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1 Introduction

1.1 Scope of application

These instructions apply to the following Rotamass Total Insight product families:

- Rotamass Nano
- Rotamass Supreme
- Rotamass Giga
- Rotamass Prime
- Rotamass Intense
- Rotamass Hygienic
- Rotamass Total Insight Spare transmitter and Spare sensor.

1.2 Target group

The following persons are the target group of this manual:

- Technicians
- Engineers

This manual along with its applicable documents enables the target group to complete the following steps:

- Installation
- Commissioning
- Configuration (parametrization)
- Integration of the flow meter into a process control system
- Troubleshooting
- Maintenance and repair
- Replacement (sensor and transmitter)
- Dismantling and disposal

1.3 Applicable documents

The following documents supplement this manual:

- Explosion Proof Type Manual (Ex-IM) IM01U10X__-00__-R
- Software Instruction Manual (SW-IM) IM01U10S__-00__-R
- General Specifications (GS) GS01U10B__-00__-R
- Dry Verification procedure MP 208-008-2019

1.4 Contact information

For more information or questions, contact your local Yokogawa sales organization.

Additional information available at <http://www.yokogawa.com> or on the last page of this document.



1.5 Explanation of safety instructions and symbols













Signal words

Warning notices are intended to alert users to potential hazards when working with the flow meter. There are four hazard levels that can be identified by the signal word:

Signal word	Meaning
DANGER	Identifies a high-risk hazard resulting in death or severe injury unless avoided.
WARNING	Identifies a fluid-risk hazard that may lead to death or severe injury unless avoided.
CAUTION	Identifies a low-risk hazard that may lead to minor or moderate injury unless avoided.
NOTICE	Identifies a hazard resulting in property damage.

Explanation of symbols

Symbols in this document	Meaning
	Indicates a hazard, documentations must be consulted.
	Indicates important information.
IM01U10S01-00__-R	The __ symbols in the document numbers are placeholders, here, for example, for the corresponding language version (DE, EN, etc.).

Symbols on the nameplates	Meaning
	Warning that requires reading the documentation
	RCM marking
	CE marking
	ATEX explosion protection marking
	EAC and EAC Ex marking
	Korean (KC and KCs) marking
	FM/CSA marking
	NEPSI marking
	INMETRO marking
	DNV GL type approval marking
	3-A Sanitary approval marking
	China RoHS marking

Symbols on the nameplates	Meaning
	Taiwan Safety (TS) marking
	Russia Pattern approval marking
	Belarus Pattern approval marking

2 Safety

2.1 Intended use

The flow meter described in this User's Manual is intended to measure mass flow of fluids and gases while simultaneously also capturing their density and temperature. These values form the basis for calculating additional measured quantities, such as volume flow and concentration of fluids.

The flow meter uses the Coriolis principle (see Measuring principle) and can be used in process automation for a wide range of flow rate measurements. It allows for measuring various fluids, e.g.:

- Oils, grease
- Gases, liquid gases
- Acids, solutions, solvents
- Emulsions and suspensions

Use of the flow meter is limited primarily by the necessary homogeneity of the fluid and chemical resistance of the wetted parts. Details can be obtained from the responsible Yokogawa sales organization. Operational safety cannot be ensured in the event of any improper or not intended use. Rota Yokogawa is not liable for damage arising from such use.

The flow meter described in this User's Manual is a class A device according to EN 61326-1 and may only be used in an industrial environment.

2.2 Technical conditions

At normal conditions, the flow meter does not release any poisonous gases or substances.

If the flow meter is operated in faulty conditions, its safety and function may be impaired.

For this reason, the following must be observed:

- ▶ Operate the flow meter only when in good working order.
- ▶ If its operational performance changes unexpectedly, check flow meter for faults.
- ▶ Do not undertake unauthorized conversions or modifications on the flow meter.
- ▶ Eliminate faults immediately.
- ▶ Use only original spare parts.

2.3 General safety instructions

DANGER

Use of fluids that are a health hazard may result in caustic burns or poisoning

- ▶ When removing the flow meter, avoid touching the fluid and breathing gas residues left in the sensor.
- ▶ Wear protective clothing and a breathing mask.

DANGER

Use of improper materials through the customer may result in heavy corrosion and/or erosion

- ▶ The medium temperature / pressure ranges are calculated and approved without corrosion or erosion.
- ▶ The customer is fully responsible to select proper materials to withstand his corrosive or erosive conditions.
- ▶ In case of heavy corrosion and/or erosion the instrument may not withstand the pressure and an incident may happen with human and / or environmental harm.
- ▶ Yokogawa will not take any liability regarding damage caused by corrosion / erosion.
- ▶ If corrosion / erosion may happen, the user has to check periodically if the necessary wall thickness is still in place.

DANGER

Improper installation in hazardous area

The following basic safety instructions must be observed when handling the flow meter:

- ▶ When using the flow meter in areas at risk of explosion, compliance with the Explosion Proof Type Manual is mandatory.

WARNING

High fluid temperatures may result in hot surfaces and therefore a risk of burns

- ▶ Apply thermal insulation to sensor.
- ▶ Attach warning labels to the sensor.
- ▶ Wear protective gloves.

WARNING

Risk of injury from electrical shock due to inadequate clothing

- ▶ Wear protective clothing as required by regulations.

⚠ WARNING**Risk of injury from electrical shock at the transmitter**

- ▶ Avoid handling the transmitter with wet hands.
- ▶ Wear protective gloves.

The following basic safety instructions must be observed when handling the flow meter:

- ▶ Carefully read the User's Manual prior to operating the flow meter.
- ▶ Only qualified specialist personnel must be charged with the tasks described in this User's Manual.
- ▶ Ensure that personnel complies with locally applicable regulations and rules for working safely.
- ▶ Do not remove or cover safety markings and nameplates from flow meter.
- ▶ Replace soiled or damaged safety markings on the flow meter. For replacing please contact the Yokogawa Service Center.
- ▶ If Rotamass Total Insight is used to measure safety-related quantities, ensure that the transmitter does not display any error messages and, if applicable, the Total Health Check function is performed at regular intervals (see applicable General Specifications GS01U01B__-00__-R, chapter "Options").
- ▶ Avoid erosion and corrosion as they reduce accuracy and resistance to temperature and pressure. Over time, calibration constants change as a result of erosion and corrosion, therefore requiring recalibration. Rota Yokogawa does not assume any guaranty or liability with respect to corrosion resistance of wetted parts in any specific process. The user is responsible for selecting the appropriate materials. Rota Yokogawa provides support in clearing up the question of corrosion resistance of the materials used (special fluids but also cleaning agents). Minor changes in temperature, concentration or pollution degree in the process may result in differences in terms of corrosion resistance. In case of corrosion or erosion, the pipes must be checked periodically to ensure necessary wall thickness. This can be accomplished by using, for example, the Tube Health Check function (see applicable General Specifications GS01U01B__-00__-R, chapter "Options").
- ▶ When performing welding tasks on the pipe, it is important not to ground the welding equipment by way of the flow meter. Soldering and welding work on parts of the flow meter is prohibited.
- ▶ Continuous temperature fluctuations in excess of 100 °C may result in tube failure due to material fatigue and therefore must be avoided.
- ▶ The operator is responsible for ensuring that design limits (pressure, temperature) are not exceeded in the event unstable fluids decay.
- ▶ External influences may result in failure of threaded connections. The operator is responsible for providing suitable protective measures.
- ▶ Compression and shock waves in pipes can cause damage to the sensor. For this reason it is important to avoid exceeding the design limits (pressure, temperature).
- ▶ Fires may result in increased process pressure (caused by temperature-related volume changes) and failure of gaskets. The operator is responsible for taking suitable measures to prevent fire-related damage.
- ▶ Manufacturing methods and technologies have been successfully field-tested for decades. Erosion and/or corrosion are not taken into account.
- ▶ Removal of material from the flow meter with power tools such as drills or saws is not permitted.
- ▶ Any repair, modification, replacement or installation of replacement parts is permitted only if it's complying with this User's Manual. Other work must be first authorized by Rota Yokogawa. Rota Yokogawa does not assume liability for damage caused by unauthorized work on the flow meter or by improper use.

3 Warranty



Please contact the Yokogawa sales organization if the device needs to be repaired.

The warranty terms for this device are described in the quotation.

If a defect for which Yokogawa is responsible occurs in the device during the warranty period, Yokogawa will repair that defect at its own cost.

If you believe that the device is defective, please contact us and provide a detailed description of the problem. Please also tell us how long the defect has already occurred and list the model code and serial number. Additional information, such as drawings, simplifies the identification of the cause and repair of the defect.

Based on our test results, we determine whether the device can be repaired at Yokogawa's expense or at the expense of the customer. If, for example, the Yokogawa calibration device for the water flow rate confirms a deviation of the output signal from the stated flow rate accuracy of the device, the device is deemed defective.

