optionally available to extend the sensor signal cable to 10 meters. As a recommendation, use only the fixed signal cable without the extension cable in industrial zones.

The portable converter is controlled by a smart device using the Clamp-on APP software. The communication with a smart device can be either via USB cable (non-restrictions) or via wireless Bluetooth communication. For use in industrial zones, Bluetooth is available for radio-approved countries.

Optionally an OPTISONIC 6300 P- I/O box is available to connect external wiring for current output, frequency output, status output and/or two current inputs for temperature sensor signals. The output ports are suitable to use in light-industrial zones connected with shielded cables of a maximum 20-meter length. Do not use the output ports in industrial zones.

For an energy measurement in a light industrial area, one or two current inputs are in the I/O box available to connect temperature sensors. For an energy measurement in industrial areas, the I/O box available as standard with integrated temperature transmitters and 2 temperature sensors with original cables must be used.

1.4 Certification

Product marking

Figure 1-1: Examples of marking logo

The manufacturer certifies successful testing of the product by applying the conformity mark on the device.

This device fulfils the statutory requirements of the relevant directives.

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

DANGER!
The OPTISONIC 6300 P ***cannot*** *be used in Hazardous Locations or Explosive Gas Atmospheres.*

1.5 Safety instructions from the manufacturer

1.5.1 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.

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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.

1.5.2 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.

1.5.3 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.

1.5.4 Information concerning the documentation

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

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

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

1.5.5 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.

1.6 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.

1.7 Instruction for transportation and handling of batteries

WARNING!
Lithium batteries are primary power sources with high energy content. If mistreated, they may present a potential risk.

WARNING!
Please be sure to observe the following warnings. As batteries contains flammable substances such as lithium or other organic solvents, they may cause heating, rupture or ignition.

INFORMATION!
The manufacturer assumes no liability for customer failure.

Please observe the following instructions:

- The battery is always installed in the converter and it is not allowed to be removed for any transport.
- Transport can be done in original packing in accordance with UN3481/IATA regulations.
- Do not short-circuit, overcharge or connect with false polarity.
- Do not expose to temperature beyond the specified temperature range or incinerate the battery.
- Keep batteries away from direct sunlight, high temperature and high humidity.
- Do not crush, puncture or open cells or disassemble battery packs.
- Do not weld or solder to the body of the battery.
- Do not expose contents of battery to water.
- Dispose battery packs in accordance to WEEE regulations (refer to *Disassembly and recycling* on page 58) or in accordance to additional local regulations.

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 device and its main accessories are delivered in a soft or hard case.

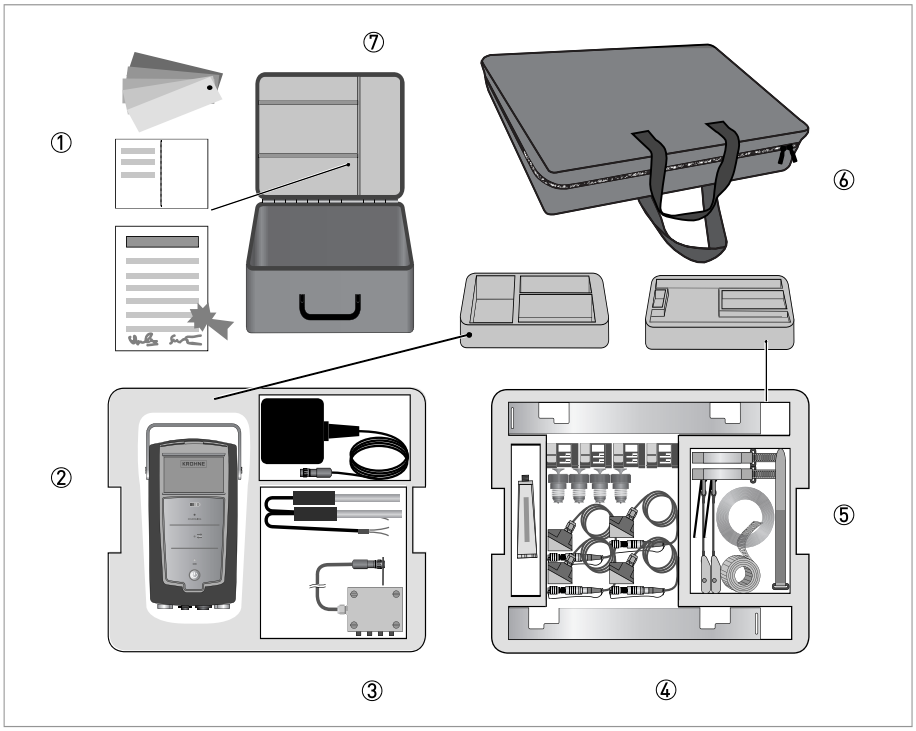


Figure 2-1: Scope of delivery

① Quick Start , factory calibration report
② Tray with UFC 300 P signal converter and power supply (adaptor)
Optionally:
③ I/O box and/or temperature sensors
④ Tray with one or two rail(s) and sensor(s) with fixing units (depending on version ordered)
⑤ Metal and/or nylon straps for mounting rail(s) and converter
⑥ Option: soft case

or (depending on version ordered)...

⑦ Hard case

INFORMATION!
The delivered content can be different, depending on the version ordered. Refer to the included checklist to see if all items are delivered and present.

2.2 Device description

The ultrasonic clamp-on sensor rail is designed to be installed on the outside of the pipeline to measure the volume flow of liquids. The device is a combination of sensor rail(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.
Scan the auto ID code (data matrix) on the device nameplate to download all product specific information.

PICK up your information

Device versions

The ultrasonic clamp-on flowmeter is available in different sensor rail versions and with a portable ultrasonic signal converter.

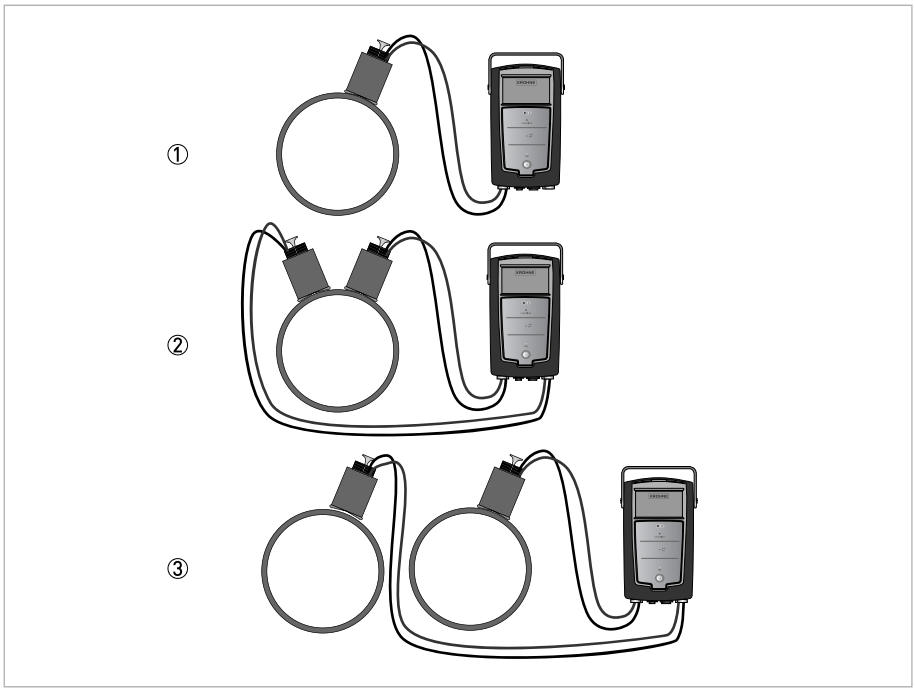


Figure 2-2: System configuration possibilities

① Single path, single pipe
② Dual path, single pipe
③ Dual pipe

2.3 Nameplate (example)

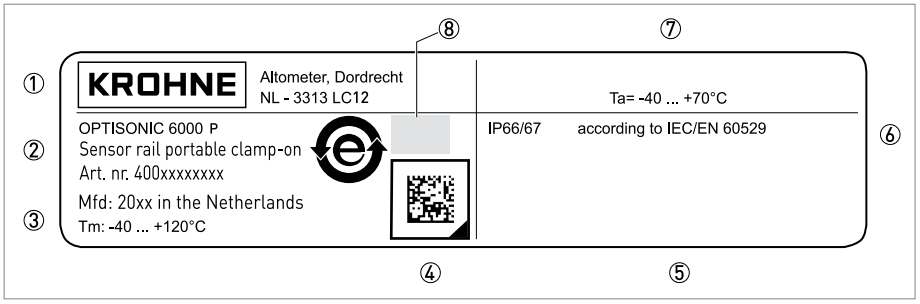


Figure 2-3: Example of a flow sensor nameplate

① Name and address of the manufacturer
② Device description, article number and manufacturing year
③ Process temperature range
④ Data matrix
⑤ Space or additional information
⑥ Protection category
⑦ Ambient temperature range
⑧ Conformity mark (e.g. CE/UKCA) with number(s) of notified body/bodies and disposal logo

Auto ID according to DIN specifications

The auto ID code (data matrix) guides you directly to the PICK server (Product Information Center KROHNE).
Scan the auto ID code on the device nameplate to download all product specific information.

- Handbooks, Quick Starts and Supplementary instructions
- Calibration certificates
- Factory settings as bin file
- Parameter data sheets
- Digital nameplates

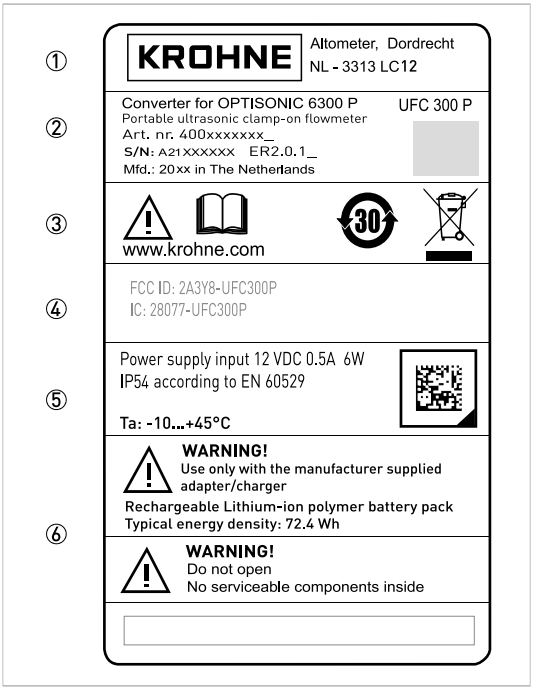


Figure 2-4: Example of converter nameplate

① Name and address of the manufacturer
② Device type, software and serial number, manufacturing year and conformity marking
③ Website, documentation info and disposal logo
④ Bluetooth registration number(s)
⑤ Device protection class, supply, ambient temperature and data matrix
⑥ Additional info and warnings

I/O Box nameplate information

For detailed information of the I/O box nameplates (on the outside of the I/O box cover), refer to *Mechanical installation* on page 41

INFORMATION!

The next steps are necessary to start a measurement on a new location:

1. *Find a suitable location and determine the basic data and parameters of the pipe.*
2. *Download and install the mobile application on your hand-held device. Set your mobile connections to "Bluetooth tethering" and connect to the UFC 300 P converter. Use the mobile application to fill in the correct data from step 1 and set the advised measurement mode.*
3. *Install the sensor rail(s) according to the advised and chosen measurement mode.*
4. *Perform an optimization loop and make small changes in the position of the transducers.*

These four steps are described in the following sections.

3.1 General safety instructions

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.

Specific for sensors:

WARNING!

- *Be careful when locking the rail back on to 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.*
- *Be careful when installing the rail with magnetic fixation units. Read the instructions and safety precautions;* *refer to Installing rail with magnetic fixation units on page 35*

CAUTION!

- *Do not bend the metal mounting strap to prevent a fault mounting of the fixation units of the sensor rail(s).*
- *Protect the pipe contact surface of the transducer, since scratches or other damages influence the correct functioning.*
- *Check the connection groove of the transducer cover for damages or dirt (and clean or replace if necessary), before fitting the transducer to the transducer knob in the sensor rail.*
- *Check sensor cabling with regular intervals for damages and wear as this may cause improper functioning. Replace when necessary.*
- *Check the presence of sufficient grease on the transducer contact surface in case of an acoustic signal failure.*
- *Check the sensor rail sliding area regularly for dirt, pollution or excess of coupling grease, which can cause improper functioning.*
- *Excess of coupling grease can be removed from the sensor rail(s) and transducers with a dry piece of cloth. Coupling grease on the converter housing can be removed using soapy water.*

Specific for converters:

WARNING!
Be careful and prevent injury when moving the handle of the converter, as your fingers can get stuck between the handle and the housing of the converter.

CAUTION!

- *To prevent improper functioning caused by dust and dirt, put the connector covers back on the connectors on the bottom side of the converter, when not in use.*
- *To prevent force on the sensor cables, turn the handle fully backwards (towards the housing) when the sensor cables are connected and the converter is positioned on a flat surface.*
- *The converter contains a rechargeable lithium-ion battery / UN3481*
- *Charge the battery every 6 months to keep the battery at an optimum condition and to prevent a total discharge of the battery.*
- *The battery charger/mains adaptor with protection class IP40, NEMA 1, must be protected against moisture entering.*
- *To prevent damage to the converter, do not install the converter in the near of excessive vibrations (see the max. specifications).*

3.2 Step 1: Find location and determine data

CAUTION!
Do not start to mount the rails yet! Step 1 is only meant to find a suitable location for a measurement. The installation itself will be done in Step 3.

Finding transducer location:

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:

- with a fixed reference point; refer to *Install 1 traverse with 2 rails (DN400...4000)* on page 31.
- using a paper roll; refer to *Determine the transducer position with a paper roll* on page 33.

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 elbows, valves, headers or pumps. Follow the given installation recommendations.

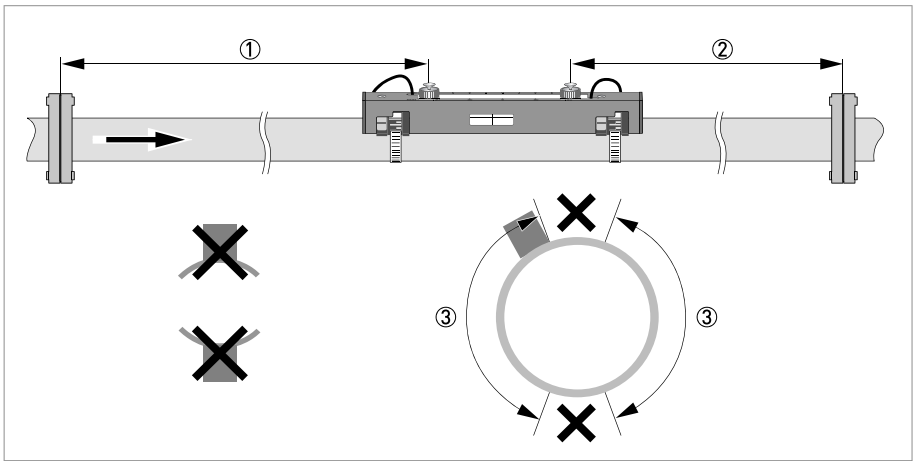


Figure 3-1: Inlet, outlet and recommended mounting area

① Min. 10 DN
② Min. 5 DN
③ Recommended installation location (120°)

CAUTION!
Make sure that the rail is not mounted at the highest point (risk for air bubbles) or at the lowest point (risk for particles) of the pipe.

