BATCHFLUX 3100 C Technical Datasheet

Electromagnetic flowmeter for volumetric filling machines

- High-speed measurement for filling applications
- Compact and lightweight housing
- Economical design for low-pressure applications

FDA

KROHNE

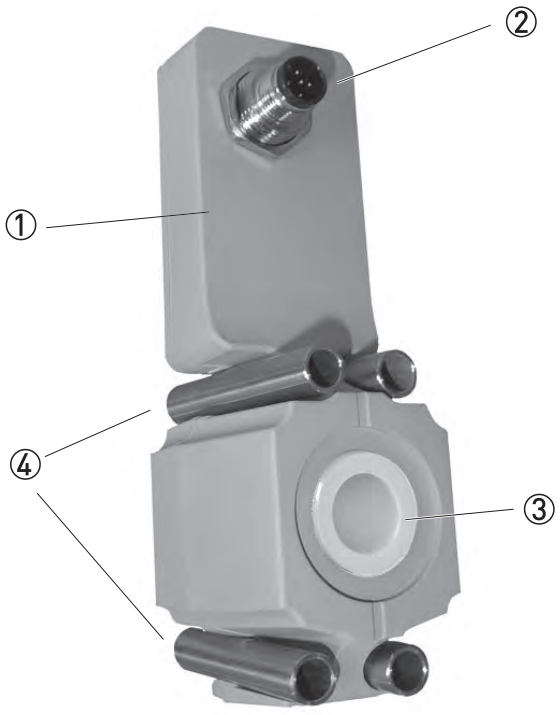
1.1 Flowmeter for measuring volumetric flow rate

The **BATCHFLUX 3100 C** is the entry model of the BATCHFLUX product family. This special flow sensor is made possible through the extensive know-how, of KROHNE in volumetric measurement. This know-how was gained thanks to the industry-leading BATCHFLUX 5500C introduced in 2008.

The BATCHFLUX 3100 C consist of a plastic ultrasonically welded fully tight housing. The flowmeter has an ultra-compact lightweight housing ideal for the tight spaces in volumetric filling machines. The meter is suitable for CIP/SIP processes.

The BATCHFLUX 3100 C features a ceramic flow tube for applications with pressurized media. The flow tubes are available in the most commonly used size of DN15.

Thanks to the unique rectangular cross-section of the flow tube the flow profile is improved, resulting in very good accuracy and repeatability.



① Ultrasonic welded plastic housing
② Fully sealed electronics with M12 connection
③ Unique flow sensor design with a rectangular cross-section
④ Spacer bushings for reduction of mechanical load on the flow tube

Highlights

- Design enables high speed filling with minimal product loss
- High level of filling accuracy
- Long term reliability due to an extremely high dimensional stability
- Low power consumption (1.5 W)
- Hygienic construction
- Easy to clean
- CIP proof
- Absolute leak-free plastic housing concept, IP69
- FDA material compliance

Industries

- Food & Beverages
- Chemical
- Pharmaceutical

Applications

- Carousel and linear filling machines
- Water
- Soft drinks

1.2 Features

1.2.1 Rugged and long term stable

Zirconium Oxide flow tube

The measuring tube of the BATCHFLUX 3100 C consists of high-strength, temperature shock resistant zirconium oxide.

This material is dimensionally extremely stable as it does not leak, creep or absorb any moisture and is vapour proof. Even after CIP and at elevated pressure the measuring accuracy and repeatability remain excellent over a long period.
Repairs, replacements or recalibrations are not required.

1.2.2 Very accurate

Rectangular cross-section design

The BATCHFLUX 3100 C has a unique, rectangular cross-section design that optimizes the flow profile and increases the flow speed locally,which results in a more accurate measurement.

1.2.3 Hygienic & light weight

Lightweight design

The BATCHFLUX 3100 C has a very compact housing with rounded edges which makes it easy to clean.

It is non-corrosive and welded tight conforming to the very stringent ingress protection marking.

The extreme lightweight design can lead to significant cost reduction design opportunities for batch filling machines.

1.2.4 Fast & versatile

Diagnostic communication options

The M12 connector features a frequency output to communicate the actual flow speed. It has an ultrafast response, able to communicate even the fastest filling processes.
All operating data for the BATCHFLUX 3100 C is preset or can be tailored to a customer application.

For changing the parameters and diagnostic purposes BATCHMon plus operation software can be used.

The BATCHMon easy to operate service tool provides quick and continuous data transmission to analyze the filling process.

This helps in diagnosing valve problems, air inclusions and determining the optimum parametrization to maximize filling performance.

1.3 Measuring principle

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils. Inside of the fluid, a voltage U is generated:
U = v * k * B * D

in which:
v = mean flow velocity
k = factor correcting for geometry
B = magnetic field strength
D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q. A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

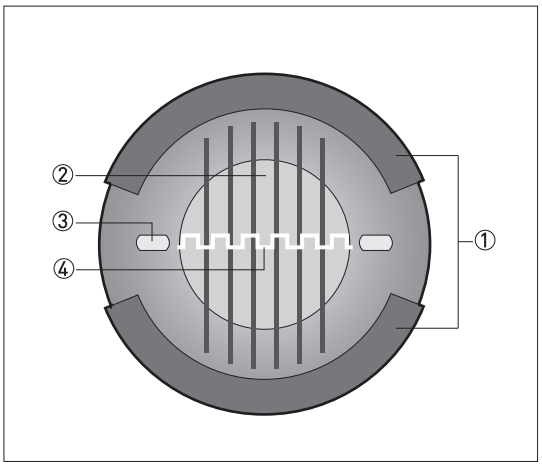


Figure 1-1: Measuring principle

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

2.1 Technical data

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

Measuring system

Measuring principle	Faraday's law
Application range	Electrically conductive fluids
Measured value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow

Design

Features	Standard wet calibration
Modular construction	The measurement system consists of a flow sensor and a signal converter and is only available as a compact version.
Compact version	BATCHFLUX 3100 C
Nominal diameter	DN15 / ½"
Measurement range	Standard: -6...+6 m/s / 20...+20 ft/s
Factory settings	Pulse value: 0.1 ml; max. flow 1 l/s
	Low flow cut off: 22.5 ml/s
	Low flow hysteresis: 2.25 ml/s
User interface	
Operating data	Factory set to customer specification
Human Machine Interface (HMI)	Option: BATCHMon Plus software and hardware
Cable connections	Standard: 1 x M12; 5-pin connector

Measuring accuracy

Reference conditions	Medium: water	
	Inlet/outlet section: 10 DN/5 DN	
	Valve closing time variation: < 1 ms	
	Flow velocity: 1 m/s, flow conditions similar to EN 29104	
	Operating pressure: 1 bar / 14.5 psi	
Error limits at reference conditions for tap water, 400 µS/cm, 20°C/68°F:		
Maximum measuring error	**DN15:**	
	± 0.3% of measured value + 2 mm/s	
Repeatability	Filling time [s]:	Standard deviation:
	1.5...3 s:	≤ 0.3%
	3...5 s:	≤ 0.15%
	> 5 s:	≤ 0.08%

Operating conditions

Temperature	
Process temperature	Depending on ambient temperature; refer to *Temperatures* on page 22.
Cleaning temperature	CIP: maximum 1 hour, 110°C / +230°F
Shock	≤ 3 K/s
Ambient temperature	-20...+60°C /-4...+140°F
Storage temperature	-20...+70°C /-4...+158°F
Pressure	
Ambient	Atmospheric (maximum height 3000 meter/9840 ft)
Process pressure	8 bar/116 psi
Vacuum load	0 mbara/ 0 psig
Chemical properties	
Physical condition	Liquids
Electrical conductivity	≥ 20 µS/cm

Installation conditions

Installation	For detailed information: refer to *Installation conditions* on page 15
Inlet run	For detailed information: refer to *Installation conditions* on page 15
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information: refer to *Dimensions and weights* on page 11

Materials

Sensor- and converter	Housing: PPSU
Rods & grounding strip	Stainless steel
M12 connection	Nickel plated brass
Measuring tube (wetted)	Ceramic (rectangular)
Measuring electrodes (wetted)	Platinum

Process connections

Connection	Sandwich design
	Construction drawings of recommended counter flanges are available on the manufacturer website.
	DIN EN 10357 adapters are available.

Electrical connections

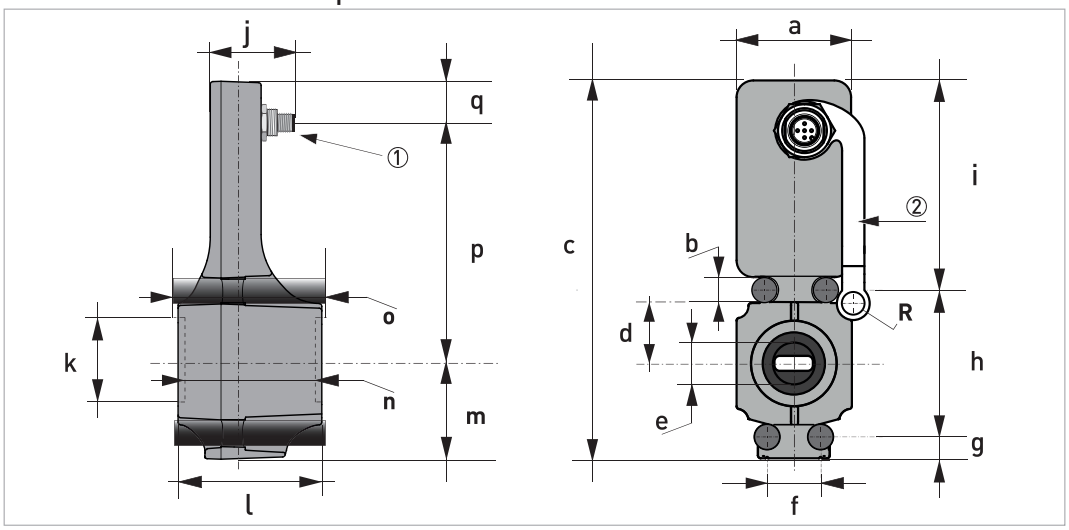
Power supply	24 VDC ± 25%
Power consumption	1.5 W
Switch on current	≤ 2.5 A (< 100 µs) at 24 VDC
Voltage loss	Possible for a maximum of 2 ms.
BATCHMON Plus	For parameter setting and diagnostic purposes, communication via PC with a single device (optional).
Status output	NA
Frequency output	
Type	Frequency (passive)
Function	All operating data preset at factory
Frequency output	≤ 10 kHz
Pulse width at full scale value	> 10 Hz: automatic, pulse width = 1 / (2 x $f_{100\%}$) or symmetrical, 1:1
	Connection of electronic counters.
	External voltage: ≥ 5 ≤ 30 VDC
	Load: I_{max} ≤ 25 mA
Low flow cut-off	Threshold: 0...6 m/s
	Hysteresis: 0...6 m/s
	Hysteresis ≤ threshold
	Depending on customers specifications.