The warranty does not apply in the following cases:

- If the adhesion, blockage, deposit, abrasion or corrosion is the result of the device's actual use.
- If the device is mechanically damaged through solids in the fluid, hydraulic shock, or similar influences.
- If the instructions in the corresponding General Specifications or User's Manual that must be met have not been followed.
- In case of problems, errors or damage that result from unprofessional installation by the customer, for example due to insufficient tightness of the pipe fittings.
- In case of problems, errors or damage that result from operation, handling or storage in rough ambient conditions that are beyond the specifications of the device.
- In case of problems, errors or damage that result from unprofessional or insufficient maintenance by the customer, for example, if water or foreign particles enter the device due to opening the device cover.
- In case of problems, errors or damage that result from use or from performing maintenance work on the device in a location other than the installation location specified by Yokogawa.
- In case of problems, errors or damage that result from modification or repair work that was not performed by Yokogawa or by a person authorized by Yokogawa.
- In case of problems, errors or damage that result from unprofessional installation, if the location of the device has been changed.
- In case of problems, errors or damage that result from external factors, such as other devices that are connected to this device.
- In case of problems, errors or damage that result from catastrophic external influences, such as fire, earthquake, storm, flooding or lightning.

4 Product specification

4.1 Scope of delivery

The scope of delivery of the flow meter must be checked for completeness using the following list:

Tab. 1: Overview: Scope of delivery of the flow meter

	Integral type	Remote type	Spare sensor	Spare transmitter
Sensor	1 unit	1 unit	1 unit	–
Transmitter		1 unit	–	1 unit
Connecting cable	–	Length acc. to model code	–	–
Operating tool for terminals	2 units	2 units	2 units	2 units
2-inch pipe mounting bracket set <ul style="list-style-type: none"> ▪ Sheet metal console (bracket) ▪ Mounting bracket (U-bracket) ▪ Fixing materials (2 nuts, 2 washers, 4 Allen screws) 	–	1 set	–	1 set
Pipe installation set for sensor (with device option PD) <ul style="list-style-type: none"> ▪ Sheet metal console (bracket) ▪ Mounting bracket (U-bracket) ▪ Fixing plate ▪ Fixing materials (14 nuts, 6 washers, 4 bolts, 8 notched washers, 4 rubber buffers) 	–	1 set	1 set	–
Cable glands are included for a device with metric cable entries and without Ex approval. Please note: <ul style="list-style-type: none"> ▪ No cable glands are included for a device with cable entries other than metric. ▪ For a device with Ex approval the inclusion of cable glands may vary. Please refer to the applicable Explosion Proof Type Manual. 	2 units	2 units	–	2 units
Cable glands for connecting cable between sensor and transmitter, metal (pre-installed)	–	2 units	–	–
Termination kit for shortening the connecting cable (not with option L000 or Y000), including instruction booklet.)	–	1 set	–	–
Document folder with this content: <ul style="list-style-type: none"> ▪ Product CD/DVD (includes the complete product documentation) ▪ Quick Reference Instruction Manual ▪ Safety Regulations Manual ▪ Further documents like certificates (depending on model code) 	1 folder	1 folder	1 folder	1 folder

4.2 Identification

The model code can be used to identify the flow meter along with its specification. The model code is located on each main nameplate.

4.2.1 Nameplates

The sensor as well as the transmitter each contain a main nameplate and an additional nameplate that feature different information.

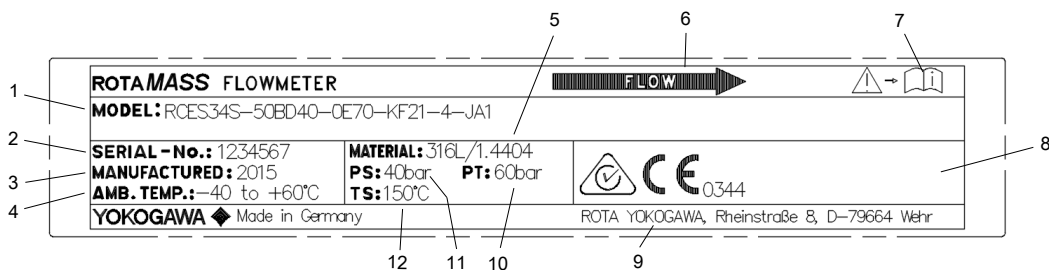
NOTICE

For individual applications (e.g. marine applications with option MC_) additional limitations to those on the nameplate may apply according to the respective applicable regulations. The language of the nameplates may vary depending on the selected option (e.g. Russian language with option VE).

The variants of the nameplates are described below.

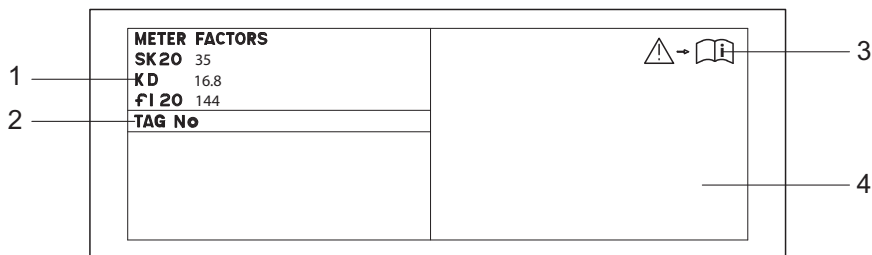
Sensor

Main sensor nameplate



1	Model code	7	Warning that requires reading the documentation
2	Serial number	8	Area for conformity marking
3	Year of manufacture	9	Manufacturer's address
4	Ambient temperature range	10	Maximum allowed test pressure at room temperature
5	Kind of material	11	Maximum allowed working pressure at room temperature
6	Direction of flow	12	Maximum allowed process temperature

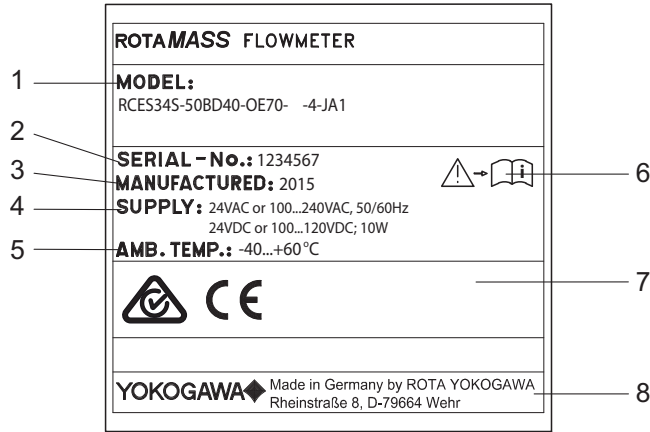
Additional sensor nameplate



1	Calibration constants of sensor	3	Warning that requires reading the documentation
2	Customer-Device location identification (option BG)	4	Space for Ex marking (see Explosion Proof Type Manual)

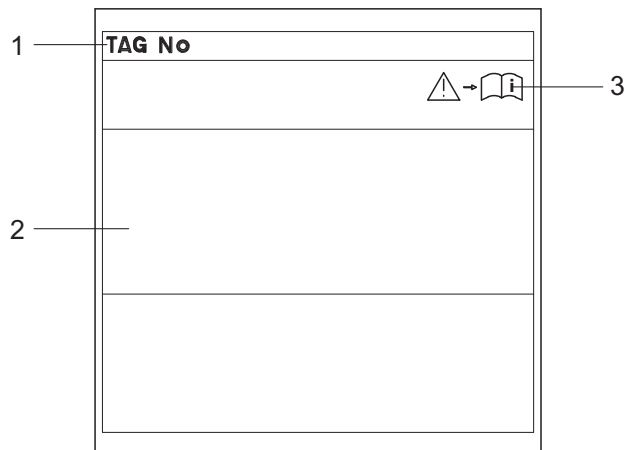
Transmitter

Main transmitter nameplate



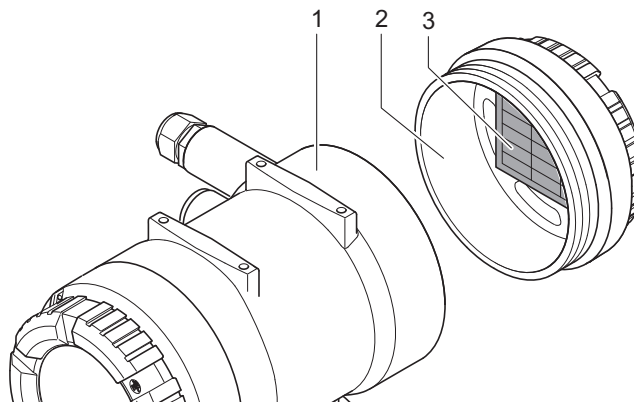
- 1 Model code
- 2 Serial number
- 3 Year of manufacture
- 4 Power supply range
- 5 Ambient temperature range
- 6 Warning that requires reading the documentation
- 7 Area for conformity marking
- 8 Manufacturer's address

Additional transmitter nameplate



- 1 Customer-Device location identification (option BG)
- 2 Space for Ex marking (see Explosion Proof Type Manual)
- 3 Warning that requires reading the documentation

