



OPTISONIC 6400 Technical Datasheet

Portable ultrasonic clamp-on flowmeter

- User friendly operation through full colour graphic display and full keypad
- Quick and easy transfer of logged data to your PC through USB interface
- Sensors: robust, fast installation, high performance

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1.1 Portable clamp-on flowmeter

The new OPTISONIC 6400 flowmeter combines mobile, straightforward and quick liquid measurement with the proven precision and reliability of KROHNE ultrasonic technology. Simply attach the sensor unit to the tube and connect the compact evaluation unit - now just read the results. It is just as easy to use the device for data logging. Data is saved to a USB stick and transferred to external evaluation systems. Its ease of use and flexibility make the OPTISONIC 6400 the ideal solution for flow measurement in a variety of applications in virtually any sector of industry.



Highlights

- Quick and easy sensor mounting
- Comprehensive user interface
- Easy transfer of logged data to PC
- 14 Hours battery life
- Energy measurement

Industries

- Chemicals
- Petrochemicals
- Power plants
- Water
- Oil & Gas
- Semi-conductor
- Food & Beverages
- Pharmaceuticals
- HVAC
- Metal & Steel

Applications

- Commissioning of HVAC systems
- Checking of inline flowmeters
- Checking of pump performance
- Temporary replacement of defective flowmeters
- General flow related problem solving

1.2 Variants

The OPTISONIC 6400 is a battery powered ultrasonic clamp-on flowmeter that can be fitted on the outside of piping to measure the flow rate of liquids. The OPTISONIC 6400 is intended for temporary flow measurement. It consists of a combination of one or two clamp-on sensor(s) and one handheld electronic signal converter.

The OPTISONIC 6400 comes as a complete and ready to use flowmeter in a robust case that can be carried as a trolley.



What's standard included?

- UFC 400 P converter including battery charger / power supply and mounting strap
- Documentation
- USB stick
- Coupling fat
- Tape measure
- Backpack
- Trunk on wheels



Flow sensor options

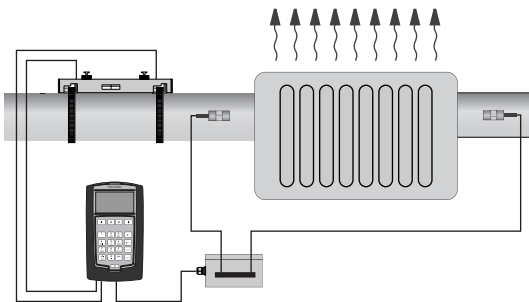
- Single rail flow sensor for pipe sizes DN15...DN150 ($\frac{3}{4}$...6")
- Single rail flow sensor for pipe sizes DN50...DN250 (2...10")
- Dual rail flow sensor for pipe sizes DN200...DN1500 (8...60")

Two flow sensors of the same type can be connected to the converter electronics simultaneously for dual path or dual pipe flow measurement. A maximum of 4 sensor rails can be fitted in the case.



I/O connection

For connection of I/O signals like pulse or current outputs a cable with I/O connection box is available optionally.



Energy measurement

Standard the OPTISONIC 6400 is provided with a measurement option for thermal energy. This requires the input of 2 temperature measurements in addition to the flow measurement.

For temperature measurement an I/O connection box is available to connect temperature transmitters. For direct connection of PT100 sensors, the I/O box can optionally be fitted with 2 temperature transmitters. When temporary temperature measurement is required 2 clamp-on PT100 sensors can be ordered optionally.

Optional thickness gauge

For setting up the flow measurement, the pipewall thickness must be known. To measure this, a pipewall thickness gauge can be ordered with the OPTISONIC 6400.

1.3 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.