3.2.1 Horizontal (long) pipes

- Install on a slightly ascending pipe section or at the lowest point of the pipe system.
- Install air/gas release devices (air vent).
- If not possible, control the flow velocity to prevent gases (air, gas or vapour) from collecting in the upper parts. In that case unwanted gases are carried along with the flow continuously.
- In partially filled pipes, the clamp-on flowmeter will report incorrect or no flow rates.

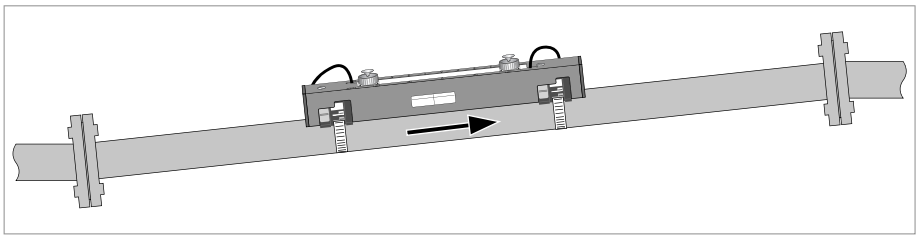


Figure 3-2: Install on a slightly ascending pipe section

3.2.2 Bends in 2 or 3 dimensions

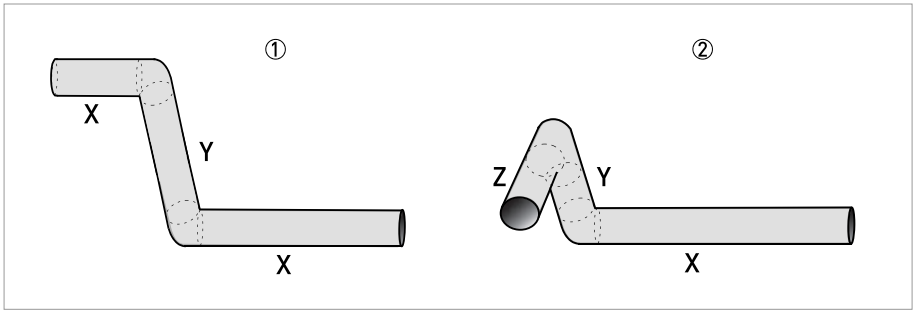


Figure 3-3: 2 and/or 3 dimensional bends upstream of the flowmeter

① 2 dimensions = X/Y
② 3 dimensions = X/Y/Z
Inlet length:
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).*

3.2.3 T-section

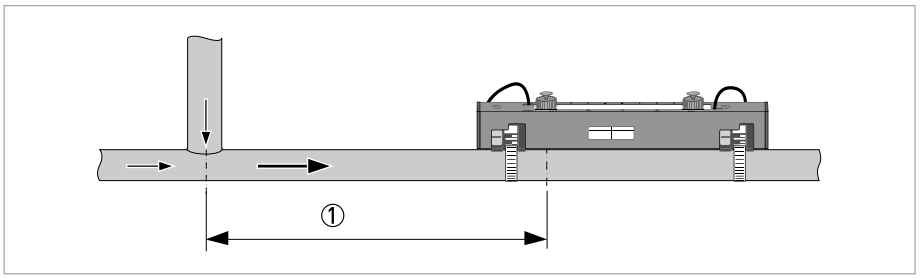


Figure 3-4: Distance behind a T-section

① ≥ 20 DN

3.2.4 Open feed or discharge

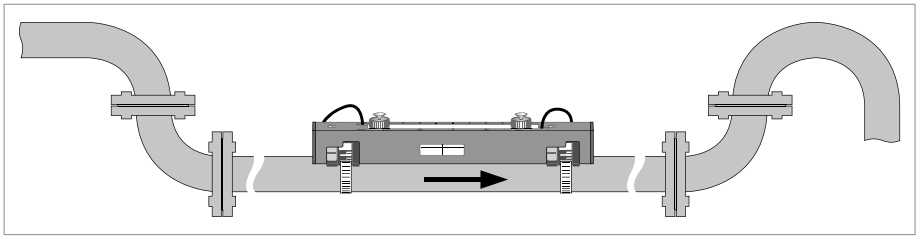


Figure 3-5: Open feed or discharge

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

3.2.5 Bends

CAUTION!

- *Ensure that the pipe is fully filled at all times.*
- *Both ascending and descending flow direction is measurable.*
- *Observe the required in- and outlets.*

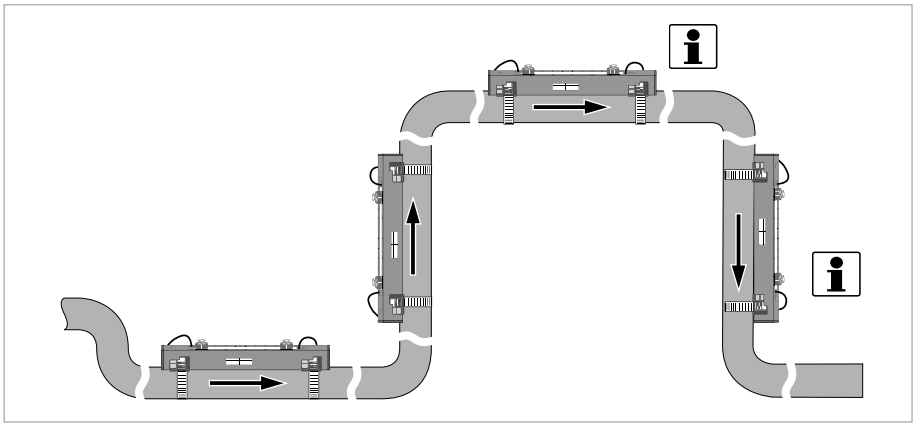


Figure 3-6: Mounting on vertical pipelines is possible

INFORMATION!

Recommended installation positions are at a lowered or ascending section of the pipeline installation. Installation at the highest point will enlarge the risk of flowmeter malfunction, because of air/gas bubbles.
Vertical installation in combination with an open discharge has to be avoided.
Vertical installation with a controlled back-pressure is possible.

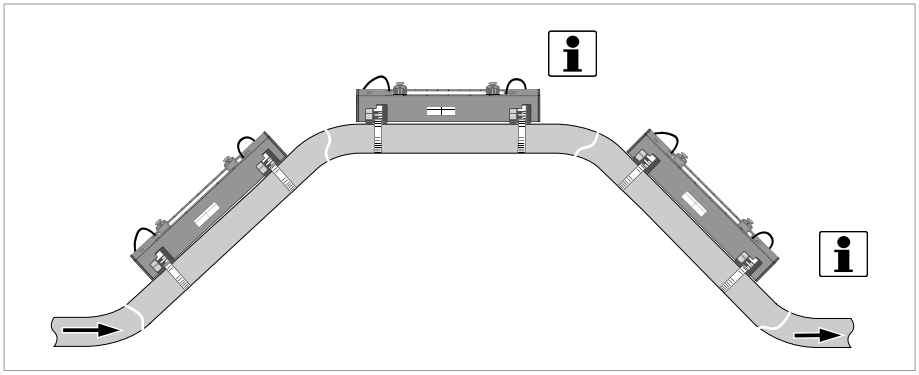


Figure 3-7: Mounting on ascending or decending pipelines is possible

INFORMATION!

Vertical installation on a descending slope in the pipeline is only recommended when the back-pressure is controlled.

3.2.6 Position of control valve

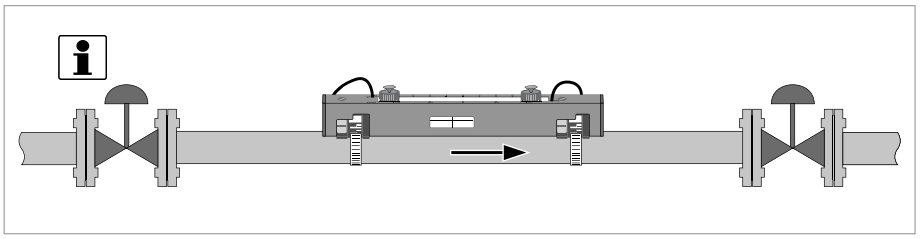


Figure 3-8: Position of control valve

INFORMATION!
Recommended position to install a flowmeter is upstream a control valve.
A clamp-on flowmeter can be installed downstream of the control valve if there is no cavitation in the pipeline system (e.g. flow profile disturbances are resolved).

3.2.7 Position of pump

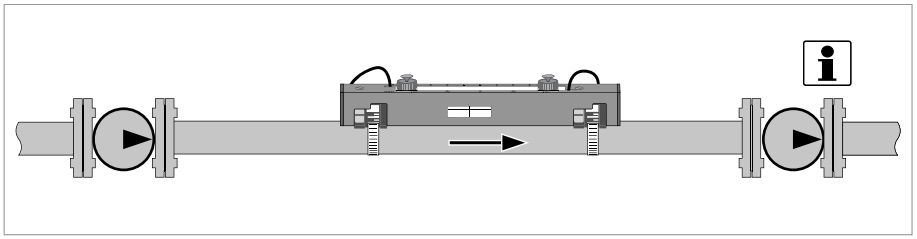


Figure 3-9: Position of pump

INFORMATION!
Recommended position to install a flowmeter is downstream a pump (on a position where the flow disturbances of the pump are resolved).
A clamp-on flowmeter can be installed in the suction line of a pump if there is no cavitation in the pipeline system.

3.3 Start up UFC 300 P signal converter

Charge the battery of the signal converter before first use and download and install the mobile application that is necessary to configure your measuring application.

The mobile application can be downloaded free of charge from the Google-Play website.
The application is only available for Android devices.

Installing application

After downloading the application, make sure to adjust and set the following parameters on your mobile device:

- go to "Settings" / Wireless and networking / Tethering
- switch on Bluetooth Tethering
- set mobile connections to “Bluetooth”

Press the "On/Off button of the UFC 300 P converter for approximately 3 seconds to initialise the converter and establish connection with your device.

Figure 3-10: Front panel UFC 300 P signal converter

① Charging indication and battery status
② Indication of data exchange and connection
③ On/Off button and status LED

INFORMATION!
In case Bluetooth operation is not used, you can choose for the wired USB connection. Connect the I/O cable with USB to the Android mobile or tablet to maintain communication.

Transducer types

The following transducer types, diameter ranges and traverse modes are possible:

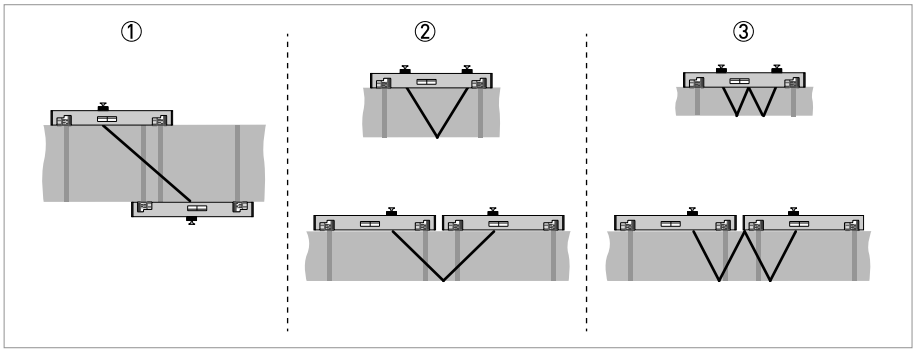
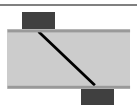
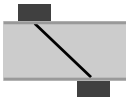
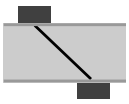
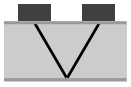
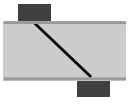
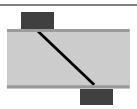
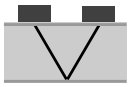
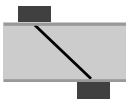
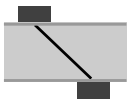


Figure 3-11: Number of traverses

① 1 traverse (Z mode)
② 2 traverses (V mode)
③ 4 traverses (W mode)

The best suitable configuration is made from the available transducer sets and selected automatically in the converter. The measurement mode and number of traverses are selectable in the following step (screen).

The message "You must select a transducer set" will show when no transducer set is selected or suitable.

Nominal diameter	Transducer type	Recommended traverse mode	Optional traverse mode	
DN15...50/ ½...2"	Small 2 MHz, 1 rail			
DN50...150/ 2...6"	Small 2 MHz, 1 rail			
DN50...250/ 2...10"	Medium 1 MHz, 1 rail			
DN200...750/ 8...30"	Medium 1 MHz, 2 rails			
DN400...1500/ 16...60"	Medium 1 MHz, 2 rails			
DN200...2000/ 8...80"	Large 500 kHz, 2 rails			
DN200...4000/ 8...160"	Large 500 kHz, 2 rails			

In standard and ideal applications with clean liquids and smooth pipe surfaces, install the transducer(s) and the rail(s) as advised. If the signal strength is not high enough, we recommend shortening the path length by decreasing the number of traverses or switching to a transducer type with a lower frequency.

For each installation, there is an "ideal transducer distance". Advise will follow for the theoretical transducer distance using the installation wizard.

Use two transducers mounted in one rail for transducer distances smaller than 190 mm / 7.5". For transducer distances of more than 190 mm / 7.5", two separate rails are used, with a transducer mounted on each rail.

Advised distance [mm]	Number of rails needed
< 190	1
≥ 190	2

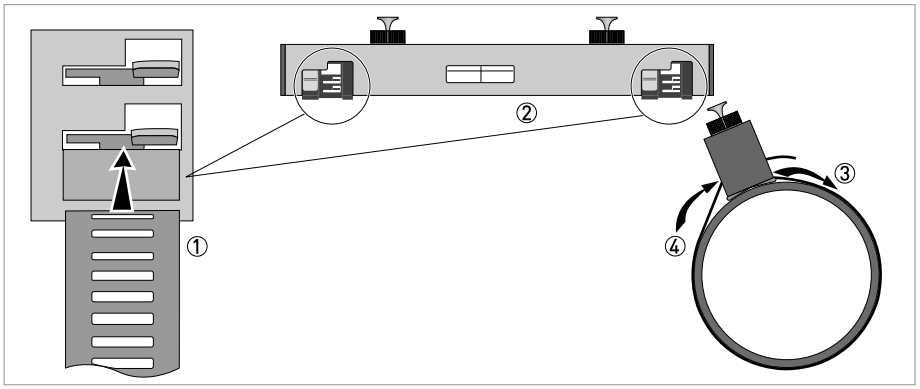
INFORMATION!
The maximum distance that can be covered with 1 rail is 195 mm.
The minimum distance for two rails is 180 mm.