Transmitter label



- 1 Transmitter
- 2 Transmitter back cover
- 3 Label

1	Spare Serial No.:		
2	Serial_No.:	D1xxxxxxxx	
3		Ex works:	Update 1:
4	SW_Revision:	xx.xx.xx	<input type="text"/>
5	Sensor_FW:	xx.xx.xx	<input type="text"/>
6	HMI_FW:	xx.xx.xx	<input type="text"/>
7	HW:	xx.xx.xx	<input type="text"/>
8	Date:	2018-11-19	
9	Dev_Rev / Dev_Rev_Comp:	xx / xx	<input type="text"/>
10	Communication:	PROFIBUS PA	
	IDENT_NUMBERS:	0x45A0 [0x9740, 0x9741, 0x9742]	

- 1 Spare serial number
- 2 Serial number
- 3 Main software revision
- 4 Sensor software revision
- 5 Indicator software revision
- 6 Hardware revision
- 7 Date of Ex works/ Update
- 8 Device Revision / Device Revision Compatibility
- 9 Type of Communication
- 10 Supported "IDENT NUMBERS" (only for PROFIBUS PA)

NOTICE

Software revisions are also shown on the Indicator after power on, with the following designations:

- ▶ "SW_Revision" indicated as "Main"
- ▶ "Sensor_FW" indicated as "Sensor"
- ▶ "HMI_FW" indicated as "Indicator"

4.2.2 Model code

General specifications

All available properties of the Rotamass Total Insight Coriolis mass flow and density meter are specified by means of a model code.

The position of the model code relevant to the respective property is depicted and highlighted in blue.

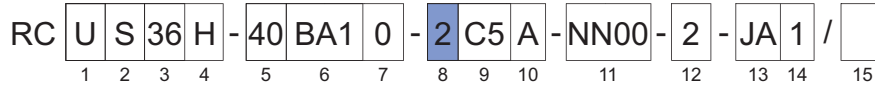


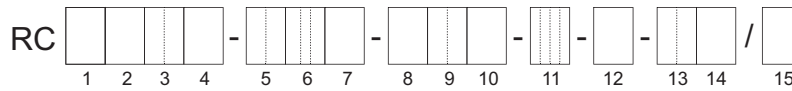
Fig. 1: Example of an model code

A complete description of the model code is included in the General Specifications (GS) of the corresponding product family.

The model code of the Rotamass Total Insight is explained below.

Items 1 through 14 are mandatory entries and must be specified at the time of ordering.

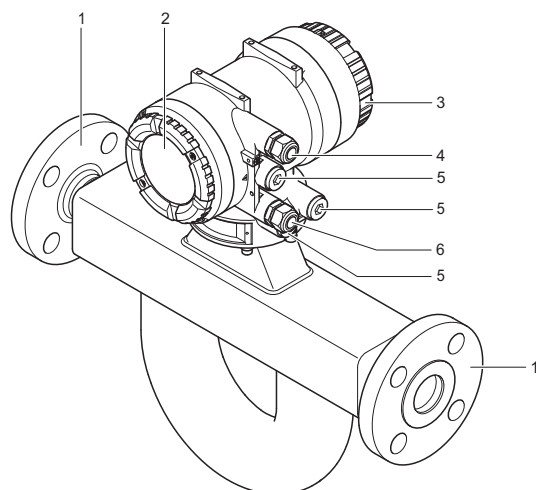
Device options (item 15) can be selected and specified individually by separating them with slashes.



- 1 Transmitter
- 2 Sensor
- 3 Meter size
- 4 Material wetted parts
- 5 Process connection size
- 6 Process connection type
- 7 Sensor housing material
- 8 Process fluid temperature range
- 9 Mass flow and density accuracy
- 10 Design and housing
- 11 Ex approval
- 12 Cable entries
- 13 Communication type and I/O
- 14 Display
- 15 Options

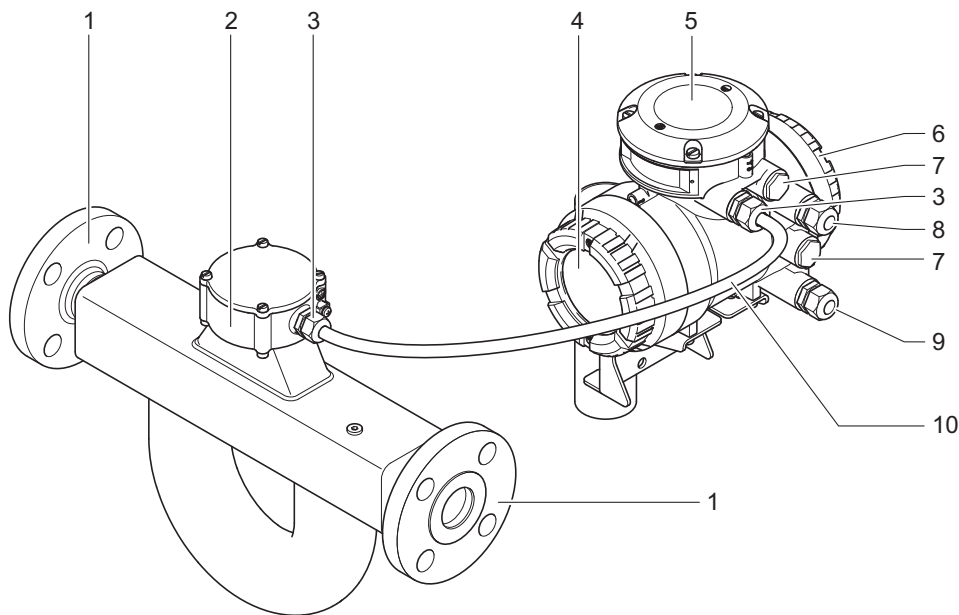
4.3 Flow meter components

Integral type



- 1 Process connections
- 2 Back cover for inputs and outputs, and power supply
- 3 Display cover
- 4 Power supply cable entry
- 5 Blind plug
- 6 Inputs/outputs cable entry

Remote type



- 1 Process connections
- 2 Terminal box
- 3 Cable entry for connecting cable
- 4 Display cover
- 5 Sensor connection cover
- 6 Back cover for inputs and outputs, and power supply
- 7 Blind plug
- 8 Inputs/outputs cable entry
- 9 Power supply cable entry
- 10 Connecting cable

5 Transport and storage

5.1 Transport

The following rules apply when transporting the flow meter:

- ▶ Observe the transport-related instructions on packaging.
- ▶ In order to avoid damage, do not unpack the flow meter until it is at the installation site.
- ▶ Do not remove protective materials, such as protective stickers or covers from process connections during transport.
- ▶ Starting at a weight of 15 kg, have at least two persons and/or use suitable tools (shoulder straps, lifting device, cart) to lift and transport the flow meter.

⚠ WARNING

Risk of injury from slipping or falling flow meter

- ▶ Ensure that suspension points of the ropes are located above the flow meter's center of gravity.
- ▶ Use a lifting device meeting local regulations.
- ▶ Attach lifting ropes to process connections.
- ▶ Do not suspend flow meter from transmitter housing, neck of sensor or flange holes.

The lifting ropes must always be attached to the sensor at the process connections (except for the Rotamass Nano). The depictions that are crossed out in the figure below show impermissible attachment types. This applies to the remote type, the remote type with long neck and the integral type, independent of the design. If the process connections are others than flanges, the holding ropes must be secured against slipping, if necessary (for example, for the Rotamass Hygienic).

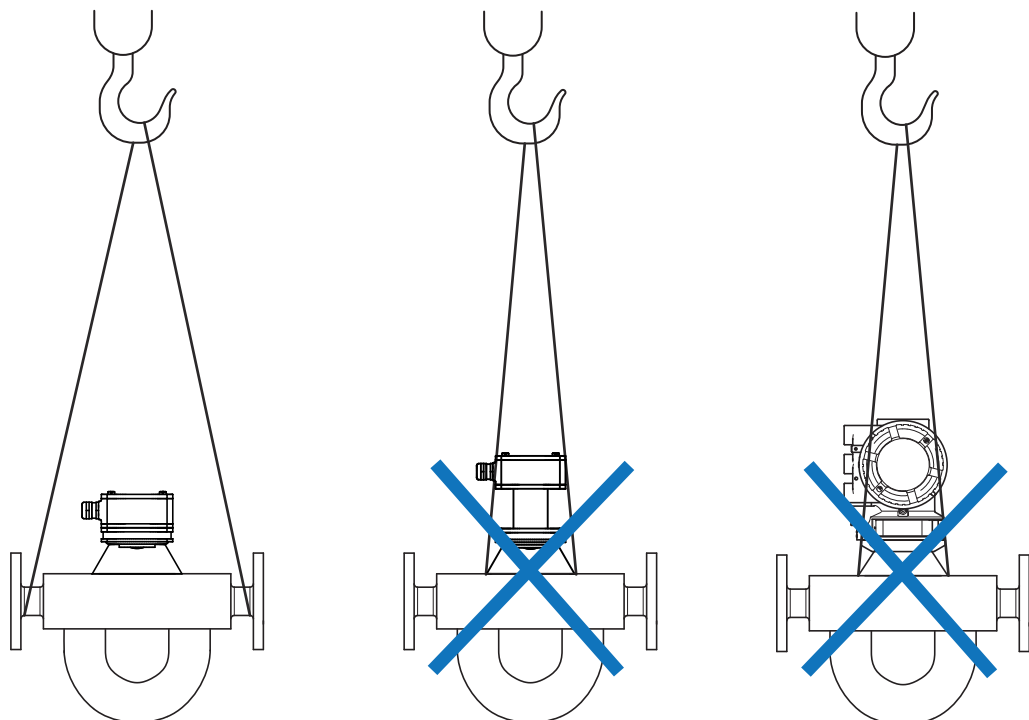


Fig. 2: Attachment of the transport ropes to the sensor independent of the design (impermissible attachment types are crossed out)