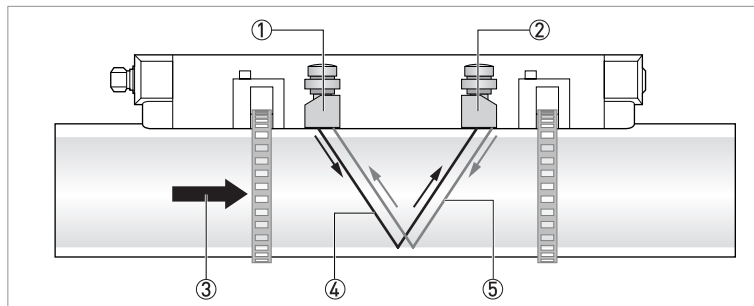


Figure 1-1: Measuring principle

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

2.1 Technical data

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

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 input of temperature (2x)).

Design

	The measurement system consists of one or two measuring sensors and a portable signal converter.
Signal converter	
Portable housing	UFC 400 P
Measuring sensor	
Standard	Single or dual rail sensors with 1 or 2 MHz transducers
Optional	OPTISONIC 6300 flow sensors using cable adapters
Diameter ranges	
DN15...150 / ½...6"	One rail, 2 MHz transducers Outer diameter must be at least 20 mm / ¾".
DN50...250 / 2...10"	One rail, 1 MHz transducers
DN200...1500 / 8...60"	Two rails, 1 MHz transducers
Options	
Outputs	0(4)...20 mA, pulse, frequency and/or status output
Inputs	0(4)...20 mA (2x) 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	1x host port (PC can use OPTISONIC 6400 as a removable media device) 1x slave (memory stick can be written by converter)
Self diagnostics	Integrated verification, diagnostic functions: flowmeter, process, measured value, empty pipe detection, bar graph.

Display and user interface	
Graphic display	4.3" TFT with LED backlight, daylight readable
	272x480 dots resolution
	The readability of the display could be reduced at ambient temperatures below -25°C / -13°F.
Operator input elements	21 Key tactile keypad:
	1 on/off key
	4 cursor keys for menu operation
	12 keys for alpha / numerical input (SMS style)
	4 function keys for direct access to main functions
Display functions	
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 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 selected measured / calculated values. Data to be logged and time interval can be set. A maximum number of 150000 values / 50 files can be stored. Display of logged data through line graphs.
Language of display texts	English, French, German, Italian, Spanish.
	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
	Straight inlet section: 10 DN
Maximum measuring error	±1% of the measured value for DN ≥ 50 mm / 2" and v > 0.5 m/s / 1.5 ft/s
	±3% of the measured value for DN < 50 mm / 2" and v > 0.5 m/s / 1.5 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: -20...+55°C / -4...+131°F (Humidity: 5...80%, non condensing).
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)
Pipewall thickness	< 200 mm / 7.87"
Liner thickness	< 20 mm / 0.79"
Media properties	
Physical condition	Liquids
Viscosity	< 100 cSt (general guideline)
	For detailed information please contact your local representative.
Permissible gas content (volume)	≤ 2%
Permissible solid content (volume)	≤ 5%
Recommended flow velocity	0.5...20 m/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	See chapter "Dimensions and weights"

Materials

Sensor	Anodized aluminum (rail)
Converter	Polyamide PA12, covered with TPE soft touch layer on the sides
Trunk on wheels	Polypropylene

Electrical connections

Power supply	Adapter for 100...240 VAC [-10% / +10%], 47...63 Hz
	Adapter voltage: 13.2 V
	Maximum power consumption: 10 W (25 W during charging)
	Charging time: 8 hours
	Battery type: Lithium polymer
	Battery lifetime:
	Measuring operation (display at 50% brightness): 14 hours
Signal cable	double shielded, internal triax, length: 3 m / 15 ft
USB ports	1x for PC, 1x for memorystick
Inputs / outputs	15 pin connector for I/O interfacing with optional I/O box
	Optional: PT100 input:
	Function: PT 100 temperature input by 2x KROHNE TT30C temperature transmitters build into an I/O box
	For specifications see TT30C datasheet.
	Optional: temperature input:
Function: temperature input by 2x KROHNE TSR-W 30 clamp-on temperature sensors only in combination with I/O box with temperature transmitters.	
For specifications see TSR-W 30 datasheet.	