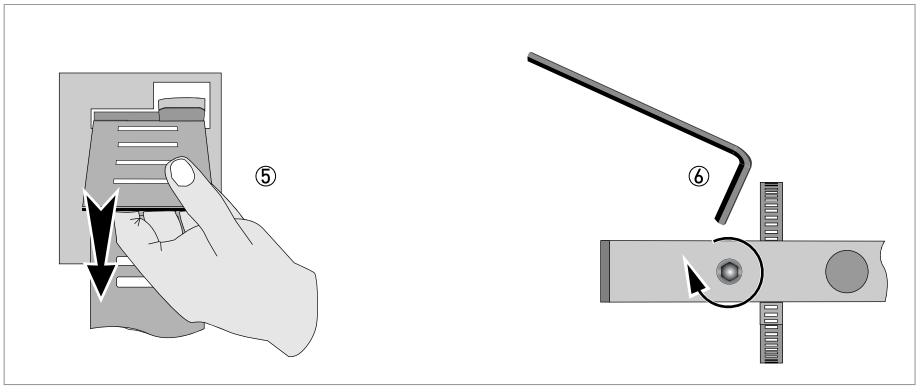
3.4 Step 3: Mount the sensor rails

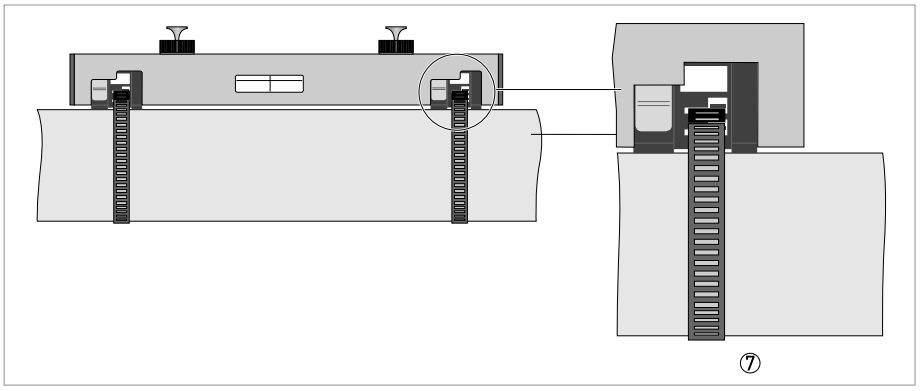
Before mounting the rails, determine the colors on the connectors of the transducers. Make sure that the blue transducer is upstream and the green transducer is downstream.

Installation with metal straps (DN15...250)

Put the metal straps around the pipe. Put the sensor rail(s) on the pipe including the transducers with fixed cables.



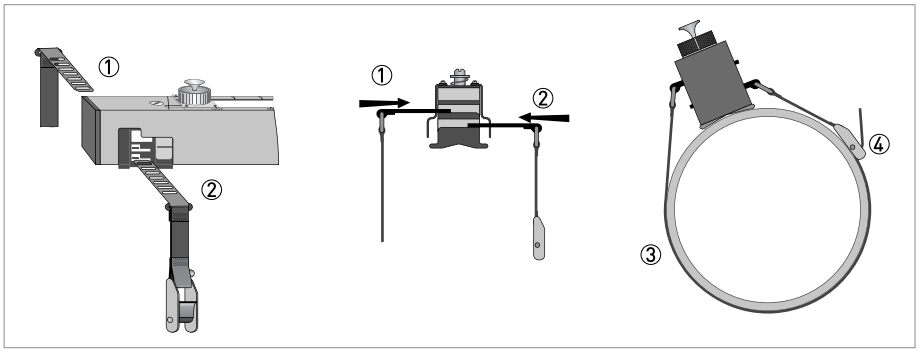




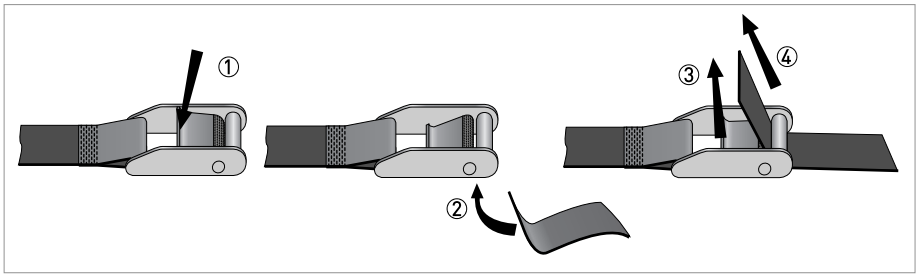
① Insert straps in the lower opening.
② Repeat the same for the other strap.
③ Pull the straps around the pipe.
④ Insert the straps in the upper opening.
⑤ Pull the straps tight.
⑥ Use an allan key nr 5 (or a big screwdriver) to fixate the rails.
➲ Detail ⑦ of the metal strap fixed in connector.

Installation with nylon straps (> DN250)

For pipe diameters above DN250 are available with different lengths.



① Insert the long strap in the upper opening.
② Insert the short strap in the lower opening at the other side of the rail.
③ Pull the strap around the pipe.
④ Fix the strap, as indicated below.



① Push lever to create a opening.
② Insert the nylon strap as indicated.
③ Release lever.
④ Pull strap tight.

3.4.1 Install 2 or 4 traverses with 1 rail

Normal pipe diameters range with one rail in reflected path configuration.

Number of traverses	Diameter range	Transducer type
4 (W mode)	DN15...150/ ½...6"	Small transducer set
2 (V mode)	DN15...150/ ½...6"	Small transducer set
2 (V mode)	DN50...250/ 2...10"	Medium transducer set

Put the first transducer at the position 0 mm/0 inch on the ruler. Put the other transducer on the distance as advised in the mobile application under "Advise to install, Transducer distance". See the figures below.

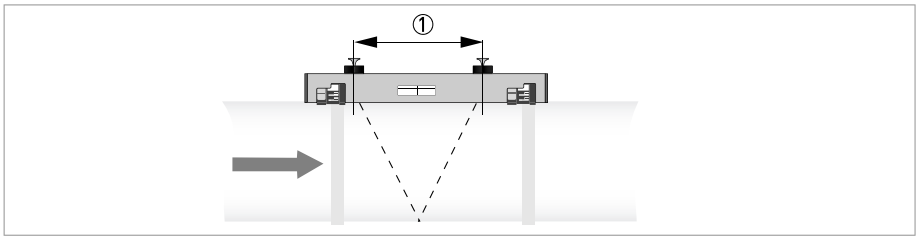
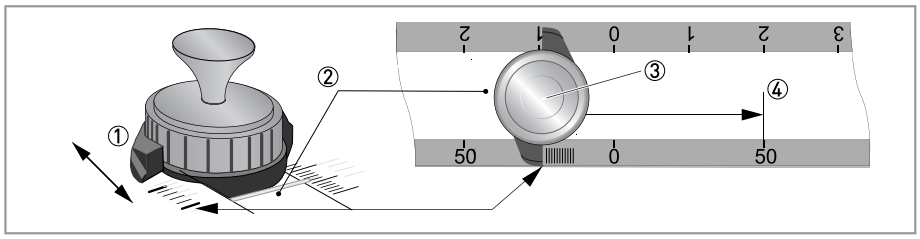


Figure 3-12: Advised distance with one rail

① Advised distance is measured from center first transducer to the center of the second transducer.



- Unlock the transducer by turning the locking knob ② counter clockwise.
- Slide the transducer ① to the new position ③ .
- Lock the transducer by turning the locking knob ② clockwise.

3.4.2 Install 2 traverses with 2 rails

Normal pipe diameters range with one rail in reflected path configuration.

Number of traverses	Diameter range	Transducer type
2 (V mode)	DN200...700/ 8...30"	Medium transducer set
2 (V mode)	DN200...2000/ 8...80"	Large transducer set

INFORMATION!
The two rails must be installed in a straight line.

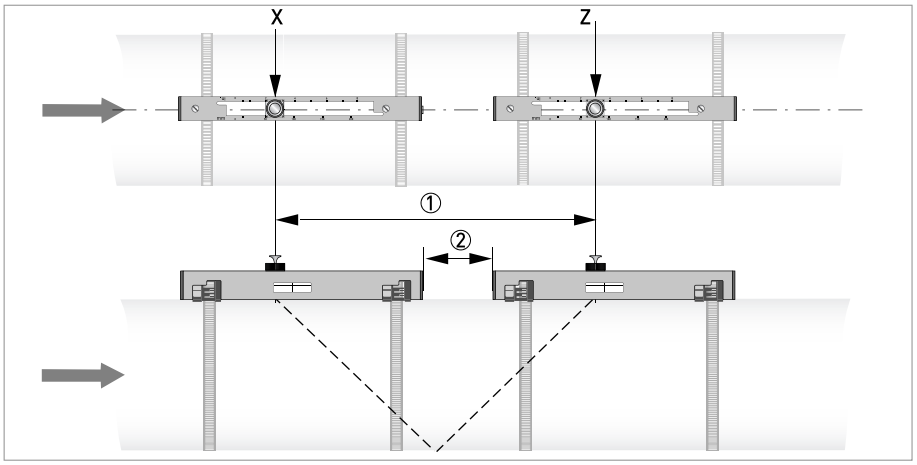


Figure 3-13: Mounting 2 rails in V-mode (2 traverses)

① Advised distance
② Distance between 2 rails

- Mount the first rail on the pipe. Make sure that you mount the rail in line with the pipe!
- Position the left transducer in any position X (see next section).
- Mount the second rail (align it with the first rail) at a distance ② to arrange that the transducer in the second rail is within the range it can be moved.
- The advised distance ① is defined from the **center** of the left transducer to the **center** side of the right transducer. Put the second transducer at position Z = advised distance ① + X - distance ② - 415 mm / 16.3".

3.4.3 Install 1 traverse with 2 rails (DN400...4000)

Normal pipe diameters range with one rail in reflected path configuration.

Number of traverses	Diameter range	Transducer type
1 (Z mode)	DN200...1500/ 8...60"	Medium transducer set
1 (Z mode)	DN200...4000/ 8...160"	Large transducer set

INFORMATION!
The rails must be installed straight from each other on the opposite side of the pipe

- Measure the outer diameter of the pipe with the tape measure.
- Calculate the half of the outer diameter.
- Start at the left side of the rail and locate the opposite side using the calculated half of the outer diameter.
- Put a mark at this position.
- Repeat this at the right side of the rail.
- Draw a line between the two markings.
- Mount the DOWN rail in such a way that the transducer is at the marked location.

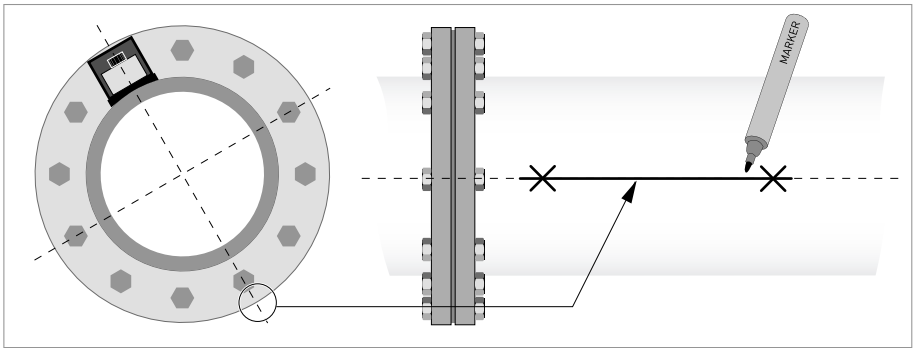


Figure: Marking on pipeline

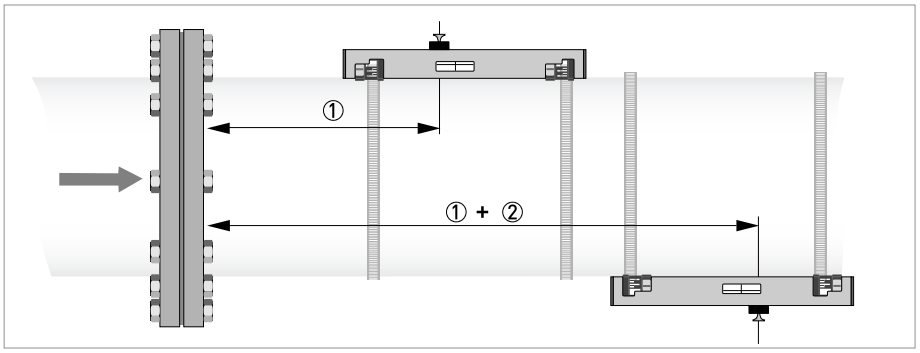


Figure 3-14: Mounting second rail in Z mode (1 traverse) using a reference point

① Measure the distance between the transducer of the UP rail and the reference point.
② Add the advised distance to determine the position of the second transducer.

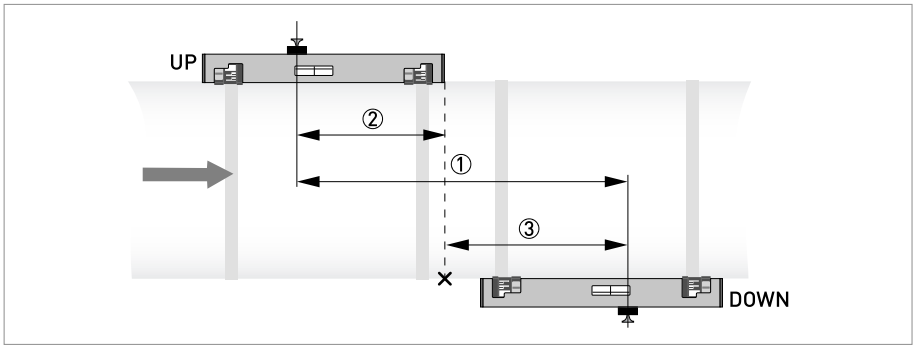


Figure 3-15: Mounting second rail in Z mode (1 traverse) without using a reference point

① Advised distance ① = ② + ③

3.4.4 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

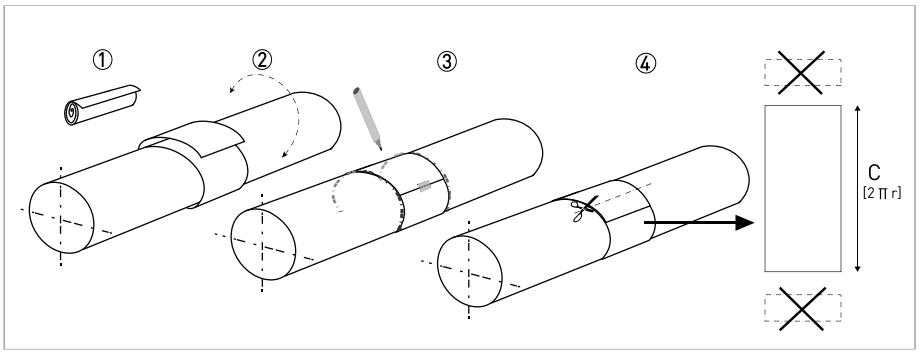


Figure 3-16: Preparing the paper roll template

Step 2

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

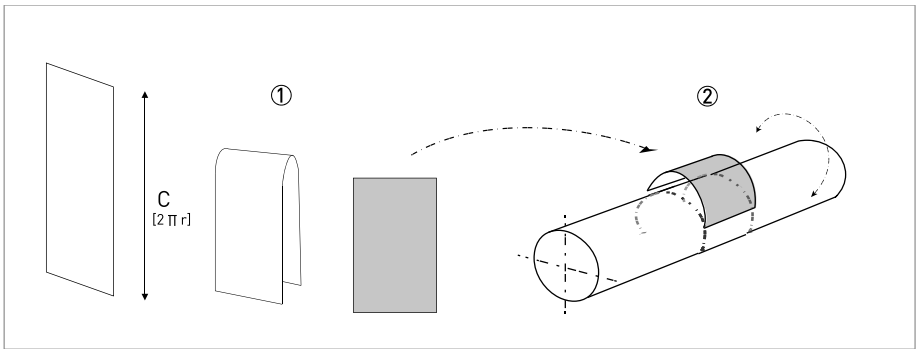


Figure 3-17: Fold paper and place back on pipe line

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

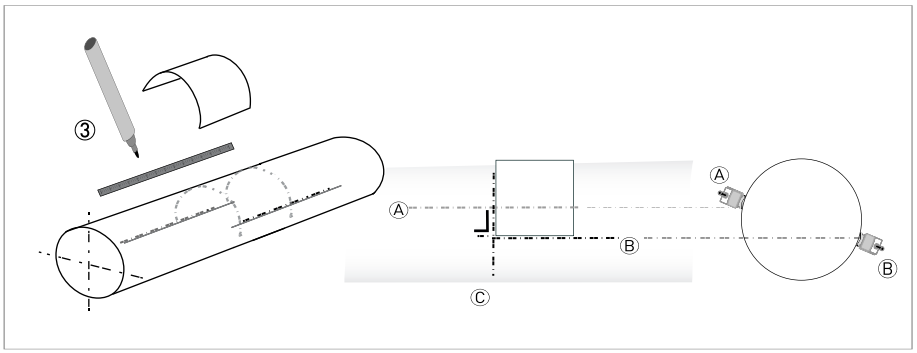


Figure 3-18: Markings on the pipeline

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

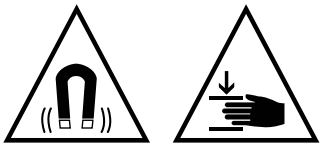
- After marking the lines:

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

3.4.5 Installing rail with magnetic fixation units

Optionally, magnetic fixation units are used to install the OPTISONIC 6300 P sensor rail on a (Ferro metallic) pipeline surface. The initial fixation units can easily be demounted from the rail and replaced by the magnetic fixation units.