5.2 Storage

Please note the following rules apply when storing the flow meter:

NOTICE**Risk of damage to the flow meter due to storage in a damp environment**

- ▶ Protect flow meter from rain and humidity.
 - ▶ Ensure that a relative humidity of 95 % is not exceeded.
-

NOTICE**Risk of damage to the flow meter due to mechanical wear during storage**

- ▶ Store flow meter in a location that is secured against mechanical influences.
- ▶ Ensure compliance with the allowed storage temperature, see *Specifications* [▶ 109].
- ▶ Protect flow meter against direct insolation to prevent exceeding the allowed storage temperature.
- ▶ Protect flow meter from rain and inappropriate humidity.
- ▶ Keep protective materials such as protective stickers or covers on process connections or re-apply them.
- ▶ Prior to storing a used flow meter, completely drain all fluids from the measuring tube, as well as from the process and heat tracing connections (if applicable), and thoroughly clean the flow meter, see *Dismantling and disposal* [▶ 107].

6 Installation

6.1 Installation instructions



WARNING

Risk of injury during installation due to insufficiently trained personnel

- ▶ Only have skilled personnel install the flow meter.

NOTICE

Risk of damage to the flow meter due to excessive mechanical stress

- ▶ The flow meter must not be used as a support for climbing (e.g. during installation work on the tube system). The flow meter must not be used to support external loads (e.g. as a support for pipes) or as a surface for depositing heavy tools (e.g. during installation work on the pipe system).
- ▶ The weight of the flow meter may generate additional mechanical forces on the piping that might lead to tensions at process connections. Design measures must be taken to prevent the above.

NOTICE

Risk of damage to the flow meter due to mechanical influences

- ▶ Protect the flow meter from vibration, shocks and mechanical strain.

NOTICE

Meet the environmental conditions of the respective General Specifications (see GS01U10B0_00-00_00-R) to prevent disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.

6.1.1 Installation dimensions

Dimensions and installation lengths of sensor and transmitter are listed in the General Specifications of the corresponding Rotamass Total Insight family in the chapter *Mechanical specification*.

6.1.2 Installation site

In order to ensure stability while operating the flow meter, the following rules regarding placement must be followed:



CAUTION

Risk of injury during installation, if space for free movement is insufficient

- ▶ Select an installation site that offers enough space for installation, electrical installation, maintenance, etc.

NOTICE

Risk of damage to the flow meter due to extreme environmental conditions

- ▶ Do not install flow meter in locations subject to severe temperature fluctuations.
- ▶ Do not install flow meter in locations subject to direct insolation or install additional sun protection.
- ▶ Avoid installation sites susceptible to cavitation, such as immediately behind a control valve.
- ▶ Install flow meter far removed from motors, transformers or other transmitters.
- ▶ If the plan calls for installing two sensors of the same kind back-to-back, use a customized design. Contact the responsible Yokogawa sales organization.
- ▶ Operate the flow meter below an elevation of 2000 m above sea level.
- ▶ If possible, avoid installing the flow meter at the end of a downpipe.

- ▶ When installing in a hazardous area, the separate Explosion Proof Type Manual must be considered.
- ▶ Install flow meter away from magnetic compasses as it contains no precaution to prevent it from causing compass deviations.
- ▶ Density indication of the Coriolis flow meter depends on installation orientation and has to be corrected. For vertical and horizontal orientation (maximum deviation $\pm 5^\circ$) of the sensor this can be done by the transmitter automatically if the appropriate sensor orientation is selected. For other orientations (inclinations to vertical or horizontal orientation $\geq 5^\circ$) this can not be automatically corrected and has to be taken into account. For highest density accuracy it is recommended to avoid sensor orientations different to horizontal or vertical installation.

6.1.3 Instructions

Observe the following general installation instructions during installation:

- ▶ Install the flow meter avoiding shock and vibration as much as possible.
- ▶ Use closing valves and bypass line to facilitate zero point setting.

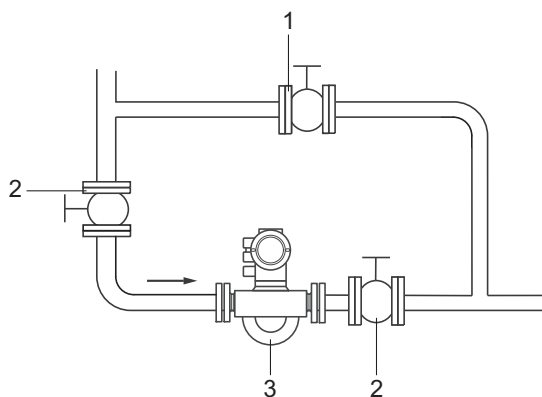


Fig. 3: Closing valves and bypass line

- | | |
|---|---------------------|
| 1 | Bypass valve |
| 2 | Closing valve |
| 3 | Coriolis flow meter |

- ▶ For application involving fluids, avoid installation at highest point of piping. Formation of gas bubbles and accumulation of gas in measuring tube may result in increased measurement uncertainties.
- ▶ In case of gas measurements, avoid installation directly in front of lowest point in piping. Accumulation of fluids, such as condensate, may result in lower accuracy.
- ▶ Do not install immediately in front of a free pipe outlet in a downpipe.
- ▶ Avoid letting the sensor run idle while taking the measurement, e.g. when installed in front of an air gap to containers in case of filling applications. Doing so may result in incorrect measurements. To avoid this, install a restriction in the open downpipe or use an orifice gauge with a diameter smaller than the nominal pipe width.
- ▶ Each device is tested for pressure prior to delivery.

6.1.4 Installation position

Rotamass Total Insight Coriolis mass flow and density meters can be mounted horizontally, vertically and at an incline. The measuring tubes should be completely filled with the fluid during this process as accumulations of air or formation of gas bubbles in the measuring tube may result in errors in measurement. Straight pipe runs at inlet or outlet are not required.

Sideways position

The sideways position must be avoided when installing the flow meter, because this may result in a deterioration of accuracy.

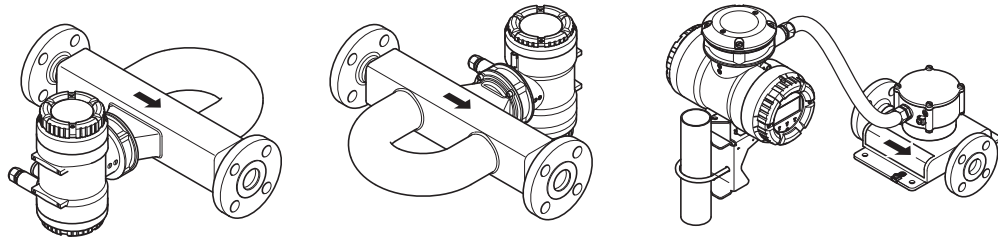


Fig. 4: Installation positions to be avoided: Flow meter in sideways position

Horizontal installation

- ▶ In case of fluids, install the measuring tubes downward so as to avoid gas accumulation in case of a low flow rate.
- ▶ For gas applications, install the measuring tubes upward so as to avoid fluid accumulation in case of a low flow rate.