Inputs and outputs

Connections	Inputs and outputs can only be connected using the optional I/O box.
Description of used abbreviations	U_{ext} = external voltage; R_L = load + resistance; U_0 = terminal voltage; I_{nom} = nominal current
Current output	
Isolation	The output is not galvanically isolated from the other circuits.
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 (2x)).
Settings	Q = 0%: 0...20 mA; Q = 100%: 10...21.5 mA
	Error identification: 0...22 mA
Operating data	
Active	$U_{int,nom} = 15$ VDC $I \leq 22$ mA $R_L \leq 450 \Omega$
Passive	$U_{ext} \leq 32$ VDC $I \leq 22$ mA $U_0 \geq 1.8$ V at $I = 22$ mA

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 (2x))
	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	$U_{nom} = 15 \text{ VDC}$
	$f_{max} \leq 100 \text{ Hz}$: $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $U_{0,nom} = 15 \text{ V}$ at $I = 20 \text{ mA}$
	$100 \text{ Hz} < f_{max} \leq 10 \text{ kHz}$: $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $U_{0,nom} = 13.5 \text{ V}$ at $I = 1 \text{ mA}$ $U_{0,nom} = 12.5 \text{ V}$ at $I = 10 \text{ mA}$ $U_{0,nom} = 9 \text{ V}$ at $I = 20 \text{ mA}$
Passive	$U_{ext} \leq 32 \text{ VDC}$
	$f_{max} \leq 100 \text{ Hz}$: $I \leq 100 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ at $U_{ext} = 32 \text{ VDC}$ closed: $U_{0,max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0,max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
	$100 \text{ Hz} < f_{max} \leq 10 \text{ kHz}$: $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ at $U_{ext} = 32 \text{ VDC}$ closed: $U_{0,max} = 1.5 \text{ V}$ at $I \leq 1 \text{ mA}$ $U_{0,max} = 2.5 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0,max} = 5.0 \text{ V}$ at $I \leq 20 \text{ mA}$

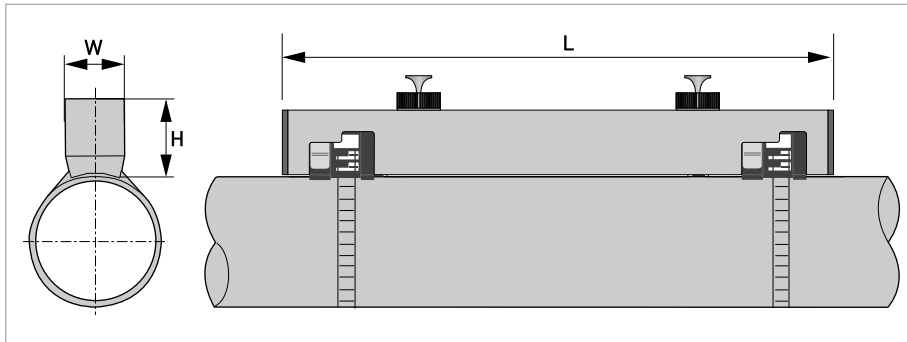
Status output	
Isolation	The output is galvanically isolated from the other circuits.
Function and settings	Settable as automatic measuring range change, indicator for direction of flow, overflow, error, operating point or empty pipe detection Status and/or control: ON or OFF
Operating data	
Active	$U_{int} = 15 \text{ VDC}$ $I \leq 20 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ closed: $U_{0, nom} = 15 \text{ V}$ at $I = 20 \text{ mA}$
Passive	$U_{ext} \leq 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ open: $I \leq 0.05 \text{ mA}$ at $U_{ext} = 32 \text{ VDC}$ closed: $U_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$
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: $-50...500^\circ\text{C}$ / $-58...932^\circ\text{F}$ (default: $0...120^\circ\text{C}$ / $-32...248^\circ\text{F}$)
Operating data	
Active	$U_{int} = 15 \text{ VDC}$ $I \leq 22 \text{ mA}$ $I_{max} = 26 \text{ mA}$ (electronically limited) $U_{0, min} = 9 \text{ V}$ with $I \leq 22 \text{ mA}$ No HART®
Passive	$U_{ext} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $I_{max} = 26 \text{ mA}$ (electronically limited) $U_{0, max} = 5 \text{ V}$ with $I \leq 22 \text{ mA}$ No HART®