WARNING!
Read the safety instructions in the manual before unpacking! Handle with care and use personal protective equipment when required. Keep magnetized parts away from mechanical/electronic instruments which may be damaged by high magnetic fileds (e.g. cell phones or pacemakers). Keep strong magnets or magnetics systems at an adequate distance apart, so that they cannot be attracted by each other.



CAUTION!
Electronic equipment (e.g. pacemakers, hearing devices, computers, monitors, watches, measuring and control instruments, etc.) and information carriers (e.g. floppy discs, credit cards, tapes, electronic badges, etc.) can be influenced or damaged by magnetic fields. Keep these objects at an adequate distance (1 m / 3 ft) of magnets or magnetic systems.

CAUTION!
The supplied magnets have a very strong force. Handle with care to prevent personal injuries. Be careful with ferrous (iron) objects (e.g. knives, scissors, tongs, screwdrivers, etc.) when unpacking the magnets.

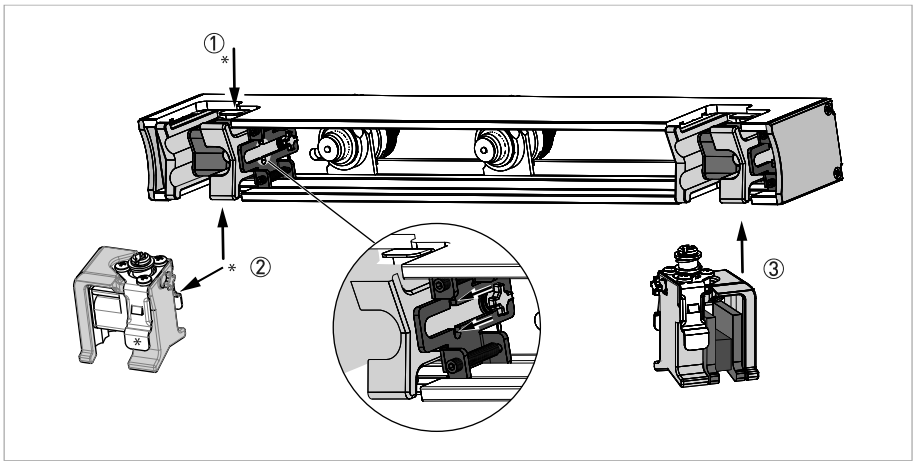


Figure 3-19: Installing magnetic fixation units

- ① Press the release clips * on both side, the unit releases from the rail.
- ② Slide the unit downwards until the positioning cam can move out of the insert opening.
- ③ Slide back in the new magnet fixation unit, while positioning the cam correctly.

3.4.6 Apply coupling grease

Push the buttons of the fixing units to unlock and tilt the rail. Then put some coupling grease on the transducers and put the rail back by clicking.

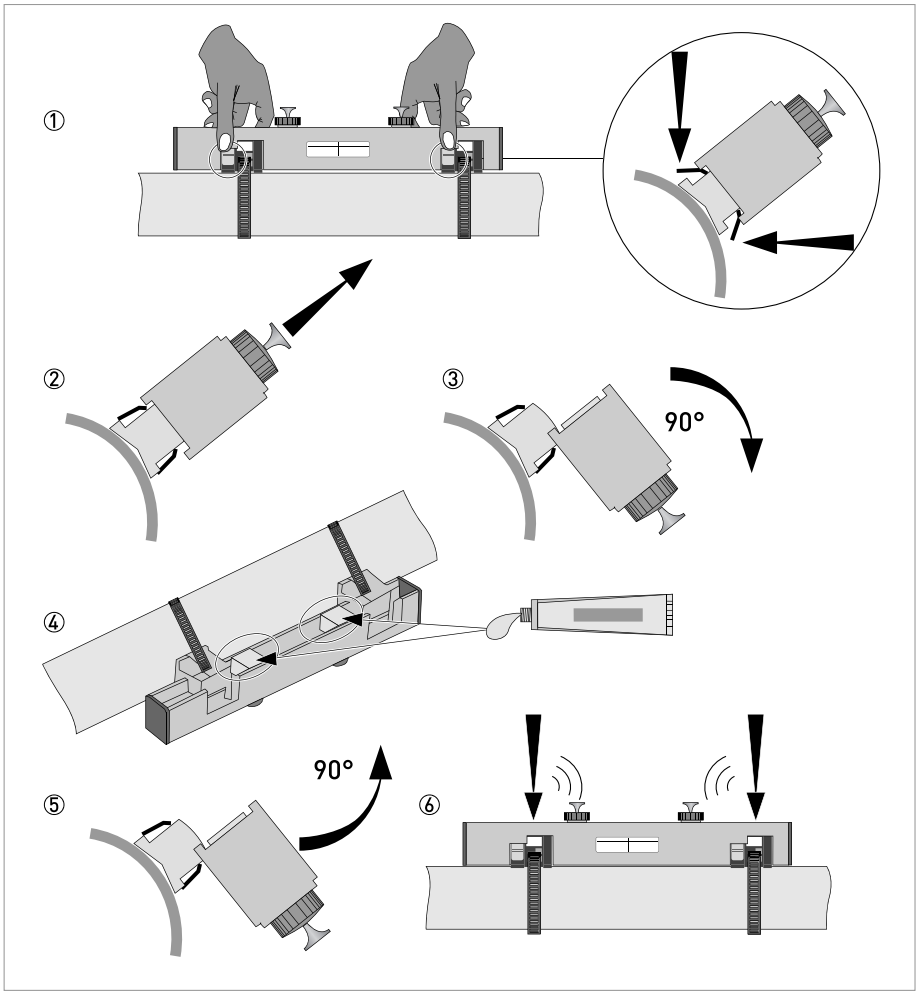


Figure 3-20: Greasing transducers

3.4.7 Connect the sensor cable

INFORMATION!
The transducers have a 3 m/ 9.8 ft fixed signal cable with blue and green marked connectors for easy, correct and safe connection with the converter. Colour marked 7 m/ 22,9 ft extension cables with connectors are optionally available.

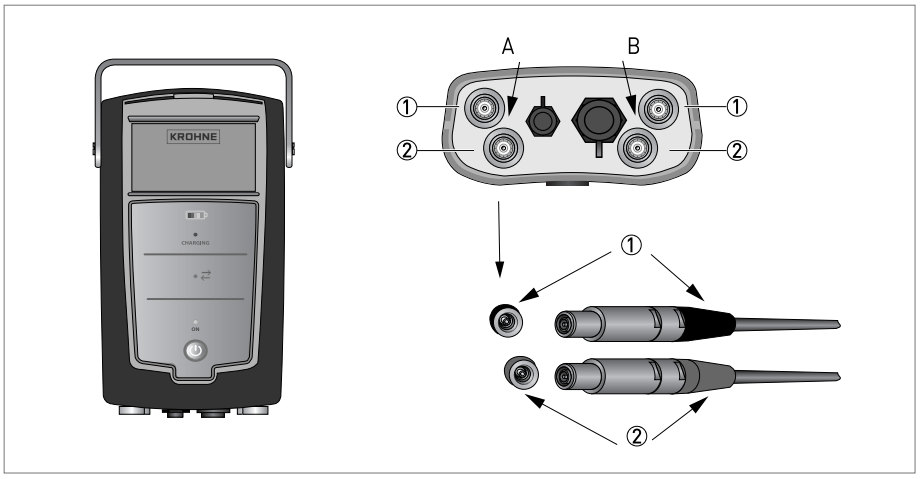


Figure 3-21: Connecting signal cables channel A and B

① Connector for "UP" transducer (blue)
② Connector for "DOWN" transducer (green)

INFORMATION!
In the mobile application, the flow signal strength is given and can be qualified as shown:

Flow signal strength	Qualification
> 75%	High signal
50...75%	Fairly high signal
10...50%	Low signal
< 10%	Bad or no signal
	Check settings in menu, change transducer distance until there is at least a low signal.

- Continue the configuration in the mobile application and follow the advised settings and actions.

3.5 Error messages

Error code	Group message	Error message	Description	Error handling
F ①	error in device		no measurement possible, measured values are not valid	repair or replace device and/or CPU; contact manufacturer service center
F	application error		no measurement possible, but device ok	check parameter settings / power off - wait 5 seconds - power on device
S	out of specification		unreliable measurement	maintenance required, check flowprofile
C	check in progress		test function is active, device is stand-by	wait until finished
I	information		no direct impact on measurements	no action needed
F ①		IO 1 (or IO 2)	error or failure of IO Module 1 (or 2)	try to load settings. If error does not disappear, replace electronics unit
F ①		parameter	error or failure of data manager, parameter or hardware error	try to load settings. If error does not disappear, replace electronics unit
F ①		configuration	incorrect configuration or no confirmation	confirm change of module; if configuration is unchanged, replace electronics unit
F ①		display	error of failure of display unit, parameter or hardware error	defect; replace electronics units
F ①		current output A (or B, C)	error or failure of the current output A (or B, C), parameter or hardware error	defect; replace electronics units
F ①		software user interface		defect; replace electronics units
F ①		hardware settings	detected hardware and set hardware settings do not match	follow display instructions
F ①		hardware detection	hardware can not be detected	defect; replace electronics units
F ①		RAM/ROM error IO 1 (or IO 2)		defect; replace electronics units
F ①		communication dsp-up	no communication between DSP and microprocessor PCB	contact manufacturer service center
F ①		front end	malfunctioning of front end PCB	contact manufacturer service center
F ①		uproc	malfunctioning of microcontroller PCB	contact manufacturer service center
F ①		dsp	malfunctioning of DSP	contact manufacturer service center
F		empty pipe	signal lost at two paths	check process conditions
F		flow > max 1	max volume flow exceeded for pipe 1	check parameter in settings
F		flow > max 2	max volume flow exceeded for pipe 2	check parameter in settings

F		open circuit A (or B, C)	current on current output A (or B, C) too low	check cable or reduce resistance (< 1000 Ohm)
F		over range A (or B, C)	current on current output A (or B, C) is limited by parameter setting	extend upper or lower limit for current output
F		over range A (or B, D)	pulse on frequency output A (or B, D) is limited by parameter setting	extend upper or lower limit for frequency output
F		active settings	error during CRC check (Cyclic Redundancy Check) of the active settings	load settings; factory setting, back up 1 or back up 2
F		factory settings	error during CRC check of factory settings	
F		back up 1 (or 2) settings	error during CRC check of back up 1 (or 2) settings	
F		signal lost path 1	signal lost at path 1	check signal cable / check for pipe obstructions
F		signal lost path 2	signal lost at path 2	check signal cable / check for pipe obstructions
F		pipe/sens1 param.	unrealistic parameter settings for pipe in combination with path 1	check parameters in settings
F		pipe/sens2 param.	unrealistic parameter settings for pipe in combination with path 2	check parameters settings
F		over range display 1 (or 2)	1st row on 1st (or 2nd) measurement page is limited by parameter setting	extend upper or lower limit for limitation in settings
S		unreliable 1	unreliable measurement at pipe 1	check process conditions for gas bubbles, solids
S		unreliable 2	unreliable measurement at pipe 2	check process conditions for gas bubbles, solids
S		zero converter	invalid value at power up	power off - wait 5 seconds - power on device
S		overflow counter 1 (or 2, 3)	counter is overflowing and will start again at zero	no action needed
S		backplane invalid	error during CRC check of backplane	restore data records on backplane
I		counter 1 (or 2, 3) stopped	counter has stopped	reset counter
I		control input A (or B) active	information only	no action needed
I		backplane sensor	incompatible data sensor on backplane	
I		backplane settings	incompatible data on backplane	
I		backplane difference	different data on backplane and display	
I		optical interface	optical interface is operational, local display can not be used	
I		softw sync error	incompatible DSP and microprocessor software	

① (bold)

4.1 Installation for energy measurement

The combination of the measured flow rate and a temperature difference over a device can be used to determine the amount of energy used by that device. The temperature difference can either be programmed manually in the converter or be measured with temperature transmitters, connected to an optional I/O box. In this case, the temperature difference is determined by measuring the temperature before and after the heat/cold producer/consumer.

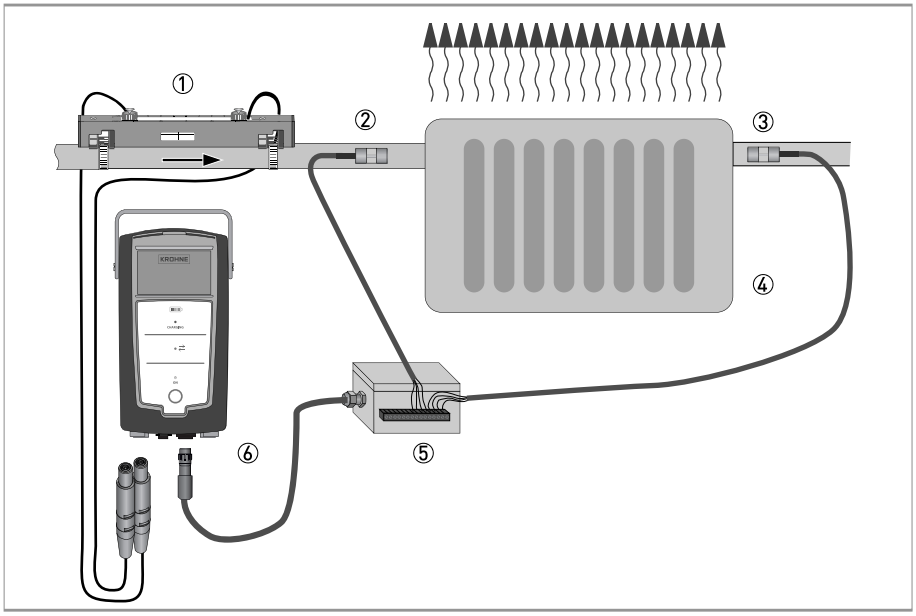


Figure 4-1: Energy measurement

① Mounted rail (in any measuring mode)
② Pt 100 temperature sensor, before the heat/cold producer/consumer
③ Pt 100 temperature sensor, after the heat/cold producer/consumer
④ Radiator
⑤ Optional I/O box with temperature transmitters option
⑥ Flow rate converter with temperature current input

4.2 Preparation of energy measurement

① Install a flow measurement as described in the previous chapter. Make sure that the rail and converter are installed close to the location of the place where the temperature sensors must be installed, because of the fixed (limited) length of the sensor cables.
② Check if temperature transmitters are already available on site.