Approvals and certifications

CE	
This device fulfils the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directives & standards and the approved certifications, please refer to the EU Declaration of Conformity or the website of the manufacturer.
Other approvals and standards	
Non-Ex	Standard
Protection category according to IEC 60529	IP69
Shock test	60721-4-3 class 3M7 (vibration & shock)
Vibration test	61298-3 "High vibration" (extended to 2 kHz)
Compliances	
Compliant with:	FDA, EC 1935/2004, EC 2023/2006, GB4806

2.2 Dimensions and weights

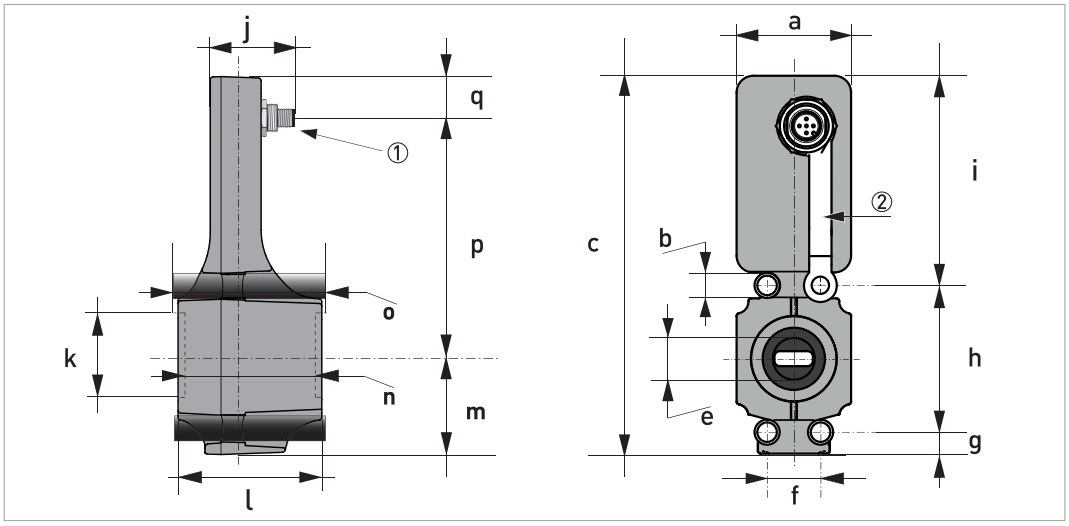
DN15 version with solid spacer



① M12; 5 pins connector (Grounding)
② Grounding strip - R (radius mounting hole) = 4.3 mm / 0.17 inch)

Weight: 0.24 kg - 0.53 lbs

DN15 version with spacer bush



① M12; 5 pins connector (Grounding)
② Grounding strip - R (radius mounting hole) = 3.1 mm / 0.1 inch

Weight: 0.18 kg - 0.39 lbs

	Dimensions [mm - inches] ± ½ mm - 0.1																
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
DN15	41	7	136	22	15	20	8	53	75	36	31	53	34	50	54	83	18
1/2"	1.6	0.3	5.5	0.9	0.6	0.8	0.3	2.1	3.0	1.4	1.2	2.1	1.3	2.0	2.1	3.3	0.7

2.2.1 Counter flanges

The BATCHFLUX 3100 C must be mounted between counter flanges (as shown in the following drawing), to ensure that the device works correctly.

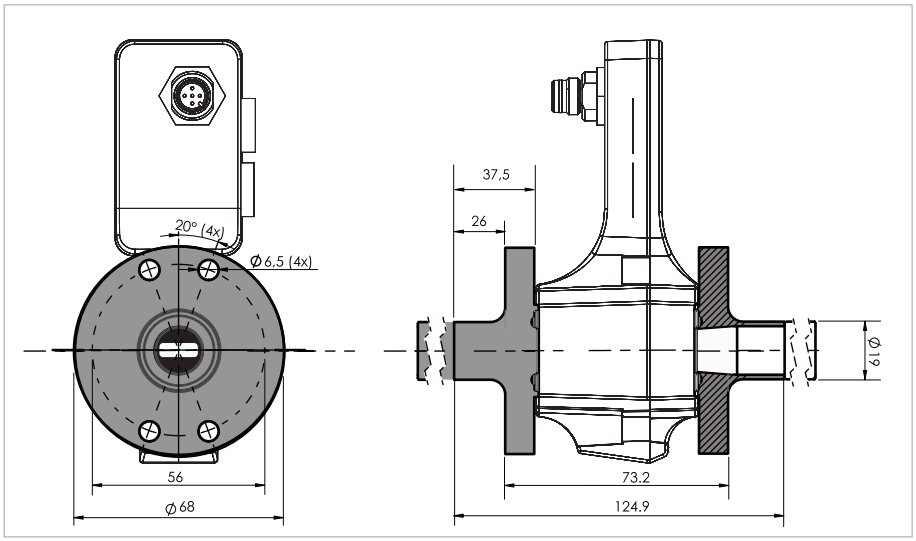


Figure 2-1: Flange according DIN 11850 row 2 / DIN 11866 row / EN 10357 Serie A

Dimensions:

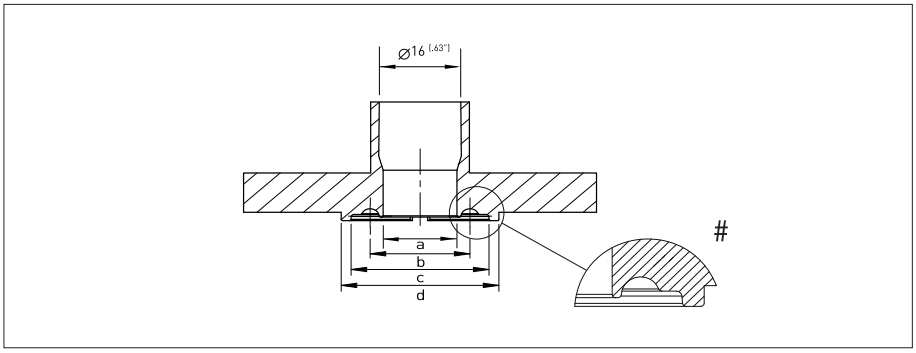


Figure 4-2: Flange according DIN 11850 row 2 / DIN 11866 row / EN 10357 Serie A

Dimensions:

Ø	a	b	c	d	O-ring
[mm]	14	19	26.2	30.4	15.5 x 3.5
inch	0.5	0.75	1.03	1.2	0.61 x 0.14

INFORMATION!
Detailed construction drawings of the above sketches are available from the manufacturer website.

2.2.2 Pressure loss

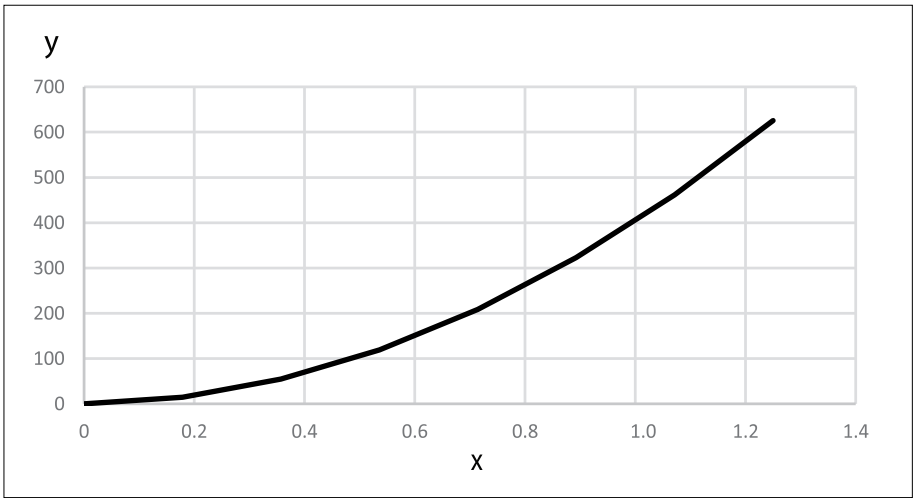


Figure 2-2: Pressure loss

x = flow volume [l/s]
y = pressure loss [mbar]

3.1 Intended use

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.

This also applies to the chemical and physical compatibility of the housing parts with the environment including cleaning process.

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

The electromagnetic flowmeter is designed exclusively for measuring the volumetric flowrate of electrically conductive, liquid process products.