Approvals and certificates

CE	
	This device fulfills the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	Directive: 2004/108/EC Harmonized standard: EN 61326-1: 2006
Low voltage directive	Directive: 2006/95/EC Harmonized standard: EN 61010: 2001
Other approvals and standards	
Protection category acc. to IEC 529 / EN 60529 / NEMA 250/2003	Sensor: IP 67 / NEMA 6
	Converter: IP 65 / NEMA 4
	Trunk on wheels: IP 67 / NEMA 6
	Power adapter: IP 40 / NEMA 1
Shock test sensor	IEC 60068-2-27
Vibration test sensor	IEC 68-2-64

2.2 Dimensions and weights

2.2.1 Clamp-on sensor



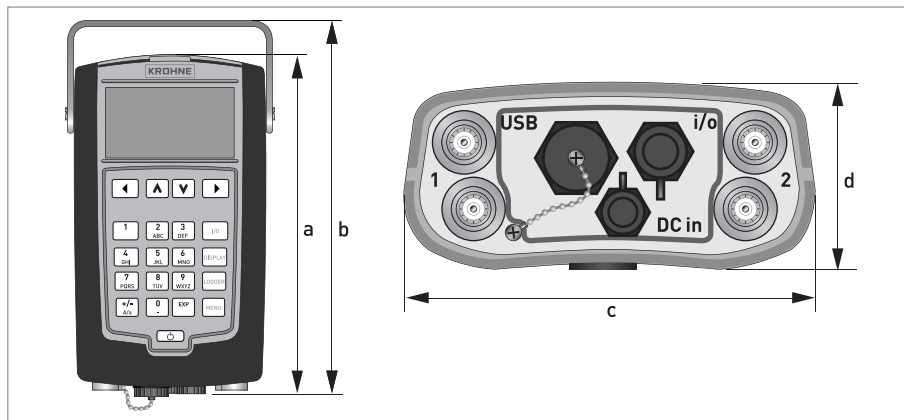
Dimensions [mm]			Approx. weight [kg]
L	H	W	
406	76	39.2	2.1 ①