Transmitters are already available on site:

Make sure that the **Standard I/O box** is used. Connect the temperature transmitters to the 4...20 mA current input of basic I/O, which is connected to the UFC 300 P converter.

Transmitters are not available on site:

Make sure that the **Extended I/O box** is used. In this version, the temperature transmitters are included. Optionally, clamp-on Pt 100 temperature sensors can be delivered, with a temperature range of 0...120°C / 32...248°F, including two meter cable and suitable for pipes up to DN300.

4.3 Mechanical installation

Mounting of temperature sensors

The delivered Pt 100 sensors are clamp-on elements. Clamp them on the pipe with the hose clamp.

INFORMATION!
Mount the temperature sensors close to the rail for flow measurement. All cables have a fixed length!

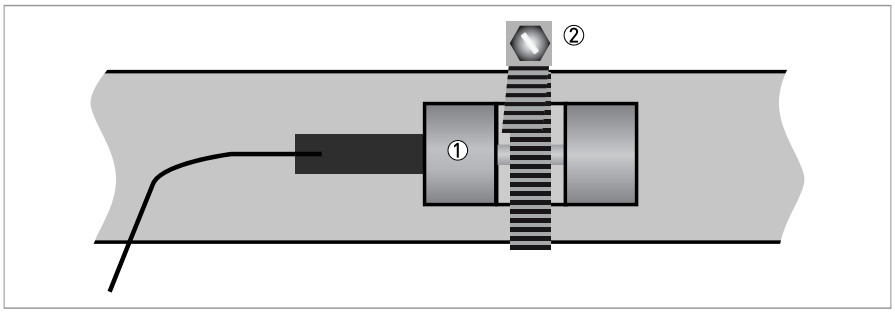


Figure 4-2: Mounting PT 100 with hose clamp

① Pt 100 thermocouple
② Hose clamp

It is possible to use the standard I/O box if the temperature sensors on the pipe have 4...20 mA temperature transmitters.

- Connect the Pt 100 sensor to the I/O box according to the sticker on the I/O box.

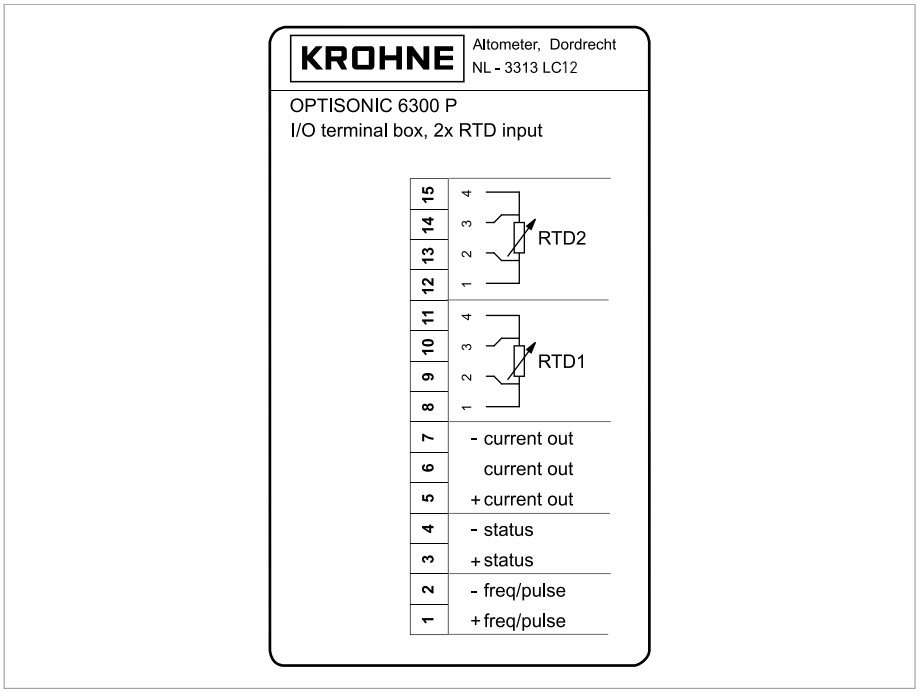


Figure 4-3: Extended I/O box with 2 temperature transmitters included for PT 100 sensors.

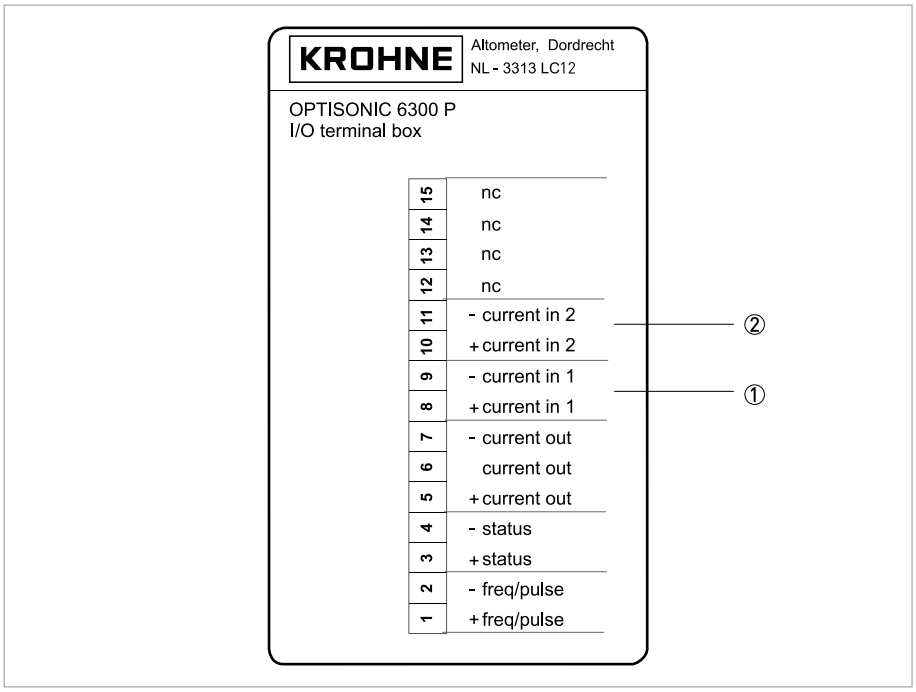


Figure 4-4: Standard I/O box for 4...20 mA temperature transmitters

① Channel A
② Channel B

- Plug the connector ② of the I/O box ③ in the connector ① of the converter, as shown in the figure below.

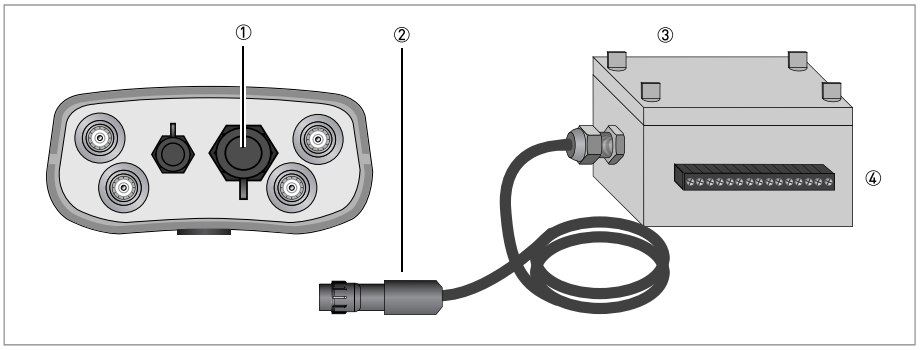


Figure 4-5: I/O box

① I/O connector on converter
② Connector of I/O box
③ I/O box with screw terminals for 1 mm^2 wiring
④ Screw terminal pins 1...15

4.4 Program the converter for energy measurement

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

- The current input must be switched on
- The energy calculation has to be switched on
- Set the program energy parameters on desired output

These settings can be switched on in the mobile app, following the set up wizard

4.5 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 setup paragraph of the mobile application.

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. Follow the setup wizard of the mobile application to set the free unit.
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.

Refer to the following table with factors for alternative energy units.

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

5.1 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!

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.

5.2 Electrostatic Discharge

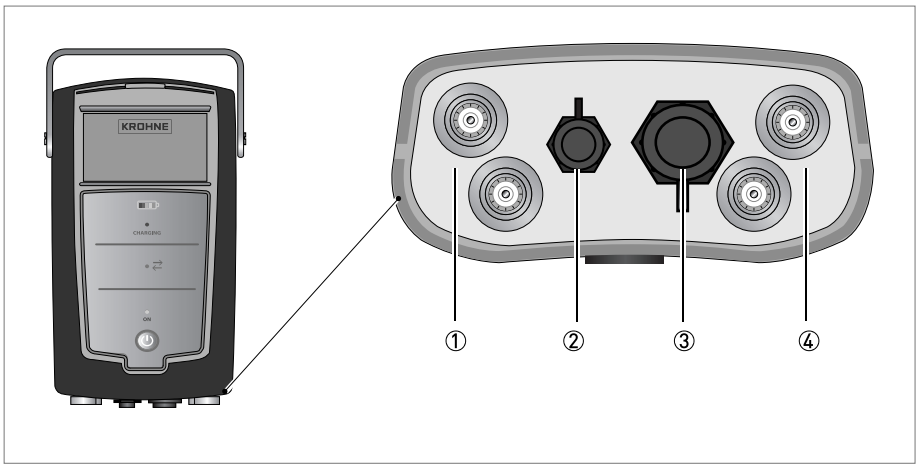
CAUTION!
Observe precautions for handling electrostatic sensitive devices

ESD notice for users and service technicians

In cold weather and dry regions with a low humidity level, an ESD charge build-up can occur. Notice, during handling, that your clothing and the plastic converter housing can built-up electrical charges. The converter has an ESD protection of +3 kV and -3 kV contact discharge. Above +3 kV and -3 kV ESD contact discharge, it's possible that the converter can switch down and power up again (forced reset).

5.3 Convertor connection options

All connectors are located at the bottom side of the converter.



① Signal cable connection channel A (left pair of connectors for path 1)
② DC power supply connection
③ I/O connector (for I/O box or connection to a specified android device)
④ Signal cable connection channel B (right pair of connectors for path 2)

The connection options are described in the following sections

5.4 Power supply

WARNING!
Only use the original supplied AC/DC power supply adaptor!

CAUTION!
The battery status indicator will be accurate after an initial full discharge directly followed by a full charge of the battery.

The battery of the signal converter has to be fully charged before first use!
The rechargeable battery pack is not replaceable by the user.

INFORMATION!
The product is externally evaluated for a maximum ambient temperature of 40°C / 104°F (without derating) and 60°C / 140°F (50% derating), a maximum altitude of 3000 meters / 9843 feet and at an overvoltage category II environment.

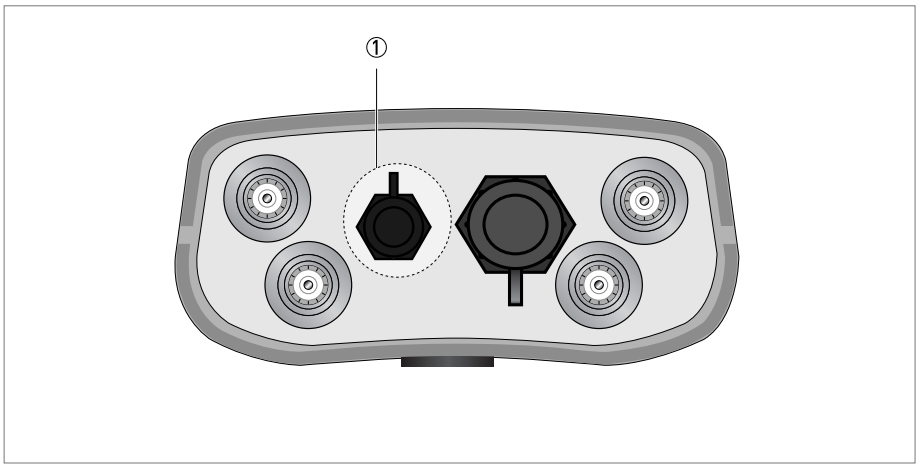


Figure 5-1: ① Connection 12 VDC power supply input

Switching on and off

The converter has an automatic switch-on functionality when connected to the mains. A switch-off is not possible during a connection.
In case the converter has to be switched off, the mains power has to be disconnected.
If the converter operates on battery power, the device is turned on/off by pressing the ON button for 3 seconds.

- Plug in the connector of the power adaptor cable into the DC connector ①
- Select your exchangeable AC power plug adapter (EU, UK, US, AUS) according to the mains outlet socket and plug it tightly onto the power adapter.
- Then insert the AC power connector into your mains outlet.

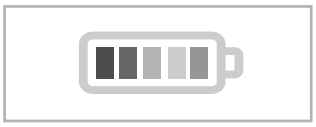
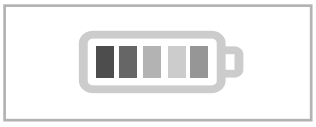
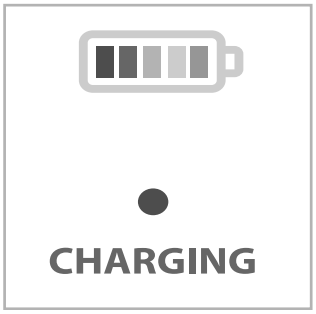
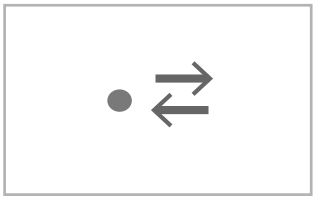
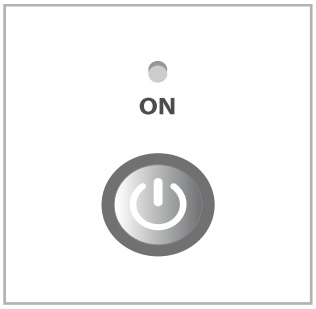
Charging in the car via the accessory plug

The flow converter can be charged via the 12 VDC accessory socket in the car.

CAUTION!
Only charge the battery when the ambient temperature is within the specified temperature range , refer to Technical data on page 67. **Avoid direct sunlight**. *When the ambient temperature is not within the specified temperature range, the battery-charging current decreases to save the battery life span.*

- Connect the cable with the 12 VDC car accessory plug to the power input of the flow converter.
- Connect the car accessory plug into the 12 VDC socket of the car.