3.2 General notes on installation

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

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

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

3.2.1 Vibration

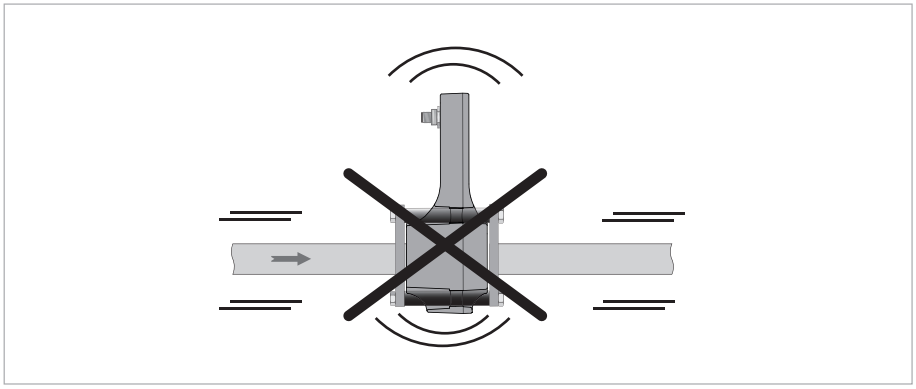


Figure 3-1: Avoid vibrations

3.2.2 Magnetic field

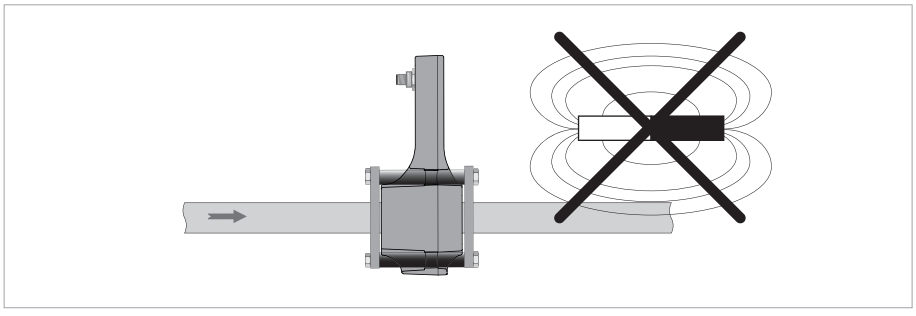


Figure 3-2: Avoid strong magnetic fileds

3.3 Installation conditions

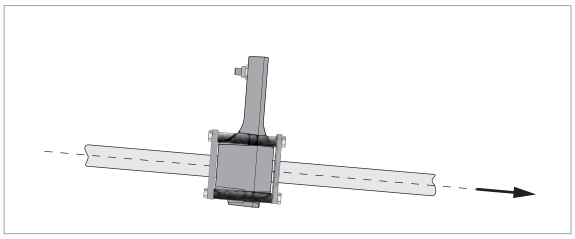


Figure 3-3: Horizontal pipe run

Install in a slightly descending pipe section , to prevent air from collecting and to avoid faulty measurements (meter can drain).

Support the pipeline on both side of the flowmeter. Make sure the M12 connector is on the flow inlet side.

3.3.1 Inlet and outlet

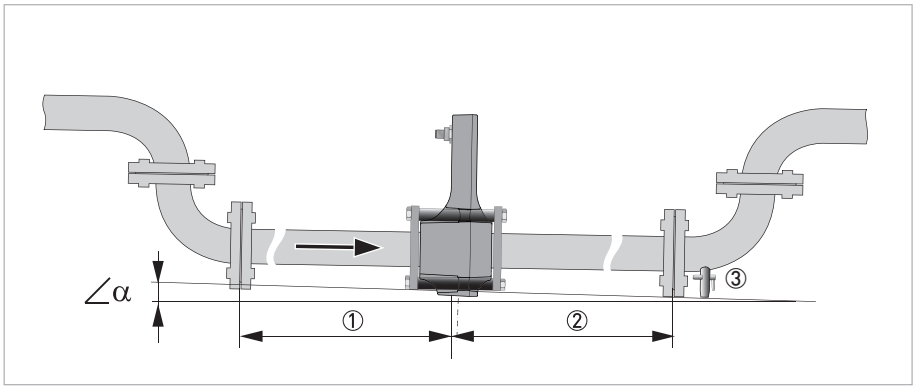


Figure 3-4: Inlet and outlet section

① Refer to chapter "Bends in 2 or 3 dimensions"
② ≥ 2 DN
③ Drain valve (to empty pipeline)

$\angle\alpha > 25°$

3.3.2 Bends in 2 or 3 dimensions

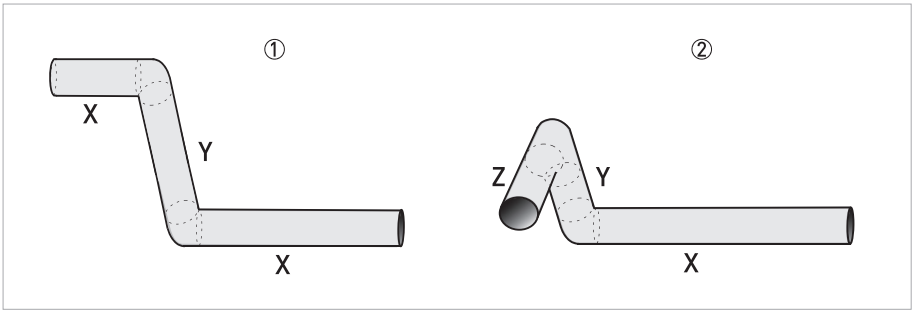


Figure 3-5: 2 and/or 3 dimensional bends upstream of the flowmeter

① 2 dimensions = X/Y
② 3 dimensions = X/Y/Z
Inlet length: using bends in 2 dimensions: ≥ 5 DN; when having bends in 3 dimensions: ≥ 10 DN