① with transducers / cable, without mounting strap

Dimensions [inches]			Approx. weight [lb]
L	H	W	
16.0	3.0	2.5	4.6 ①

① with transducers / cable, without mounting strap

2.2.2 Converter

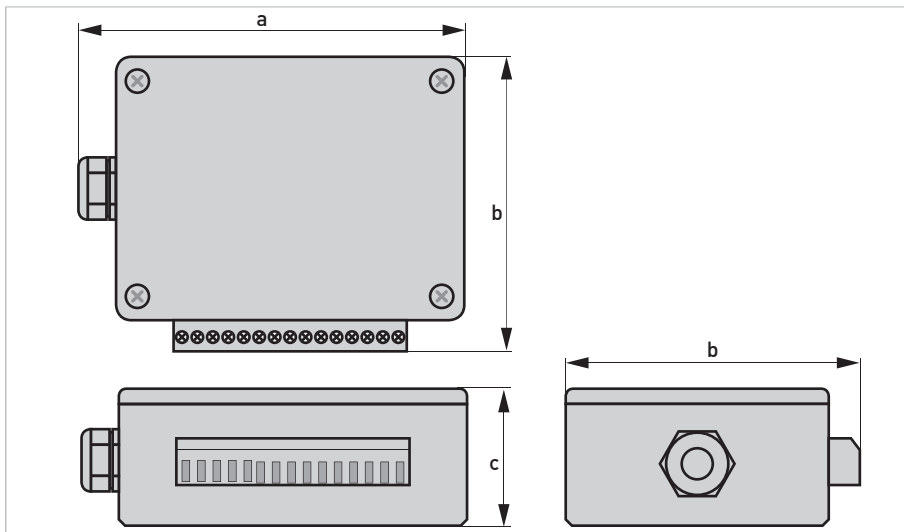


Dimensions UFC 400 converter

Dimensions [mm]				Approx. weight [kg]
a	b	c	d	
247	289	168	66	1.6

Dimensions [inch]				Approx. weight [lb]
a	b	c	d	
9.7	11.4	6.6	2.6	3.5

2.2.3 I/O box

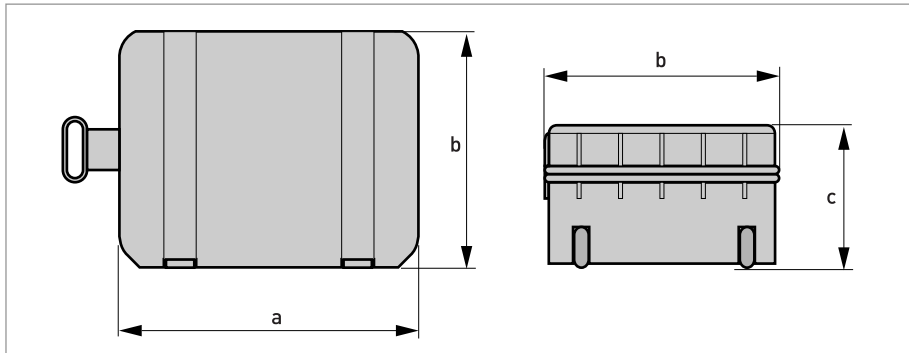


Dimensions I/O box

Dimensions [mm]			Approx. weight [kg]
a	b	c	
112.5	84.6	41.3	0.2

Dimensions [inch]			Approx. weight [lb]
a	b	c	
4.4	3.3	1.6	0.44

2.2.4 Trunk on wheels



Dimensions trunk on wheels

Dimensions [mm]			Approx. weight [kg]
a	b	c	
565	374	241	6.2

Dimensions [inch]			Approx. weight [lb]
a	b	c	
22.2	14.7	9.5	13.7

3.1 Intended use

The OPTISONIC 6400 portable clamp-on flow meter is designed for measurement of liquid flows in full pipes, datalogging, transfer of logged results to the PC. The portable clamp-on flow meter makes it possible to measure the flow on places temporary or you can make use of it if you want to compare the output with other measurement devices. If an inline measurement device is broken and you are in need of the information the OPTISONIC 6400 might be the solution for you.

3.2 Environmental requirements

- Pollution degree 2
- Protection class I
- Humidity: 5...80 % RH
- Temperature: $-20\dots+55^{\circ}\text{C}$ / $-4\dots+131^{\circ}\text{F}$ operating and $-30\dots+80^{\circ}\text{C}$ / $-22\dots+176^{\circ}\text{F}$ storage
- Suitable for indoor and outdoor use and certified for operating up to an altitude of 2000 m / 6562 ft
- IP class 65 (NEMA 4/4x) for converter; IP class 67 (NEMA 6, 6P) for sensor.

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

3.3 Installation of the flowmeter

Please look at the labels on the cable of each transducer for the calibration number. All transducers for the same measuring path MUST have the same calibration number!