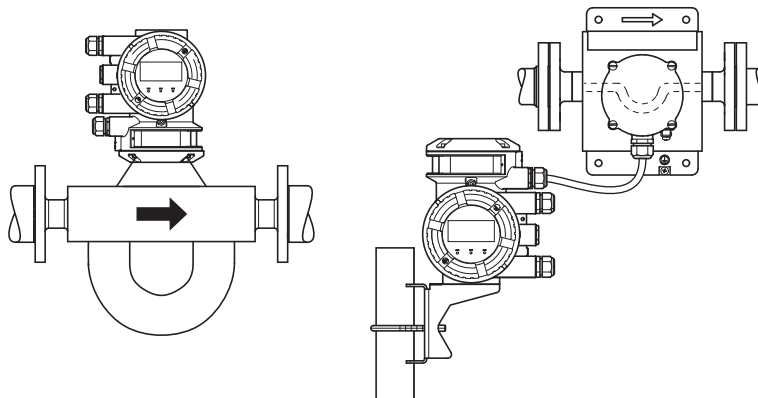


Fig. 5: Horizontal installation, measuring tubes downward

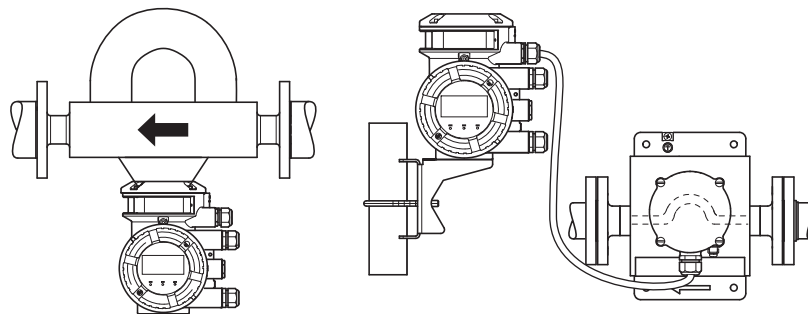


Fig. 6: Horizontal installation, measuring tubes upward

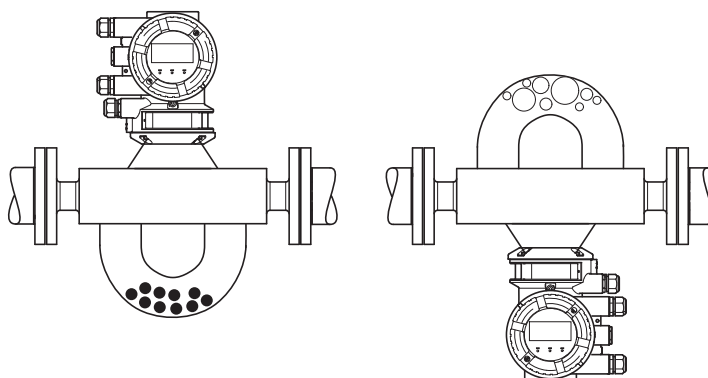


Fig. 7: Risk of solid matter and/or gas accumulation

Vertical installation (recommended)

- ▶ Draining the pipe is easier in case of maintenance, production start or product change.
- ▶ Allows gas bubbles to escape more easily.
- ▶ Only one shut-off valve required to ensure zero flow rate when running autozero.

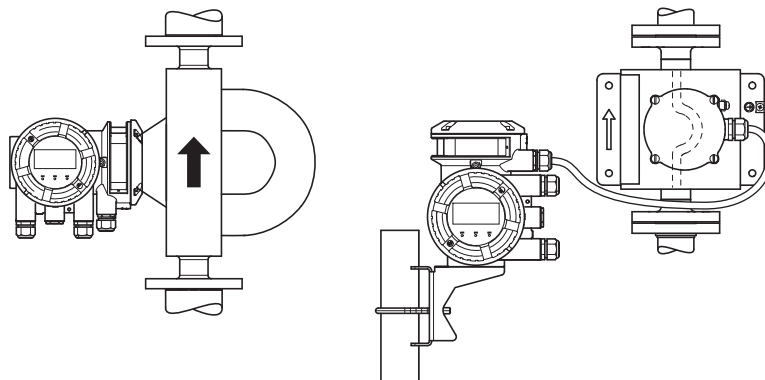


Fig. 8: Vertical Installation

6.1.5 Sanitary installation

EHEDG compliant installation

In order to comply with the requirements of the European Hygienic Engineering and Design Group (EHEDG), the following aspects need to be considered:

- ▶ The installation must ensure a self-draining of the device (see figure below). A vertical installation is recommended.
- ▶ An EHEDG compliant process connection requires a combination of process connections and gaskets according to the latest version of the EHEDG Position Paper: "Easy cleanable Pipe couplings and Process connections".

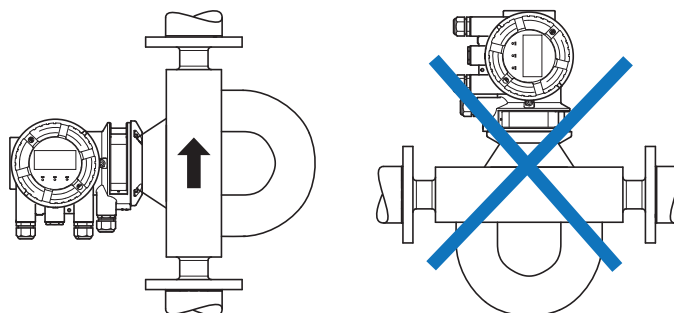


Fig. 9: EHEDG compliant installation position

3-A compliant installation

Remote transmitter installation

- ▶ For compliance with 3-A sanitary standards, remote transmitter is restricted to hanging installation, as shown in figure below.

NOTICE

Fixation of the transmitter

For fixation of the transmitter at the bracket either hexagon head screws (M6x10) or socket head screws with rubber cap must be used.

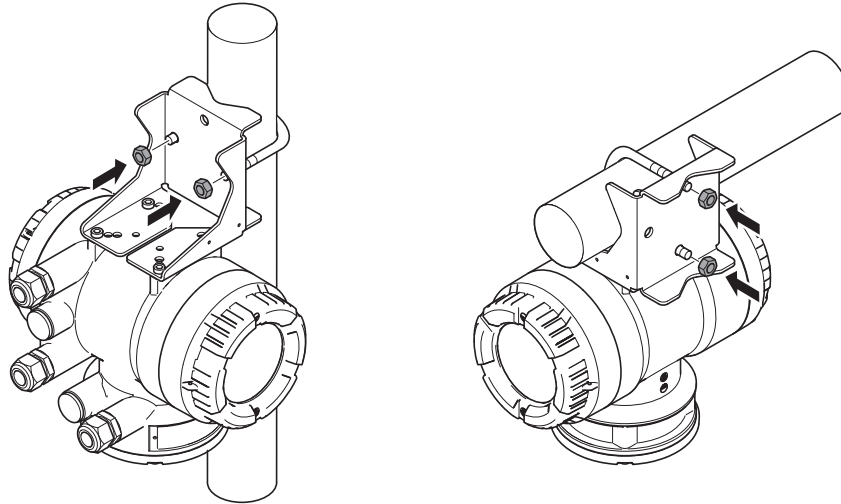


Fig. 10: Hanging installation for remote transmitter

Sensor installation (remote or integral version)

- ▶ For compliance with 3-A sanitary standards, a vertical installation of sensor with fluid flowing upwards (self-draining) is recommended, as shown in figure below.

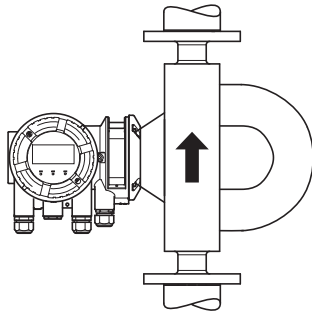


Fig. 11: Vertical (self-draining) installation

- ▶ A horizontal installation of sensor with tubes down, as shown in figure below, shall be drained via air purge.

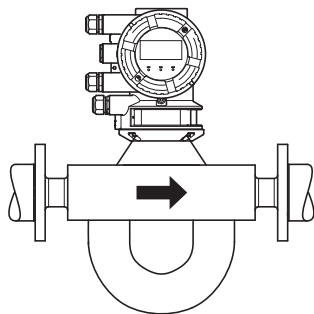


Fig. 12: Horizontal installation with tubes down

- ▶ For Cleaning-In-Place (CIP) application, the standard minimum flow velocity of 1.5 m/s shall be used for cleaning the sensor. Volumetric flow shall be determined by using the cross-sectional area at process connection.

Notes on fittings and gasket

- ▶ General note: It must be ensured that the inner diameter (ID) of adjacent pipe matches the ID of process connection of the sensor fitting to ensure 3-A compliance.
- ▶ For compliance of DIN 11851 process connection (process connection HS2) with 3-A standards, a special sanitary gasket such as the k-flex gasket system by Kieselmann GmbH, or similar must be used to retain 3-A compliance.

6.2 Unpacking

Note the following rules prior to installation:

- ▶ Check packaging and contents for damage.
- ▶ Do not remove protective materials such as protective stickers or caps on process connections until the start of the installation process.
- ▶ Dispose packaging materials in compliance with country-specific regulations.

6.3 Sensor installation

6.3.1 General installation rules



Risk of injury due to escaping fluids, if pipe connection is faulty

- ▶ Correct slope and mismatch of pipe connections before inserting the sensor.

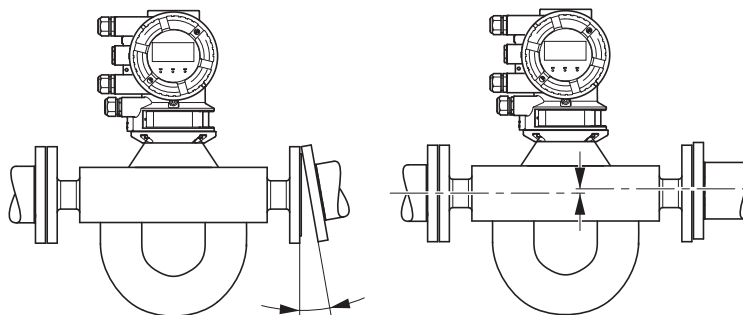


Fig. 13: Avoid: Slope and mismatch

- ▶ Avoid fixing anything directly to the sensor. Doing so may result in increased deviations.