*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).*

3.3.3 T-section

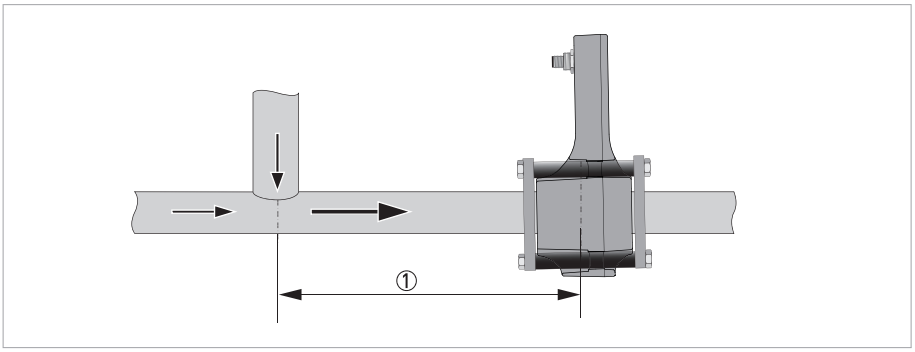


Figure 3-6: Distance behind a T-section

① ≥ 10 DN

3.3.4 Open feed or discharge

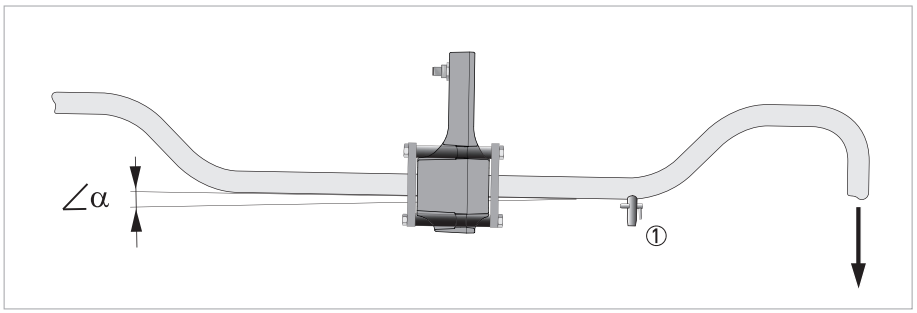


Figure 3-7: Installation in front of an open discharge

∠α > 25°
① Drain valve (to empty pipeline)

3.3.5 Pump

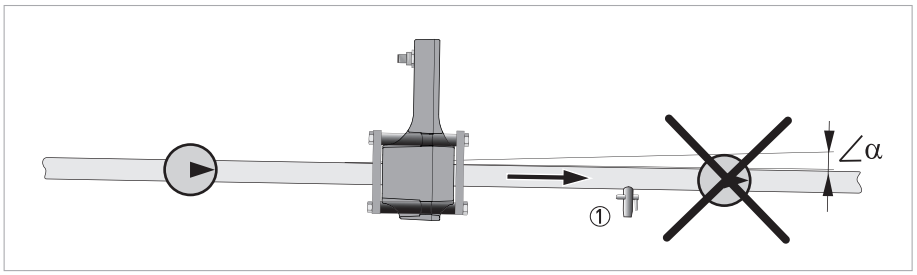


Figure 3-8: Installation behind a pump

∠α > 25°
① Drain valve (to empty pipeline)

3.3.6 Control valve

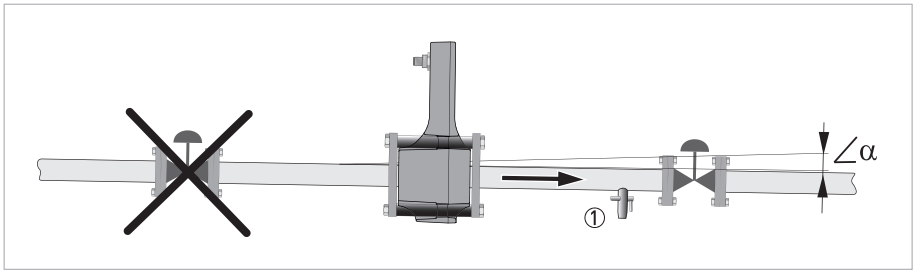


Figure 3-9: Installation in front of a control valve

∠α > 25°
① Drain valve (to empty pipeline)

3.3.7 Flange deviation

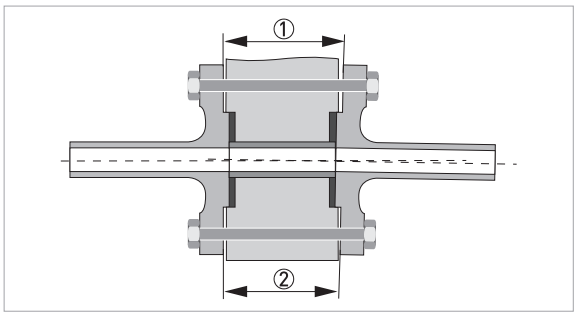


Figure 3-10: Mounting position and flange deviation

① L_{max}
② L_{min}

Max. permissible deviation of pipe flange faces:
L_{max} - L_{min} ≤ 0.5 mm / 0.02"

Install the device always with the 4 rods or bushes supplied. Non compliance will lead to damaging of the tube or leaking.

3.4 Mounting

3.4.1 Installation location

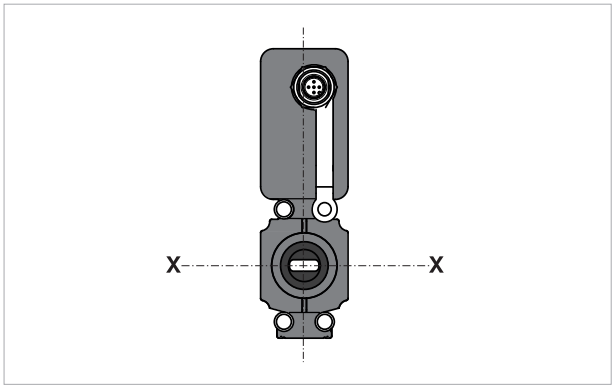


Figure 3-11: Horizontal installation

Mount the flow sensor in such a way that the electrode axis (X--------X) is approximately in a horizontal pipe run.

3.4.2 Adjustment after installation

It is not allowed to use any force (turning or rotating) on the device after installation between flanges and with the bolts already tightened.