3.3.1 Inlet, outlet and recommended mounting area

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

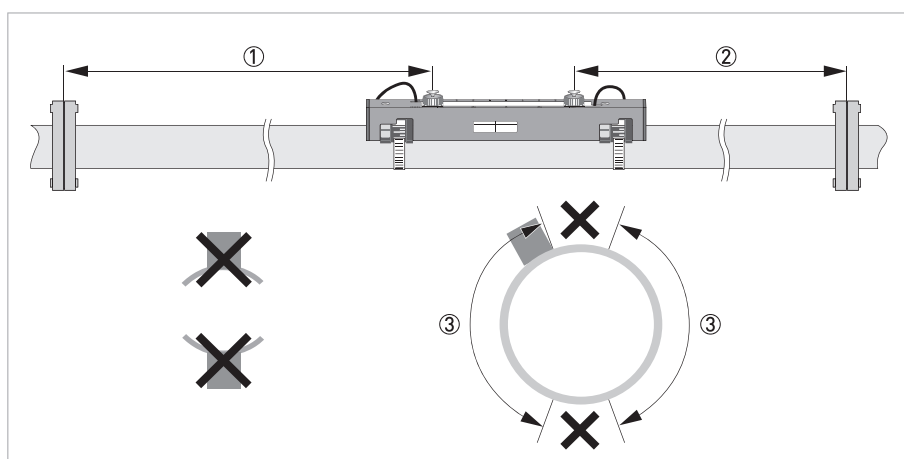


Figure 3-1: Inlet, outlet and recommended mounting area

- ① Min. 10 DN
- ② Min. 5 DN
- ③ OK, 120°

3.3.2 Long horizontal pipes

- Install on slightly ascending pipe section.
- If not possible, ensure adequate velocity to prevent air, gas or vapor from collecting in upper part.
- In partially filled pipes, the clamp-on flowmeter will report incorrect flow rates, or not measure.

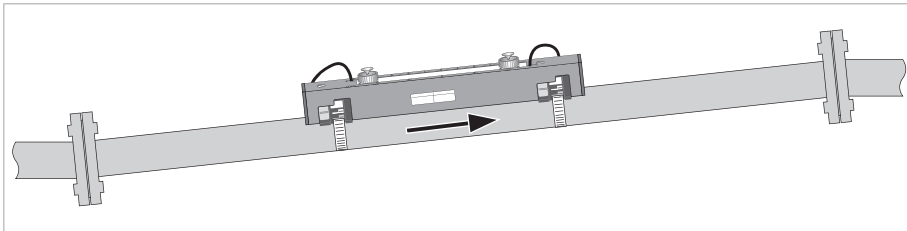


Figure 3-2: Long horizontal pipes

3.3.3 Open feed or discharge

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

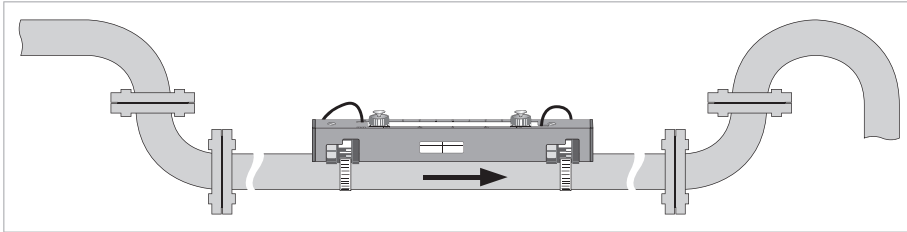


Figure 3-3: Open feed or discharge

3.3.4 Down going pipeline over 5 m /16 ft length

Install air vent downstream of the flow meter to prevent vacuum. Although this will not harm the meter, it may cause gases to come out of solution (cavitate) and interfere with proper measurements.