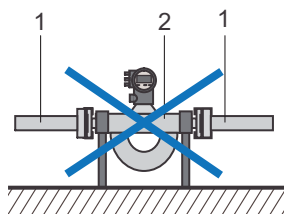


Fig. 14: Installation to be avoided: Fixing the sensor

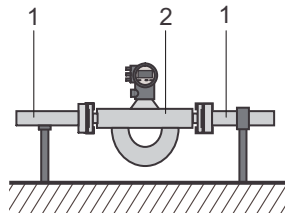


Fig. 15: Recommended installation: use the piping to support the sensor

- 1 Pipe
- 2 Sensor

- ▶ Secure pipes before installing the flow meter.
- ▶ Avoid damaging the process connections.
- ▶ Flush new pipes before installing the flow meter to remove foreign matter, such as shavings or other residues.

Avoiding creation of noise

Zero point stability is a prerequisite for exact mass flow measurement. Insufficient installation may lead to mechanical tensions or flow noise which impact zero point stability.

Countermeasures to help avoid noise creation:

- ▶ Support sensor weight by using soft coupling (silicone or other types of cushioning materials).
- ▶ Avoid bending or tensioning the sensor while aligning the pipe.
- ▶ Avoid reductions or expansions in pipe directly up- or downstream of flow meter.
- ▶ Avoid placing control valves, apertures or other devices generating noise near the sensor.

6.3.2 Installation in pipe

Depending on process connections, the sensor is connected to the pipe by means of flanges, terminals or thread. The model code provides information on the process connections selected.

DANGER

Risk of injury due to escaping fluids and damage, if fixing materials are inappropriate or not professionally installed

- ▶ Fixing materials (screws, nuts, terminals, terminal connectors, gaskets, etc.) are not included in the delivery and must be provided by the customer. The operator is responsible for selecting suitable gaskets and defining corresponding torque values.
- ▶ Protective materials such as protective stickers or caps on process connections must be removed immediately before installation.
- ▶ The direction in which the fluid flows through the pipe is indicated by an arrow on the flow meter. The sensor must be installed in accordance with the flow direction indicated to ensure optimal measuring results for density measurements.

Otherwise, the parameter *flow direction* in the transmitter menu must be changed, see applicable Software Instruction Manual.

Clamp connection

The clamp connection must be installed as shown in the figure below.

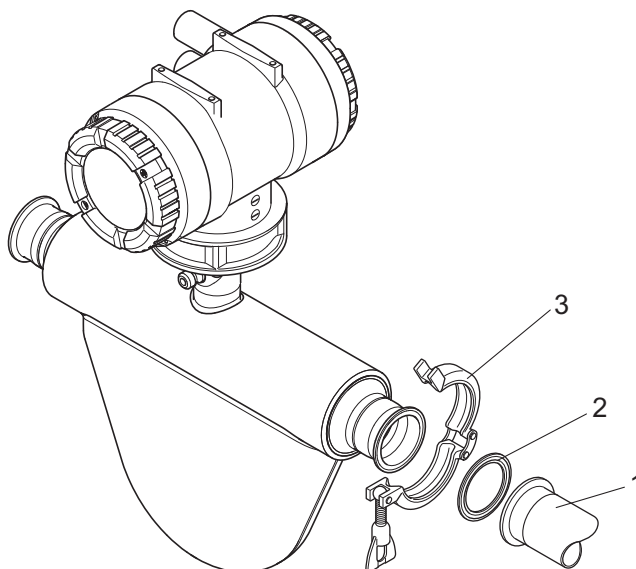


Fig. 16: Clamp connection

- | | |
|---|--------------------|
| 1 | Terminal |
| 2 | Gasket |
| 3 | Terminal connector |

Fixing the flange

- ▶ Use screws and nuts suitable for the flanges.
- ▶ In case the nominal width of the piping deviates from the flow meter, use the appropriate reductions.
- ▶ Inner gasket diameters should not fall below the inner diameters of the flange.

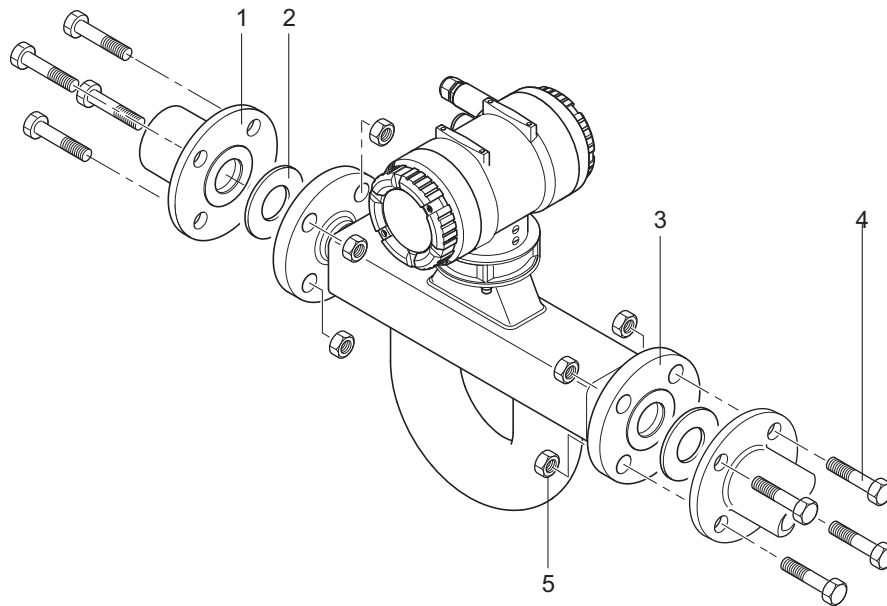


Fig. 17: Fixing the flange

- 1 Pipe flange
- 2 Gasket
- 3 Sensor flange
- 4 Bolt
- 5 Nut

Internal thread connection

For process connections with an internal thread, the connection must be installed in accordance with the following figure.

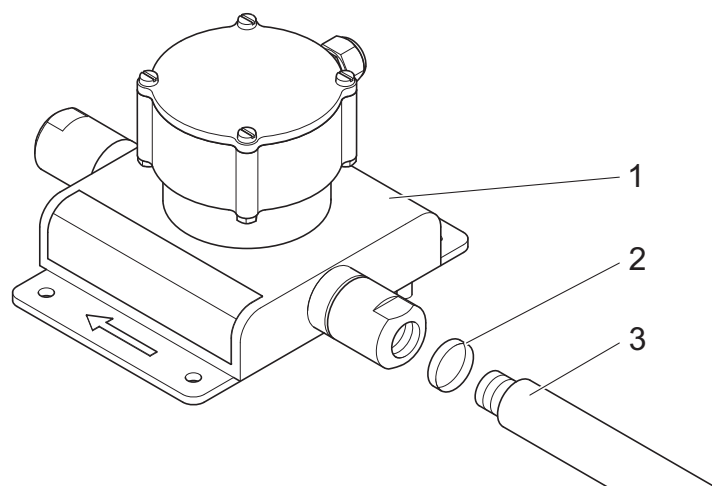


Fig. 18: Internal thread connection

- 1 Sensor
- 2 Gasket (not use in case of NPT)
- 3 Pipe

NOTICE**Use of seal tape for installation**

In case of process connection with internal thread NPT you have to use a seal tape for installation.

6.3.3 Installation Rotamass Nano (Option PD)

For the Rotamass Nano the sensor can be installed on a DN50 (2") pipe by using a bracket and U-bolt assy (model code position 15, option PD).

NOTICE

The bracket contains vibration dampers, but for extreme cases of vibration stronger damping arrangements may be necessary to ensure best performance.

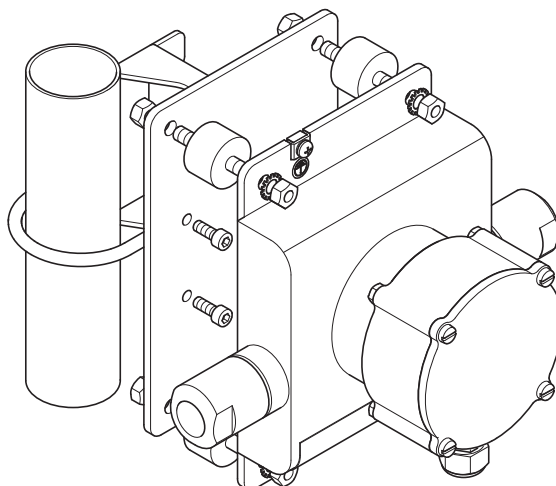


Fig. 19: 2" fixing device option /PD for Nano

6.3.4 Installation recommendation for viscosity function

In order to use this function an external differential pressure transmitter (separate order) measuring the pressure difference at the flow line is necessary. The accuracy of the estimated viscosity is strongly depending on the accuracy of the pressure transmitter and the correct position and implementation of the pressure taps.