5.5 Front panel LED indications

	Battery LEDs: status of the battery • Red blinking: charge the signal converter to avoid an automatic power-off. • Red: battery is 2-20% or lower • Orange: battery is between 20% and 40% • 1st Green LED: battery is between 40-60% • 2nd Green LED: battery is between 60-80% • 3rd Green LED: battery is between 80-100%
	Battery LEDs: during start-up of the converter When the signal converter is switched on the (battery) LEDs show the progress of the start-up. • The actual battery status is shown shortly • Then, 1, 2 or 3 green LEDs start blinking depending on the progress. • After complete signal converter start-up, the LEDs show the actual battery status again.
	Charging LED: (Red color) Red LED is on: • The signal converter is connected to the mains and the battery is being charged by using the power adapter. Red LED is switched off: • The battery is charged fully and the signal converter can be disconnected from the mains power supply. For continuous measurements, it is possible to leave the mains power supply connected to the converter.
	Data exchange and connections (blue LED) Blue LED on: • There is a valid connection with a smart device by USB cable or Bluetooth Blue LED switched off: • No connection with a smart device Blue LED blinking • Status for open Bluetooth and visibility of the converter for a period of 2 1/2 minutes after a short press on the ON/OFF button on a fully started up converter.
	On/Off indication (green LED) Green LED switched off: • Converter is switched off Green LED on • Converter is connected to mains (automatically switch on function when connected to mains) • Converter is switched on in battery mode by pressing the ON/OFF button for 3 seconds

5.6 Connection of the signal cables

CAUTION!
Find the calibration numbers that are noted on the labels on the cable of each transducer. Make sure that both transducers have the same calibration number as shown by the converter.

INFORMATION!
The signal cables are prefixed to the transducers in the factory.

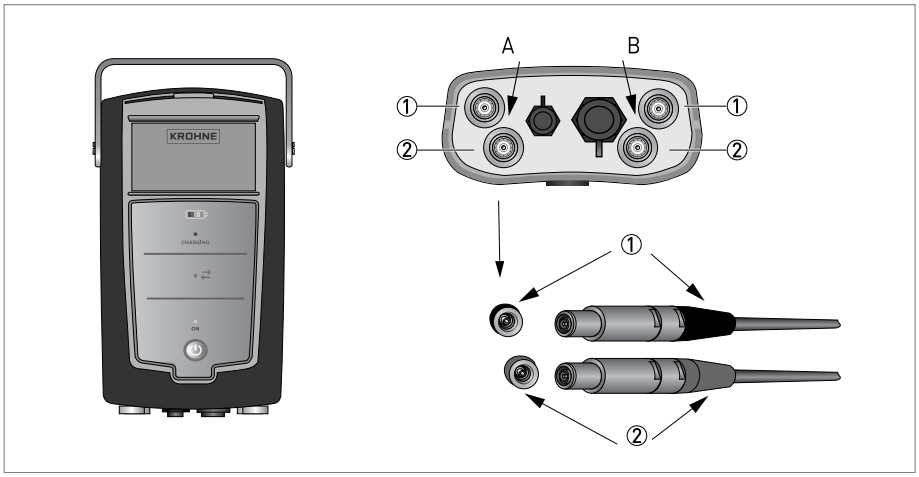


Figure 5-2: Connecting signal cables channel A and B

① Connector for "UP" transducer (blue)
② Connector for "DOWN" transducer (green)

INFORMATION!
The flow converter can measure two paths (A and B) simultaneously. Use the left pair of connectors ① and ② for path A and the right pair connectors ① and ② for path B.

5.7 I/O cable

To use the available inputs and outputs of the converter, you need an optional I/O box. The I/O box is available in two versions (standard I/O functions and heat measurement version).

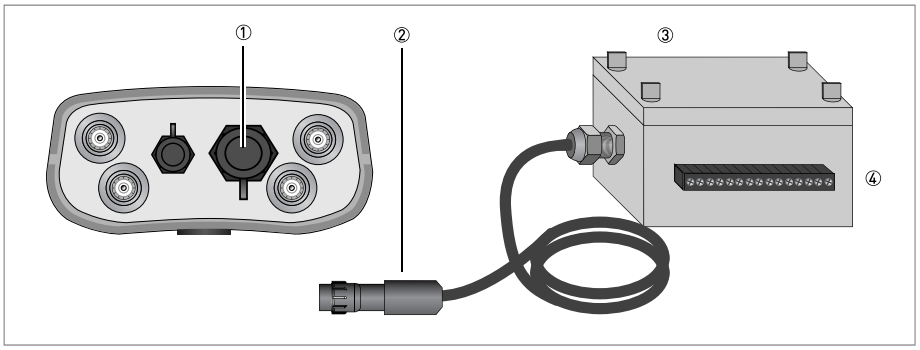


Figure 5-3: I/O box

① I/O connector on converter
② Connector of I/O box
③ I/O box with screw terminals for 1 mm^2 wiring
④ Screw terminal pins 1...15

- Plug the connector ② of the I/O box ③ in the connector ① of the converter. Then use the connectors ④ to setup the wanted I/O, as shown in the connection diagrams on the next pages.

Versions of I/O box

Screw terminal pin	Standard I/O box	I/O box with heat energy option
1	Frequency / pulse output D	Frequency / pulse output D
2	Frequency / pulse output D-	Frequency / pulse output D-
3	Status output X	Status output X
4	Status output X-	Status output X-
5	Current output C+	Current output C+
6	Current output C	Current output C
7	Current output C-	Current output C-
8	Current input A+	Temperature sensor 1 (PT 100, 4 wire connection)
9	Current input A-	
10	Current input B+	
11	Current input B-	
12	Not connected	Temperature sensor 2 (PT 100, 4 wire connection)
13	Not connected	
14	Not connected	
15	Not connected	

Table 5-1: Terminals of I/O box

5.8 Connection diagrams

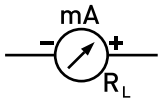
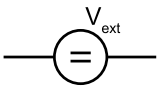
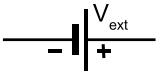
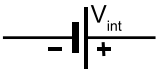
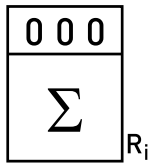
	mA meter 0...20 mA or 4...20 mA and other R_L is the internal resistance of the measuring point including the cable resistance
	DC voltage source (U_{ext}), external power supply, any connection polarity
	DC voltage source (U_{ext}), observe connection polarity according to connection diagrams
	Internal 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, NO contact or similar

Table 5-2: Description of symbols

Basic inputs/outputs

CAUTION!
Observe connection polarity.
Not galvanically isolated.

Current output active, basic I/Os (4...20 mA)

- $V_{int,nom}$ = 15 VDC nominal
- I ≤ 22 mA
- R_L ≤ 1 kΩ

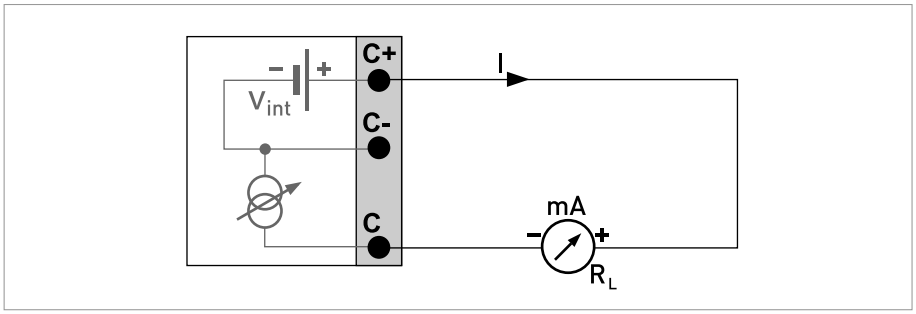


Figure 5-4: Current output active I_a

Current output passive, basic I/Os

- $V_{int, nom}$ = 15 VDC Nominal
- V_{ext} ≤ 32 VDC
- I ≤ 22 mA
- V_0 ≥ 1.8 V
- R_L ≤ (V_{ext} - V_0) / I_{max}

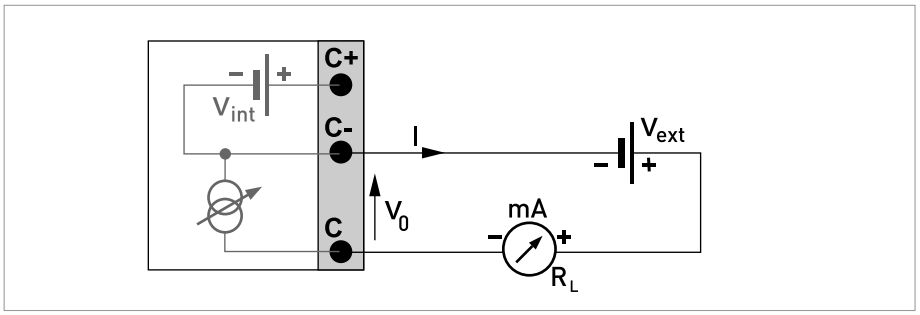


Figure 5-5: Current output passive I_p

INFORMATION!

- *Any connection polarity.*
- *Galvanically isolated.*
- *At frequencies above 100 Hz, shielded cables must be used to reduce electrical interferences (EMC).*

Pulse/frequency output passive, basic I/Os

- $V_{ext} \leq 32$ 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:
  $V_{0, max} = 0.2$ V at $I \leq 10$ mA
  $V_{0, max} = 2$ V at $I \leq 100$ mA
- f_{max} in the operating menu set to 100 Hz < $f_{max} \leq 10$ kHz:
  $I \leq 20$ mA
  open:
  $I \leq 0.05$ mA at $V_{ext} = 32$ VDC
  closed:
  $V_{0, max} = 1.5$ V at $I \leq 1$ mA
  $V_{0, max} = 2.5$ V at $I \leq 10$ mA
  $V_{0, max} = 5.0$ 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:
  $R_{L, min} = (V_{ext} - V_0) / I_{max}$
- Can also be set as a status output; for the electrical connection, see status output connection diagram.

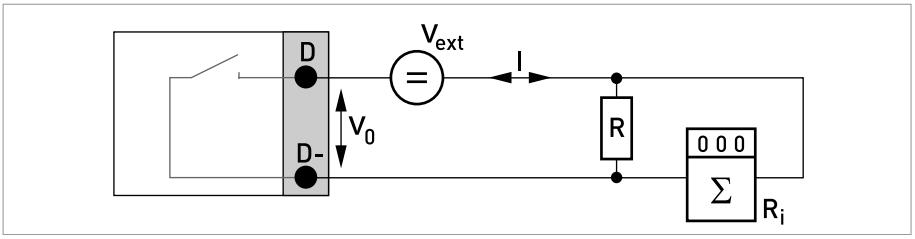


Figure 5-6: Pulse frequency output passive P_p

Pulse/frequency output active, basic I/Os

- V_{nom} = 15 VDC
- f_{max} in operating menu set to $f_{max} \leq$ 100 Hz:
  I ≤ 20 mA
  open:
  I ≤ 0.05 mA
  closed:
  $V_{0, nom}$ = 15 V at I = 20 mA
- f_{max} in the operating menu set to 100 Hz < $f_{max} \leq$ 10 kHz:
  I ≤ 20 mA
  open:
  I ≤ 0.05 mA
  closed:
  $V_{0, nom}$ = 13.5 V at I ≤ 1 mA
  $V_{0, nom}$ = 12.5 V at I ≤ 10 mA
  $V_{0, nom}$ = 9.0 V at I ≤ 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 ≤ 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 resistance $R_{L, min}$ is calculated as follows:
  $R_{L, min} = (U_{ext} - U_0) / I_{max}$

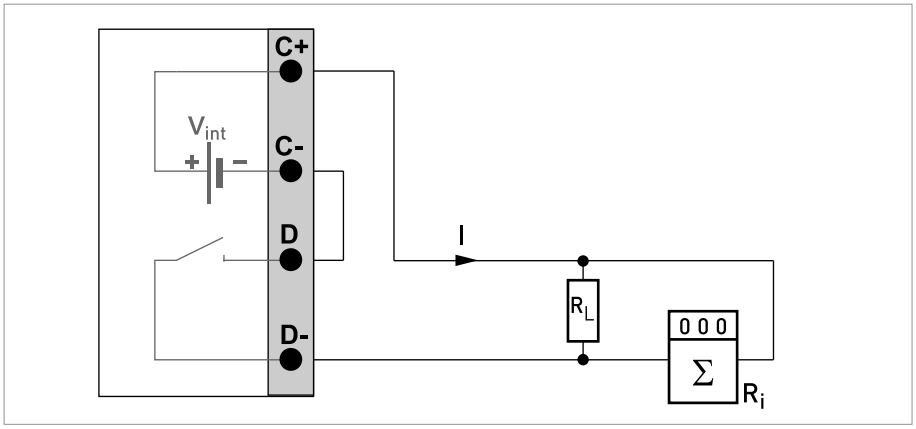


Figure 5-7: Pulse frequency output active P_a

INFORMATION!

- *Any connection polarity.*
- *Galvanically isolated.*
- *At frequencies above 100 Hz, shielded cables must be used to reduce electrical interferences (EMC).*

Status output / limit switch passive, basic I/Os

- $V_{ext} \leq 32$ VDC
- $I \leq 100$ mA
- $R_{L, max} = 47\ k\Omega$
  $R_{L, min} = (V_{ext} - V_0) / I_{max}$
- open:
  $I \leq 0.05$ mA at $V_{ext} = 32$ VDC
  closed:
  $V_{0, max} = 0.2$ V at $I \leq 10$ mA
  $V_{0, max} = 2$ V at $I \leq 100$ mA
- The output is open when the device is de-energized.

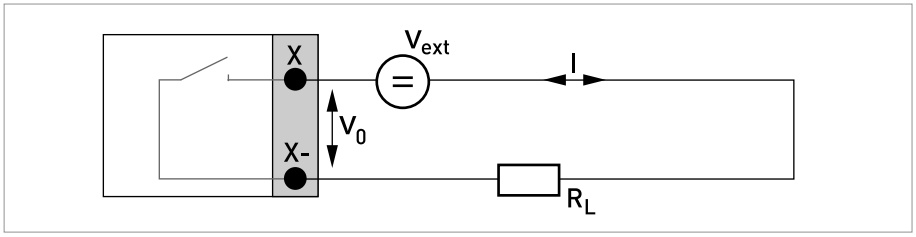


Figure 5-8: Status output / limit switch passive S_p

Current input active

- $V_{int, nom} = 15$ VDC
- $I \leq 22$ mA
- $I_{max} \leq 26$ mA (electronically limited)
- $V_{0, min} = 9$ V at $I \leq 22$ mA
- **no** HART®
- Not galvanically isolated
- X designates the connection terminals A or B, depending on the version of the signal converter.

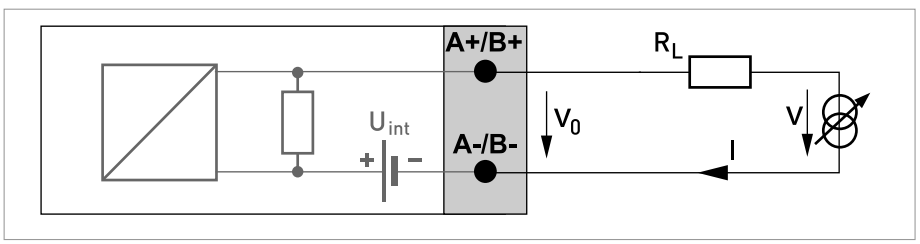


Figure 5-9: Current input active IIn_a

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

6.1 Spare parts availability

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

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

6.2 Availability of services

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

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

6.3 Returning the device to the manufacturer

6.3.1 General information

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

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

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

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

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

6.3.2 Form (for copying) to accompany a returned device

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

Company:		Address:
Department:		Name:
Telephone number: Fax number:		Email address:
Manufacturer order number or serial number:		
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 caused by any residual media contained in this device when it is returned.		
Date:		Signature:
Stamp:		

6.4 Disposal

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

Separate collection of WEEE (Waste Electrical and Electronic Equipment):

According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

6.5 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: UFC 300 P signal converter

Electronic device for measuring flow in pipe line systems.