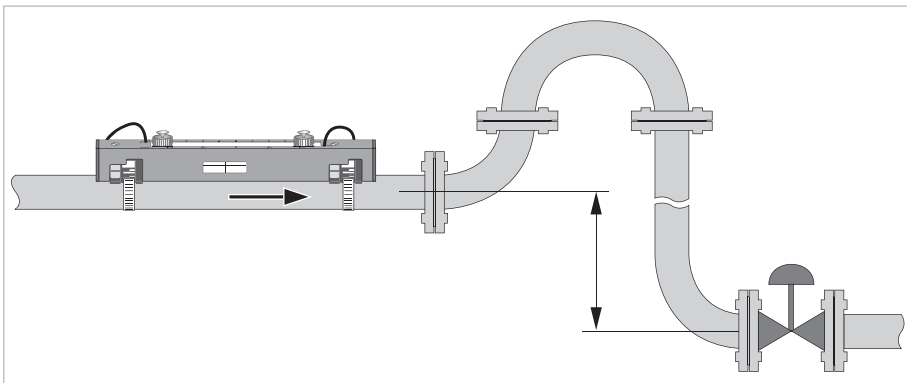


Figure 3-4: Down going pipeline over 5 m /16 ft length

3.3.5 Position of control valve

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

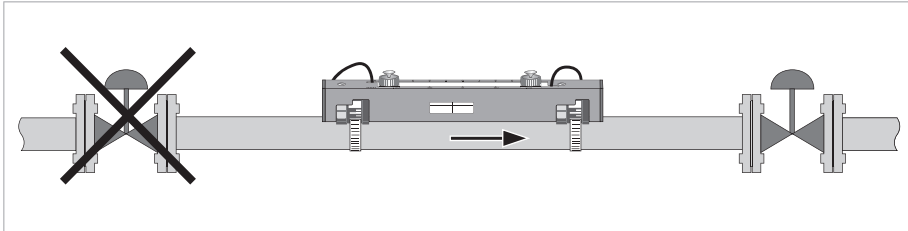


Figure 3-5: Position of control valve

3.3.6 Position of pump

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

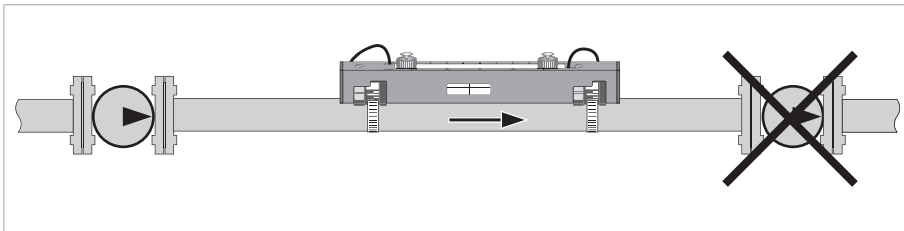
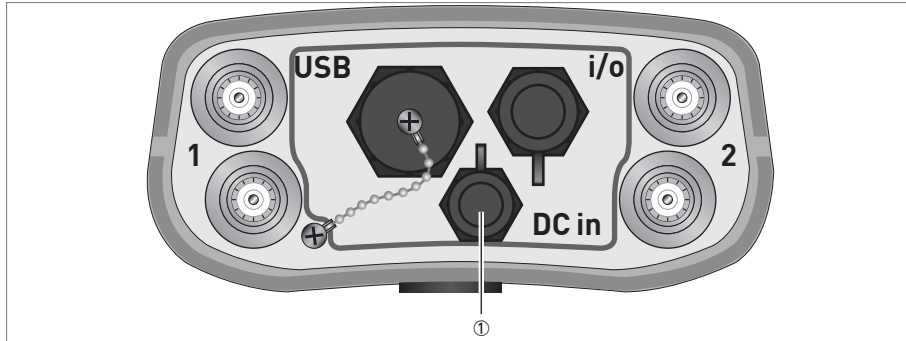


Figure 3-6: Position of pump

4.1 Power supply

Only use the supplied AC charger to charge the battery of the converter!



Plug in the connector of the supplied charger at the connector ①. Then insert the main power connector into your mains outlet.

4.2 Signal cable

Please look at the labels on the cable of each transducer for the calibration number. All transducers for the same measuring path MUST have the same calibration number!