NOTICE

The needed pressure taps have to be placed at the flow line at approximately 4D – 5D upstream and downstream of the Rotamass sensor. The differential pressure transmitter is directly connected via analog input to the Rotamass transmitter (analog input function must be available).

HART

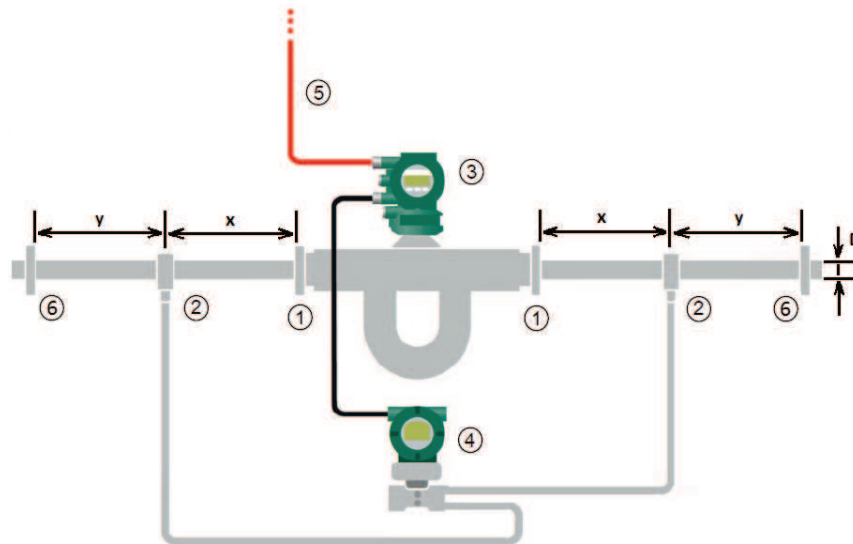


Fig. 20: Positioning of pressure taps / HART communication line

- | | | | |
|---|----------------------------------|---|---|
| ① | Mounting flanges | ④ | Differential pressure transmitter with HART |
| ② | Pressure taps | ⑤ | HART communication |
| ③ | Rotamass Total Insight with HART | ⑥ | Other flow elements |

PROFIBUS PA

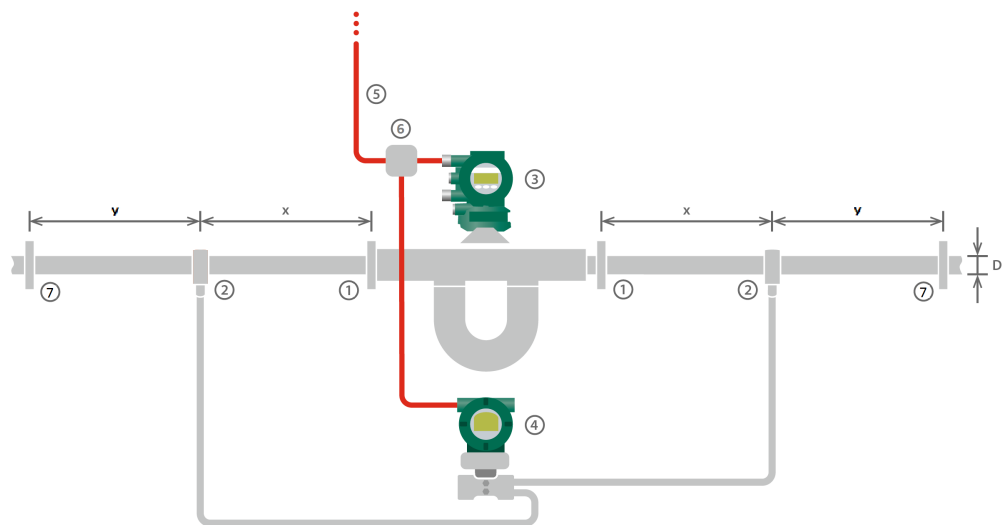


Fig. 21: Positioning of pressure taps / PROFIBUS PA communication line

- | | | | |
|---|---|---|--------------------------------|
| ① | Mounting flanges | ⑤ | PROFIBUS PA Communication line |
| ② | Pressure taps | ⑥ | PROFIBUS PA Junction box |
| ③ | Rotamass Total Insight
PROFIBUS PA | ⑦ | Other flow elements |
| ④ | Differential pressure transmitter with
PROFIBUS PA | | |

$x, y = \text{minimum } 4 \text{ to } 5 \times D$

- | | |
|---|---|
| x | Flow line upstream or downstream of the Rotamass Total Insight sensor |
| y | Flow line upstream or downstream of the pressure transmitter |
| D | Inner diameter of process line |

6.4 Insulation and heat tracing

6.4.1 Heat tracing

The majority of applications do not require or provide insulation or heat tracing for the sensor. Product versions with insulation and/or heat tracing are available for specific technical applications, see applicable General Specifications. Starting with fluid temperatures of approx. 80 °C above or below the ambient temperature, insulating the sensor is recommended if the goal is to maintain utmost accuracy. These measures are also sensible with increased requirements for fluid temperature stability.

The sensor is heated by means of heat tracing via a heat transfer fluid running through stainless steel pipes. The heat transfer fluid is supplied through process connections that can be selected. The operator is responsible for temperature control of the heat carrier. Here the specifications for pressure and the temperature of the heat transfer fluid must be met, see applicable General Specifications.

Heat tracing is only available for the remote type of flow meter and must be selected by including an appropriate device option when placing the order, see applicable General Specifications.



WARNING

Risk of overheating the transmitter due to increased ambient temperature

Failure of measuring electronics

- ▶ Observe the maximum allowable ambient temperature for the transmitter.
- ▶ Install the transmitter at a sufficient distance from heat sources.

6.4.2 Customer-supplied insulation

For insulation provided by the customer it is important to select a sensor with the appropriate design type (remote type, sensor with long neck). The space between upper insulation edge and lower edge of the sensor's terminal box must be at least 40 mm.

Recommended insulation thickness is 80 mm and recommended heat transfer coefficient 0.4 W/m² K.

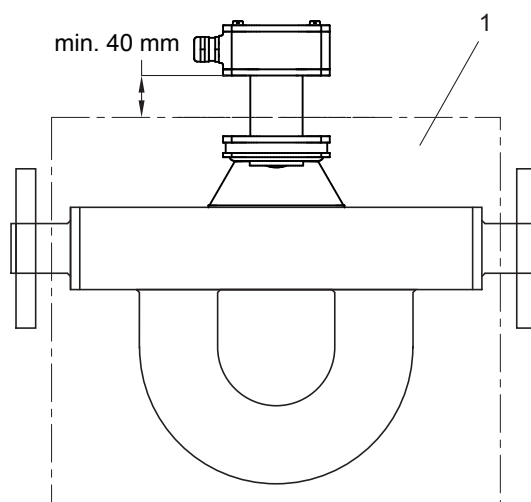


Fig. 22: Customer-supplied insulation

1 Insulation box



DANGER

When installing in hazardous areas, the applicable Explosion Proof Type Manual must be considered.

6.5 Transmitter installation

6.5.1 Rotating and replacing the display

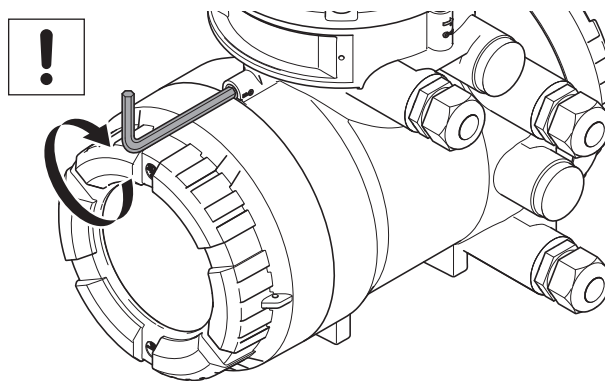
The transmitter display can be oriented in line with the flow meter installation position.