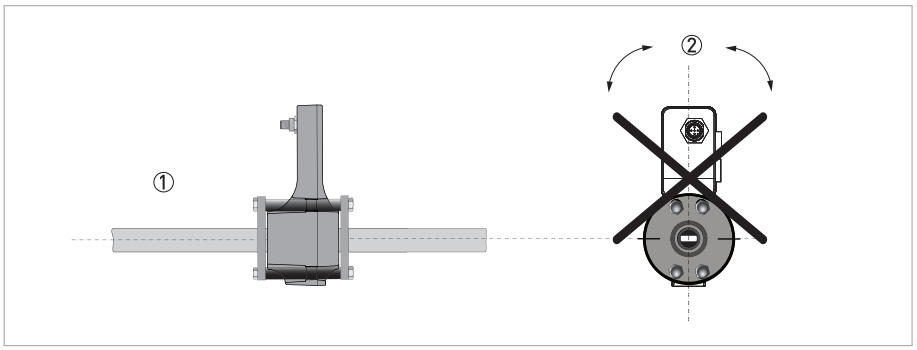


Figure 3-12: No force on device after installing

① After installation between flanges
② No turning or twisting of device

Do not use a rotation force on the device once mounted between flanges. The device will be damaged!

The (counter) flanges are installed with M6 studs and nuts, positioned and fastened through the four bushing rods. Do not exceed the specified torque!

3.4.3 Mounting position

The flowmeter can be installed in every position.

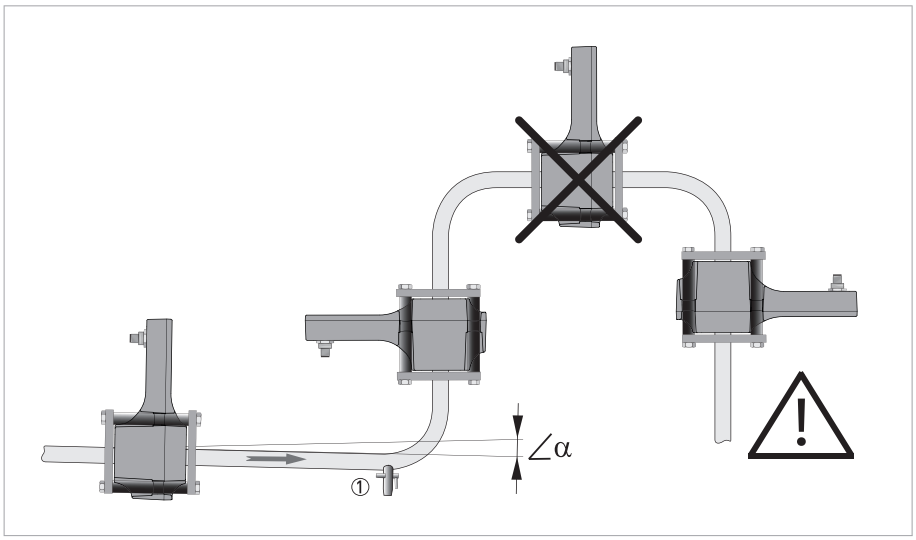


Figure 3-13: Installation in bending pipes

∠α > 25°
① Drain valve (to empty pipeline)

Install in a slightly descending pipe section (of 25 degrees or larger), to prevent air from collecting and to avoid faulty measurements (meter can drain).

To ensure a correct measurement, avoid draining or partial filling of the flow sensor during operation.

Vertical down position only in conjunction with a control valve.

3.4.4 Torques and pressures

The maximum pressure and torques values for the flowmeter are theoretical and calculated for optimum conditions and use with steel counter flanges.

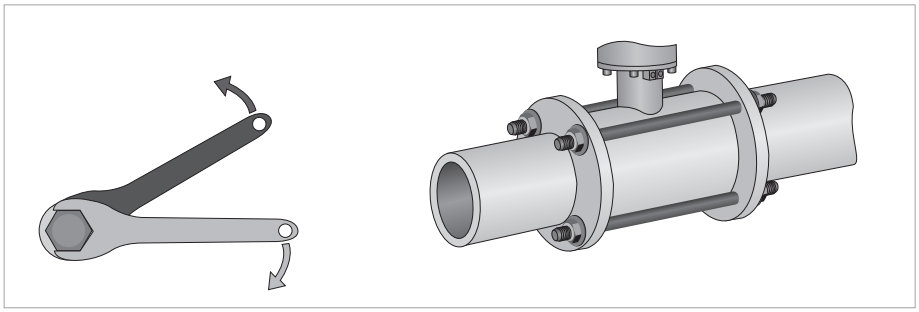


Figure 3-14: Tightening of bolts

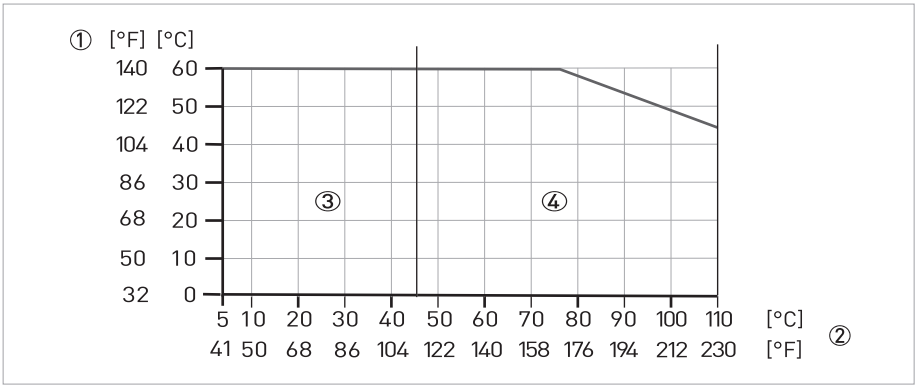
Tightening of bolts

- Always tighten the bolts uniformly and in diagonally opposite sequence.
- Do not exceed the maximum torque value.
- Step 1: Apply approx. 50% of max. torque given in table.
- Step 2: Apply approx. 80% of max. torque given in table.
- Step 3: Apply 100% of max. torque given in table.