Depending on version: (values ± 5%)		
L x W x H:	Dimensions and weights	
	[mm]	[inch]
	289 x 168 x 66	11.4 x 6.6 x 2.6
Volume:	0.0032 m³	196 inch³
Weight:	1.6 kg	3.5 lb
Weight seperate parts:	[kg]	[lb]
Accu/battery	0.33	0.72
Metal parts aluminum:	0.13	0.28
Metal parts steel:	0.22	0.48
Plastic parts:	0.46	1.01
Electronics (PCB, LCD)	0.3	0.70
Other: Cu intern wire	0.16	0.35

DANGER!
The device MUST be disconnected from mains power before disassembling.

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

INFORMATION!
The device has to be de-installed from the piping-circuit and cleaned properly before disassembling is possible. The device have a battery (or circuit board cell) inside which have to be removed before disassembling. The printed circuit board material used, contains a minimal weight percentage of brominated flame retardants. The device is RoHS compliant.

INFORMATION!
Before disassembling the device, make sure you have the proper tools needed:
- *Torx screwdriver set*
- *Pozidriv screwdriver set*
- *Adjustable wrench or wrench set (e.g. 10-27 mm)*

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

6.6 Disassembling the OPTISONIC 6000 sensor rail

The OPTISONIC 6000 sensor rail is available in an aluminium housing. This handbook describes the standard version (refer to *Technical data* on page 67) and not specific customized versions. Where available, additional data will be mentioned. For more specific data concerning versions, please contact the support centre.

Exploded view

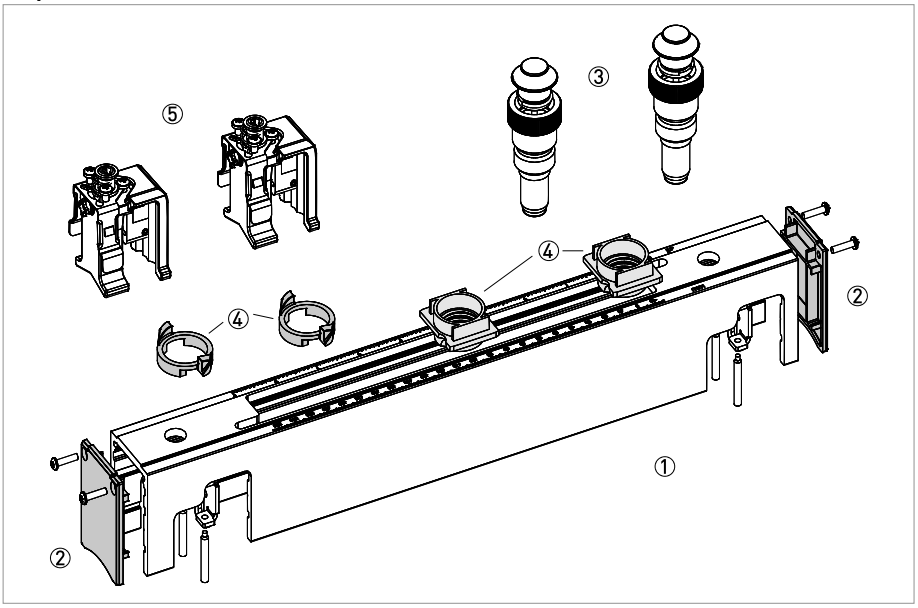


Figure 6-1: Disassembled device

① Aluminum housing
② Plastic end caps
③ Positioning knobs
④ Plastic parts positioning knobs
⑤ Stainless steel fixing units

INFORMATION!
Disconnect all electric cables from connection terminals (if still attached).

It is not necessary to disassemble the device completely to separate all the materials.
If complete disassembling is required, parts can be separated by using a Torx screwdriver size T8.

- 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.
- Unscrew the two screws of the plastic end-caps to separate them from the rail
- Both transducers can be removed from the positioning knobs but only with force.
- Slide the transducers with force out of the locking cams on the knobs.
- Remove the transducers and plastic parts of the position knobs.
- Remove the connection cables with the transducers.

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

Transducers and signal cables

The transducer can be detached from the signal cable by unscrewing the connector(s).

Exploded view

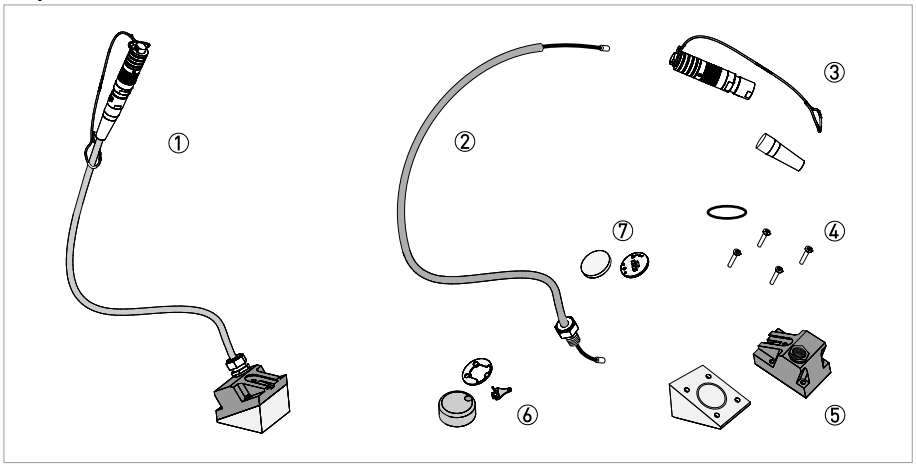


Figure 6-2: Disassembled transducer cable

① Assembled transducer cable
② Cable part
③ Connector parts
④ Screws and rubber sealing ring
⑤ Transducer housing (plastic parts)
⑥ Brass parts
⑦ Connection board and ceramic disc

Cable and connector components

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Connector housing and cap (nickel-plated copper)	0.07	0.15	2 cable connector plugs
Cable feed and gland(plastic)	negligible		
Metal wire, bolts	negligible		
PA transducer housing and element / PCB	0.13	0.29	2 transducers
Standard cable RGD-316: PTFE plastics/silver plated copper/ mixture	0.21	0.46	approx. 2 x 3 m/9 ft standard cable
			16 gram / 0.56 ounce copper per m/ft

6.7 Disassembling the converter

The UFC 300 P portable signal converter consists mainly out of plastic and metal parts and it is possible to fully separate the materials if desired.

The essential parts which have to be separated before a recycle trajectory can be followed are the:

- battery pack
- button cell battery (V1 version only)
- electronic PC boards

The following disassembling sequence describes the complete retrieving of all components. See the next chapter for a compact exploded view of the device with the location of the essential parts to remove.

Remove the connection and/or other cable(s)

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

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 each other is not sufficient anymore. Replacement of transducers is possible, please contact the support centre and/or refer to *Service* on page 56.

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 / 0.013 lb max: 0.15 kg / 0.33 lb
Cable gland (nickel-plated copper)	0.03	0.067	
Standard cable: plastics/copper/steel mixture	0.8	1.76	approx. 6 m/20 ft standard cable (optionally cable lengths are possible up to 30 m/98 ft)
			7 gram / 0.25 ounce copper per m/ft

Cable (I/O) box and power supply (adapter)

No further disassembling necessary, dispose the components as described refer to *Disposal* on page 57 .

Disassemble the device

- remove the 6 Torx screws on the back and open the device, lay the top and bottom parts flat on your work table
- unscrew the 4 Torx screws from the battery holder and loosen the plug from the PC board, remove the battery

- loosen the 2 screws of the handle and remove the aluminum handle
- remove the silicone seal that is between the upper and lower housing part
- open the click connections on the PC board (from the ribbon cables to the LC display ③ and push buttons), disconnect the cables and lay the top piece aside
- remove the small battery (button cell - V1 version only) on the PC board
- Remove the 4 (blue) silicone center rubbers and the entire electronics unit, remove all plugs that are on the PC board
- remove the small connector plate on the side and the connector plate of the cables on top of the electronics unit, the cables are now free
- manually unscrew the connection sockets from the 4 cable connection terminals on the connection panel and remove the inside of the connections
- remove all plugs on the PC board from the connection panel and remove all plastic covers from this panel
- remove the coax buses, USB connection (V1 version only) and the other wiring. Place the coax buses back on the 4 coax cables
- remove all accessible plastic fastening screws from the PC board on both sides of the unit
- remove connection cable and plugs on the side of the PC board unit and turn (180°) both small PC boards to the side
- remove the top PC board (by removing the plug) and unscrew the spacer with which the PC board was still attached
- remove the metal screws that secure the LC display
- open (using a small screwdriver) the plug that secures the cable from the LC display and then remove the LC display (V1 version only)

Exploded view

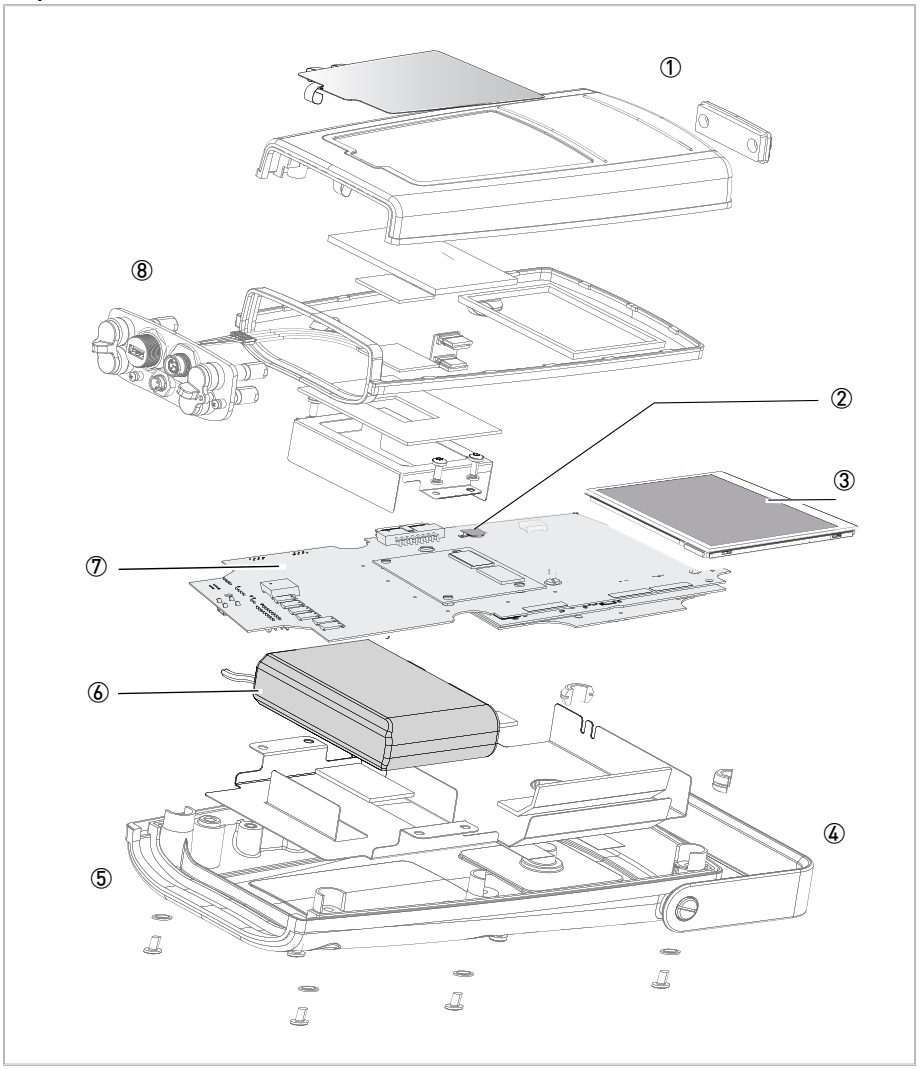


Figure 6-3: Disassembled device

① Plastic upper parts of the housing (numeric button panel V1 version only)
② Button cell battery (V1 version only)
③ LCD (V1 version only)
④ Aluminium handle
⑤ Plastic bottom part of the housing
⑥ Battery / accu pack
⑦ PCB with electronic units
⑧ Connector plate

INFORMATION!
The V1 (previous design) and V2 version have some different components. The illustration shows an abstract version and can deviate from the actual device version.

6.8 Overview of the converter materials and components

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

The signal converter exist in two versions. UFC 300 P (V1) with a numeric touch panel and LCD screen. UFC 300 P V2 with a blind front panel and no LCD screen (operated with the mobile application via bluetooth).

Materials and weight of both versions differ and are desribed in the following tables with **average data**.

Materials/components, which must be removed and treated separately

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed circuit boards	0.21	0.46	average size (depends on version): 360 - 470 cm^2 / 56 - 73 $inch^2$ (± 5%)
Electrolyte capacitor	*	*	* The PC boards of the electronic insert contains approximately 3 cm^3 / 0.18 $inch^3$ of electrolytic capacitors.
Battery	0.33	0.73	**Remove** both parts before recycling
LCD screen/glass	0.1	0.23	screen size < 25 cm^2 / 3.9 $inch^2$
Noble/precious metal	-	-	

Table 6-1: Signal converter UFC 300 P

Material/components, which can disturb recycling processes

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Metal mixture	0.18	0.4	e.g. bolts, washers, screws, cable clamp, brackets
Plastics / copper mixture	0.05	0.11	intern wiring
Silicon / rubber / Neoprene	0.06	0.13	Seal-rings
PVC & connector parts	0.013	0.03	e.g. caps and foils (display)

Table 6-2: Signal converter UFC 300 P

Beneficial material/components, useful for recycling

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Accu, battery	0.33	0.72	**Remove** before recycling
Metal	0.22	0.48	inside brackets
Aluminum	0.13	0.28	handle and bottom plate
Polyamide	0.46	1.0	plastic sections of housing
PC boards, LCD	0.2	0.46	separate electronic units
LCD	0.1	0.23	V1 version only
Cabling	0.15*	0.3*	* all cables are detachable from the device
Ferrite	negligible		
Copper, brass	negligible		

Table 6-3: Signal converter UFC 300 P

7.1 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.

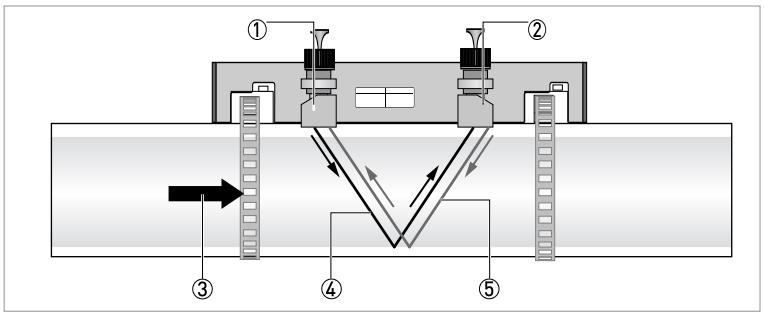


Figure 7-1: Measuring principle (example reflected path set-up)

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

7.2 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, thermal energy (requires 2 x temperature input).