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

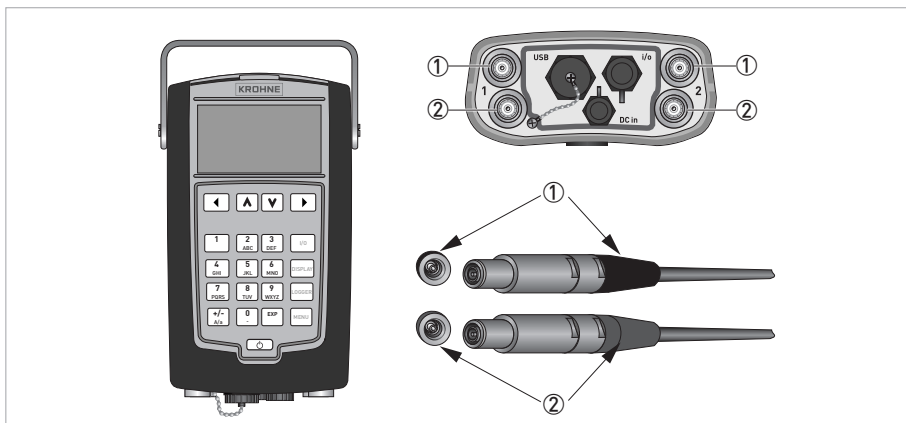
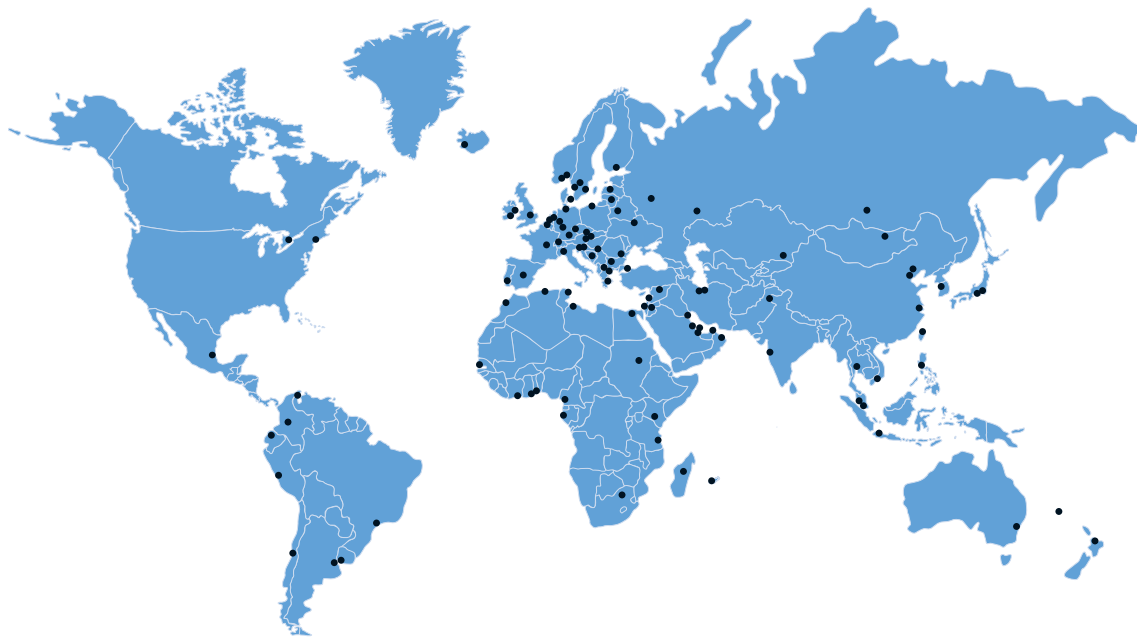


Figure 4-1: Connecting signal cables

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

You can measure two paths with this converter simultaneously. Use the left pair of connectors for path 1 and the right pair for path 2.





KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

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