Nominal size	Counter flanges		Max. operating pressure	Bolts	Bush / spacer	Max. torque [Nm]
	Flange size	Flange class				
DN15	15 [mm]	PN16	≤ 8 [bar]	4 x M8	solid spacer	22
				4 x M6	open bush	9
½"	½ [inch]	150 [lb]	≤ 116 [psi]	4 x M8	solid spacer	22
				4 x M6	open bush	9

3.5 Temperatures

Process temperature vs ambient temperature



① Ambient temperature
② Process temperature
③ Temperature area for continuous process
④ Temperature area for cleaning, up to 1 hour

For more information on temperatures refer to Technical data on page 8

4.1 Safety instructions

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

Observe the national regulations for electrical installations!

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.

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

4.2 EMC regulation

EMC radiation limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

The device shall not be used with long-distance lines longer than 30 meters, or which leave the building (including lines of outdoor installations).

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

4.3 Grounding

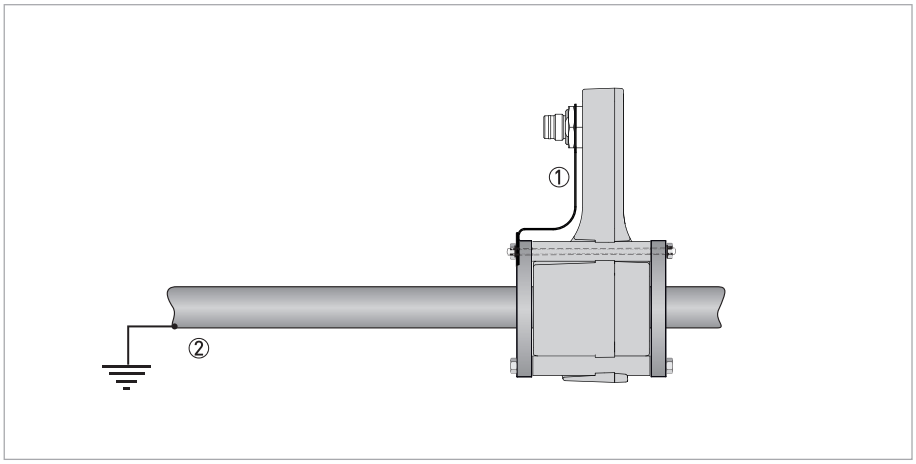


Figure 4-1: Grounding

① Metal grounding strip
② Grounding of the installation

The groundingstrip should not transmit any interference voltage. Therefore do not ground any other electrical device at the same conductor.

When connecting to functional extra-low voltages (24VDC), ensure that you use protective separation (PELV) according to IEC 60364/IEC 61140 or VDE 0100/VDE 0106.

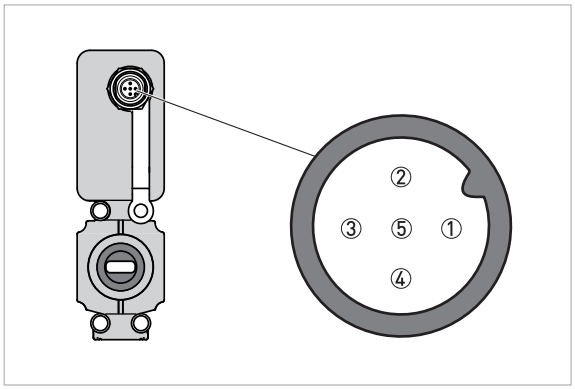
The installation requires metal piping and flanges on both sides of the process connections to ensure galvanic connection to the liquid.

Do not use excessive force to tighten the M12 nut, when connecting the metal ground strip (maximum torque allowed ≤ 4 Nm).

4.4 Electrical connection

4.4.1 Cable connector M12 - 5 pin

All the operating data are preset at the factory. For changing the parameters and diagnostic purposes BATCHMon plus operation software can be used.



① +24 VDC
② Frequency output
③ Frequency output (ground)
④ Ground
⑤ To be connected for servicing only

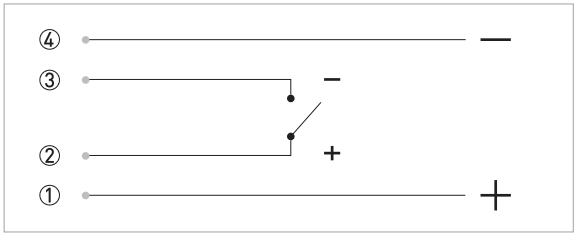


Figure 4-2: Connection diagram

Note; the switch circuits are polarity sensitive and have a resistance of approximately 76 Ohm.

Use one of the following attachment plug types to connect the flowmeter to a third party system:

- moulded plug, straight or angle-entry form
- integrally extruded plug with cable in various lengths
- moulded plug, straight form, especially suitable for high-interference environments

Cables for electrical installation are available at request, please contact the supplier. When purchasing cables, make sure the material and protection class are suitable for the installation conditions. Contact the manufacturer support office, for suitable cables options.

KROHNE – Products, Solutions and Services

- Process instrumentation for flow, level, temperature, pressure measurement and process analytics
- Flow metering, monitoring, wireless and remote metering solutions
- Engineering, commissioning, calibration, maintenance and training services

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

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