Design

	The measurement system consists of one or two measuring sensors and a portable signal converter.
Signal converter	
Portable housing	UFC 300 P
Measuring sensor	
Standard	Single or dual sensor rail with 500 kHz, 1 MHz or 2 MHz transducers
Optional	OPTISONIC 6300 flow sensors using cable adaptors
Normal pipe diameter ranges (recommended)	
Small transducers (2 MHz)	DN15...150 / ½...6" (1 rail)
Medium transducers (1 MHz)	DN50...250 / 2...10" (1 rail)
	DN200...1500 / 8...60" (2 rail)
Large transducers (500 kHz)	DN200...4000 / 8...160" (2 rail)
Options	
Outputs	0(4)...20 mA, pulse, frequency and/or status output with optional I/O box.
Inputs	0(4)...20 mA (2 x) with optional I/O box.
Counters	4 internal counters with a maximum of 8 counter places, for counting volume, energy and/or mass units.
USB	1 x host port (Mobile device USB-C via I/O connection of OPTISONIC 6300 P to make a connection with Android device).
Self diagnostics	Integrated verification, diagnostic functions: flowmeter, process, measured value, empty pipe detection, bar graph.

User interface	
Operator elements and indicators	1 on/off key with LED indication
	LED indication Bluetooth connection
	LED indication charging battery
	LED bar graph for status of battery charge
Display functions on Android device	
Menu	Wizard for setup and configuration of measurements.
	Support for the configuration of 2 path / 2 pipe or 2 path / 1 pipe measurement.
	Averaging, adding or subtracting of measurement results of 2 path measurements.
	Storage of measurement configurations as site file. Maximum number of site files is 100.
	Measurement data can be displayed as value or as bar or trend graph.
Thermal energy measurement	By input of 2 temperature sensors providing a temperature difference, thermal energy can be calculated.
Data logger	Logging of free selectable measured and calculated values. Data storage up to 16 GB/500 logfiles on fielddevice. Per log file, a maximum of 1.500.000 values can be stored. Display of logged data through line graphs.
Languages	English, French, German, Spanish, Italian, Chinese, Czech, Polish, Dutch.
	Other languages on request.
Units	Metric, British and US units selectable from list / free unit.

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
Ambient temperature	Sensor: -40...+70°C / -40...+158°F
	Signal converter: -10...+45°C / +14...+113°F (Humidity: 5...80%, non condensing)
Ambient pressure	Up to an altitude of 3000 meters / 9843 feet above sea level
Ambient conditions	Signal converter and sensor rails can be used in wet conditions, for indoor and outdoor use.
	Pollution degree of the intended environment PD=3
Storage temperature	-30...+80°C / -22...+176°F (Humidity: 5...80%, non condensing)
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	Liquids
Viscosity	< 200 cSt (general guideline)
	For detailed information please contact your local representative.
Permissible gas content (volume)	≤ 2%
Permissible solid content (volume)	≤ 5%
Recommended flow velocity	0.1...20 m/s / 0.3 ....60 ft/s

Installation conditions

Measurement configuration	Single pipe, single path
	Single pipe, dual path
	Dual pipe, dual path
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 74.

Materials

Sensor	Anodized aluminium (rail)
Converter	Polyamide PA12, covered with TPE soft touch layer on the sides
Hardcase	Polypropylene, inner material EPP
Soft case	Polyester, inner material EPP

Electrical connections

Power supply	Adaptor: charger input: 100...240 VAC (V_{nom}), 50...60 Hz
	Adaptor: charger output: 12 VDC, 2.33 A, P_{max} 28 W
	Flow converter power supply input: 12 VDC, 0.5 A, 6 W During charging, the current input increases to: 1.7 A (typical).
Overvoltage category	Signal converter category 1
Battery pack	Charging time: ± 8 hours
	Measuring operation time: ± 16 hours
	Battery type: Lithium-Ion polymer (10200 mAh)
	Energy density: 72.4 Wh
	Weight 0.33 kg /0.72 lb
Signal cable	Double braided shielded coax cables; 3 m / 9.8 ft Optional: extension cables; 7 m / 22.9 ft
USB ports	1 x for Android device
Bluetooth	2.4 GHz, 8.32 mW integral antenna build-in
Inputs / outputs	15 pin connector for I/O interfacing with optional I/O box
	Optional: Pt100 input
	Function: Pt100 temperature input by 2 x KROHNE TT33C temperature transmitters build into an I/O box
	For specifications see TT33C data sheet.
	Optional: temperature input
	Function: temperature input by 2 x KROHNE TSR-W 30 clamp-on temperature sensors only in combination with I/O box with temperature transmitters.
	For specifications see TSR-W 30 data sheet.

Inputs and outputs

Connections	Inputs and outputs can only be connected using the optional I/O box.
Description of used abbreviations	V_{ext} = external voltage, R_L = load resistance, V_o = terminal voltage, I_{nom} = nominal current
Current output	
Isolation	The output is not galvanically isolated from the other circuits. The - current out is connected to the metal connection panel and the connector shielding of the sensor.
Output data	All analog measurement parameters like volume and mass flow (at constant density), flow speed, speed of sound, gain, signal to noise ratio, reliability of flow measurement, quality of acoustic signal, thermal energy (requires input of temperature (2 x)).
Settings	Q = 0%: 0...20 mA; Q = 100%: 10...21.5 mA
	Error identification: 0...22 mA
Operating data	
Active	$V_{int,nom}$ = 15 VDC $I \leq 22$ mA $R_L \leq 1$ kΩ
Passive	$V_{ext} \leq 32$ VDC $I \leq 22$ mA $U_0 \geq 1.8$ V at I = 22 mA $R_L \leq (V_{ext} - V_0) / I_{max}$

Pulse or frequency output	
Isolation	The output is galvanically isolated from the other circuits.
Output data	For pulse counting and/or analog output: Volume flow, mass flow, thermal energy (requires input of temperature (2 x)
	As analog output: Flow speed, speed of sound, gain, signal to noise ratio, reliability of flow measurement, quality of acoustic signal
Function	Can be set as a pulse output or frequency output
Settings	For Q = 100%: 0.01...10000 pulses per second or pulses per unit volume
	Pulse width: setting automatic, symmetric or fixed (0.05...2000 ms)
Operating data	
Active	V_{nom} = 15 VDC
	$f_{max} \leq$ 100 Hz: I ≤ 20 mA open: I ≤ 0.05 mA closed: $V_{0,nom}$ = 15 V at I = 20 mA
	100 Hz < $f_{max} \leq$ 10 kHz: I ≤ 20 mA open: I ≤ 0.05 mA closed: $V_{0,nom}$ = 13.5 V at I = 1 mA $V_{0,nom}$ = 12.5 V at I = 10 mA $V_{0,nom}$ = 9 V at I = 20 mA
Passive	$V_{ext} \leq$ 32 VDC
	$f_{max} \leq$ 100 Hz: I ≤ 100 mA open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 0.2 V at I ≤ 10 mA $V_{0, max}$ = 2 V at I ≤ 100 mA
	100 Hz < $f_{max} \leq$ 10 kHz: I ≤ 20 mA open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 1.5 V at I ≤ 1 mA $V_{0, max}$ = 2.5 V at I ≤ 10 mA $V_{0, max}$ = 5.0 V at I ≤ 20 mA

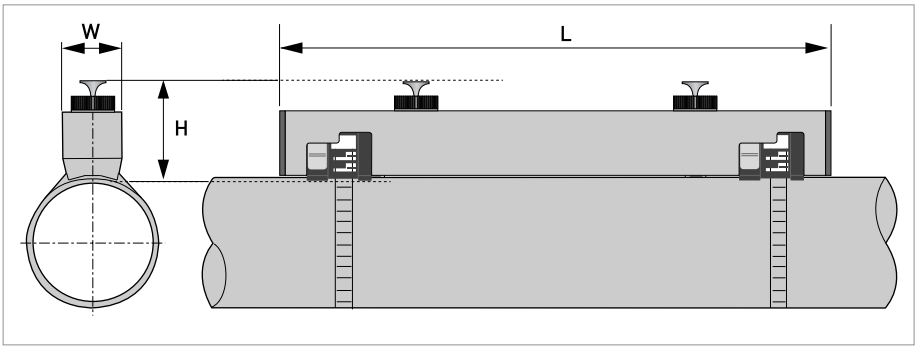
Status output	
Isolation	The output is galvanically isolated from the other circuits.
Function and settings	Settable as automatic measuring range change, indicator for direction of flow, overflow, error, operating point or empty pipe detection
	Status and/or control: ON or OFF
Operating data	
Active	V_{int} = 15 VDC I ≤ 20 mA open: I ≤ 0.05 mA closed: $V_{0, nom}$ = 15 V at I = 20 mA
Passive	V_{ext} ≤ 32 VDC I ≤ 100 mA open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 0.2 V at I ≤ 10 mA $V_{0, max}$ = 2 V at I ≤ 100 mA
Current inputs	
Isolation	The inputs are not galvanically isolated from the other circuits.
Function	Input of temperature, used for energy calculation in combination with flow measurement
	Range: -50...500°C / -58...932°F (default: 0...120°C / -32...248°F)
Operating data	
Active	V_{int} = 15 VDC I ≤ 22 mA I_{max} = 26 mA (electronically limited) $V_{0, min}$ = 19 V with I ≤ 22 mA No HART®
Passive	V_{ext} ≤ 32 VDC I ≤ 22 mA I_{max} = 26 mA (electronically limited) $V_{0, max}$ = 5 V with I ≤ 22 mA No HART®

Approvals and certificates

CE	
This device fulfils the statutory requirements of the relevant directives. The manufacturer certifies successful testing of the product by applying the conformity mark on the device.	
	For more information on the directives, standards and the approved certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
Other approvals and standards	
Protection category according to IEC 60529 / NEMA 250/2018	Sensor: IP66/67, NEMA 4X/6
	Converter: IP65, NEMA 4
	Hardcase on wheels: IP67, NEMA 6
	Power adaptor: IP40, NEMA 1
Shock resistance	IEC 60068-2-27
	30 g for 18 ms
Vibration resistance	IEC 60068-2-64
	1 g up to 2000 Hz

7.3 Dimensions and weight

7.3.1 Clamp-on sensor rail



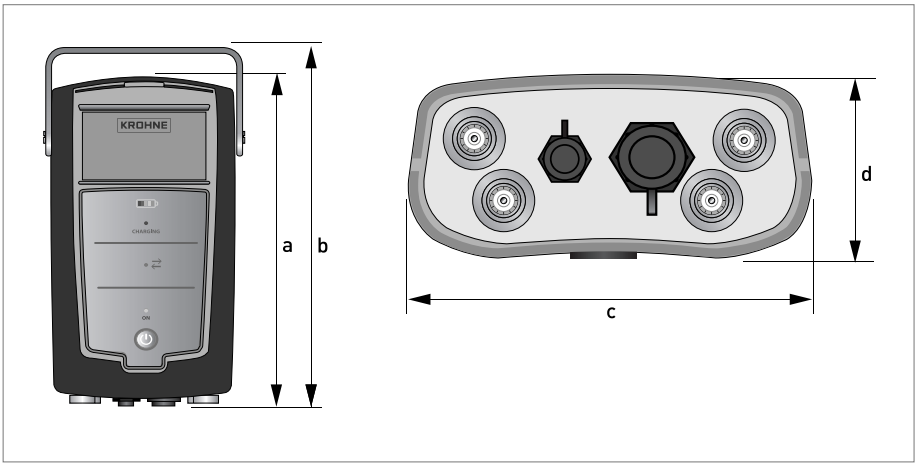
Version	Dimensions [mm]			Approx. weight [kg]
	L	H	W	
V1	406	76	39.2	2.1 ①
V2	406	81.5	42.7	2.2 ①

① with transducers / cable, without mounting strap

Version	Dimensions [inches]			Approx. weight [lb]
	L	H	W	
V1	16.0	3.0	1.54	4.6 ①
V2	16.0	3.2	1.68	4.8 ①

① with transducers / cable, without mounting strap

7.3.2 Converter

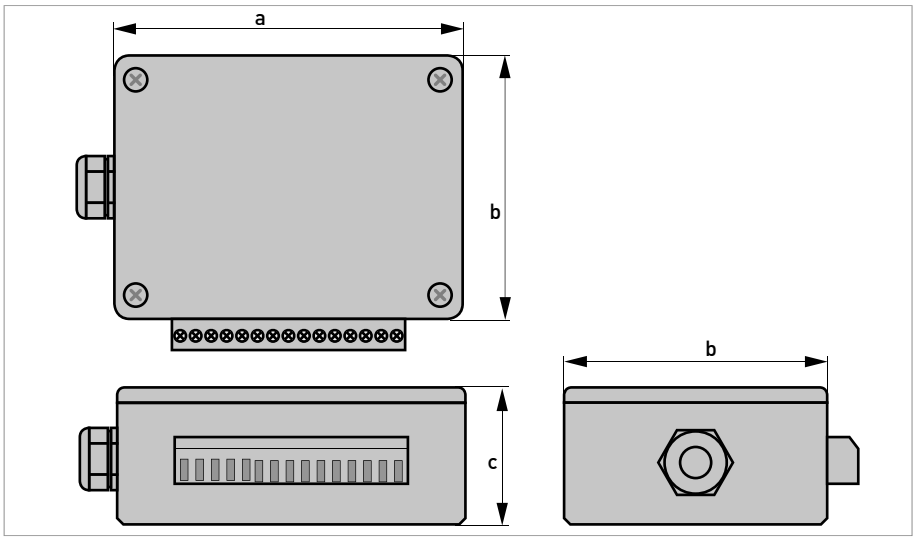


Dimensions UFC 300 P converter

Dimensions [mm]				Approx. weight [kg]
a	b	c	d	
247	289	168	66	1.5

Dimensions [inch]				Approx. weight [lb]
a	b	c	d	
9.7	11.4	6.6	2.6	3.3

7.3.3 I/O box

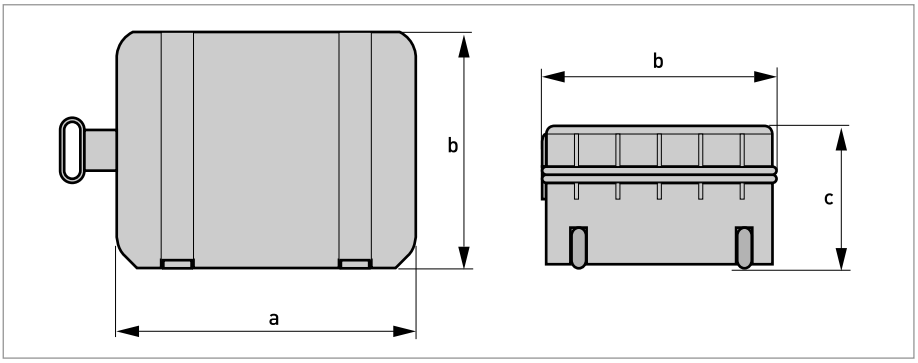


Dimensions I/O box

Dimensions [mm]			Approx. weight [kg]
a	b	c	
112.5	84.6	44	0.34

Dimensions [inch]			Approx. weight [lb]
a	b	c	
4.4	3.3	1.7	0.75

7.3.4 Hardcase on wheels



Dimensions hardcase on wheels

Dimensions [mm]			Approx. weight [kg]
a	b	c	
521	394	254	6.4

Dimensions [inch]			Approx. weight [lb]
a	b	c	
20.5	15.5	10	14.1

7.3.5 Softcase

Dimensions softcase

Dimensions [mm]			Approx. weight [kg]
a	b	c	
530	400	160	1.7

Dimensions [inch]			Approx. weight [lb]
a	b	c	
20.9	15.8	6.3	3.8

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