NOTICE

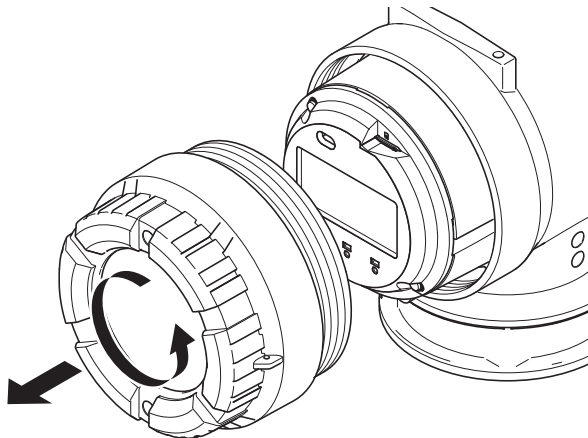
The following instruction must only be performed at the following ambient conditions:

- ▶ at temperatures up to 31 °C: relative humidity maximum 80 %
- ▶ at temperatures between 31 °C and 40 °C: from 80 % linearly decreasing to 50 % of maximum relative humidity

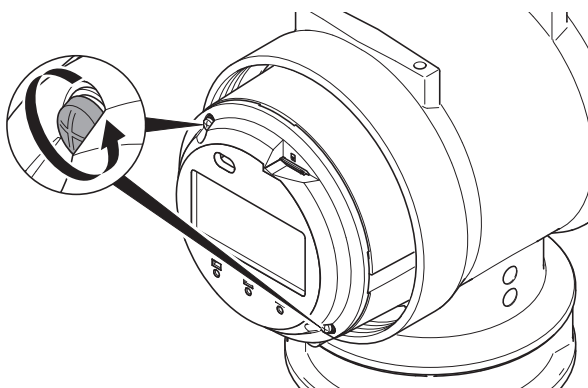
1. Switch off power supply.
2. Using an Allen wrench (size: 3.0), turn the locking screw on display screw plug clockwise to remove.



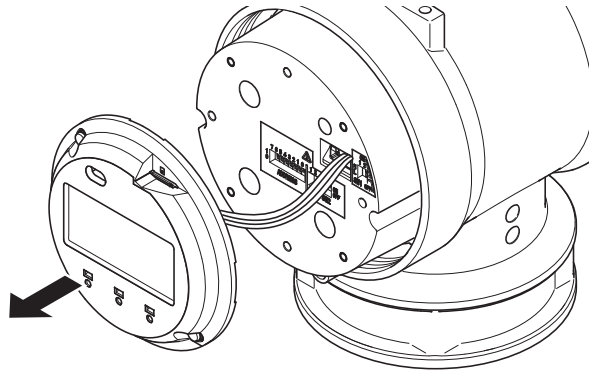
3. Unscrew display cover from transmitter housing.



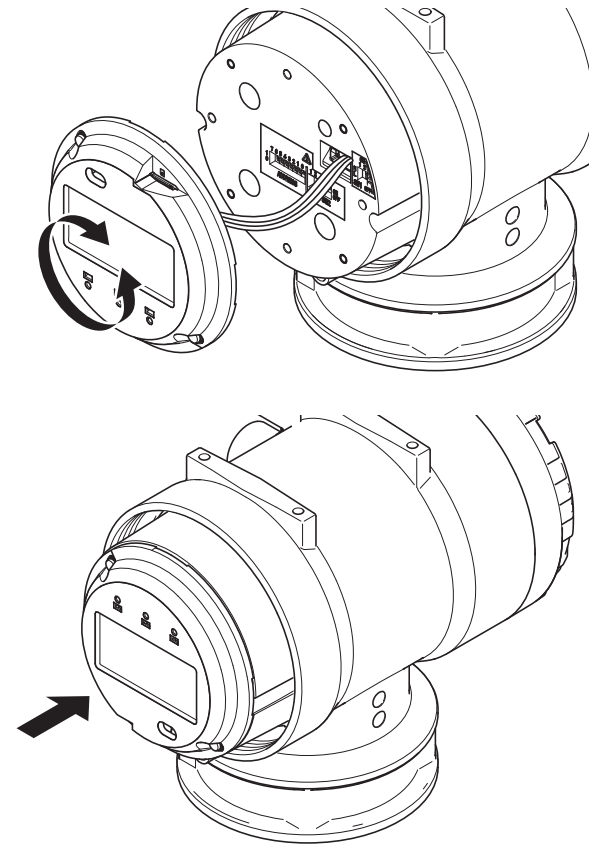
4. Remove the two screws from the display.



5. Remove the display from housing by pulling forward.

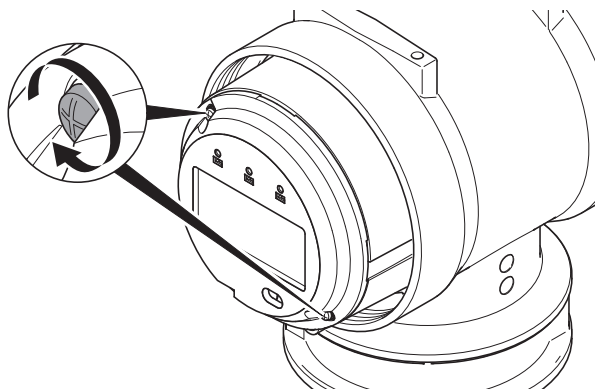


6. Rotate display and push back into housing in the orientation desired.

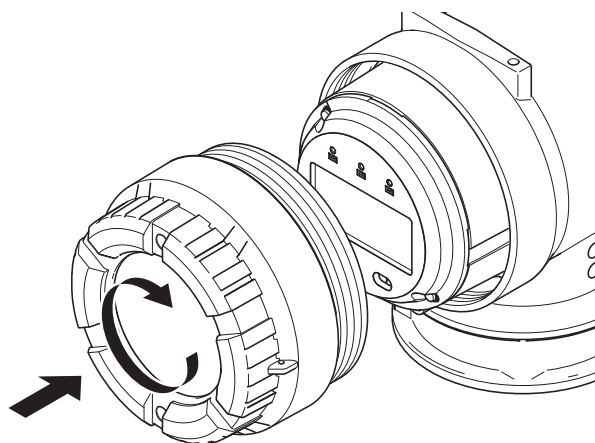
**NOTICE**

The display can be removed and replaced by loosening the connector.

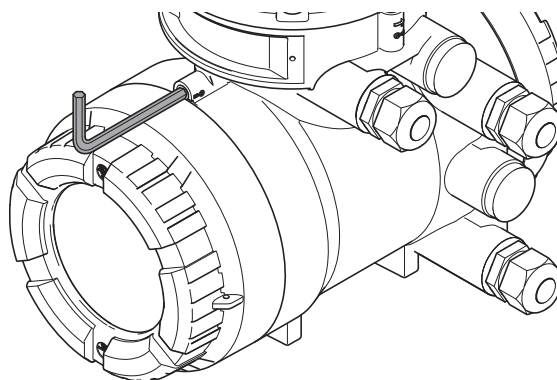
7. Tighten screws.



8. Screw display cover back onto transmitter housing.



9. Using an Allen wrench (size: 3.0), turn the locking screw on display screw plug counter-clockwise to tighten.



6.5.2 Rotating transmitter housing (integral type)

The transmitter housing can be installed in any one of four orientations.

⚠ WARNING**Short-circuit hazard caused by penetrating water**

Failure of measuring electronics

- ▶ In order to prevent any water from penetrating the flow meter by way of the cable, install the transmitter in a way so that the cable gland is not pointed upward.

⚠ WARNING**Insufficient sensor grounding connection**

Electric shock and ignition in hazardous areas

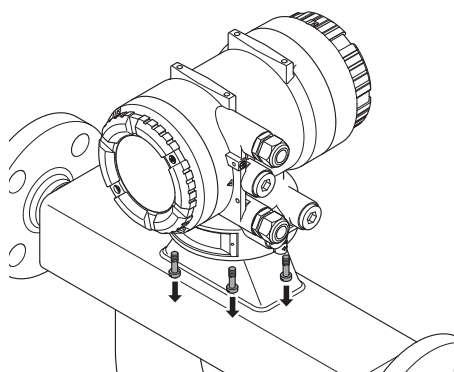
- ▶ Use a minimum torque of 4.3 Nm when tightening the screws.

NOTICE**Damage to flow meter**

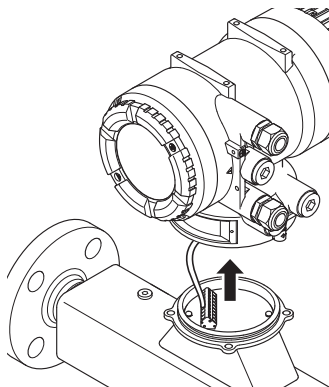
Rotating the transmitter housing several times in the same direction may damage the connection between sensor and transmitter.

- ▶ Do not turn transmitter housing more than 270° in the same direction.

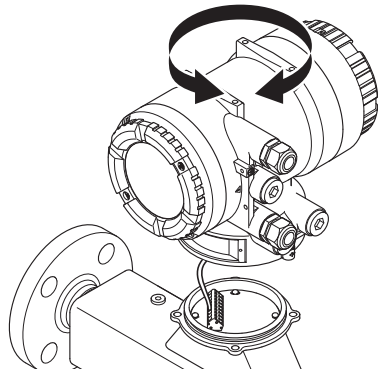
-
1. By using an Allen wrench, remove the four fixing screws.



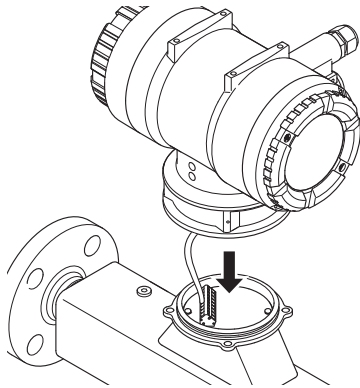
2. Lift transmitter housing.



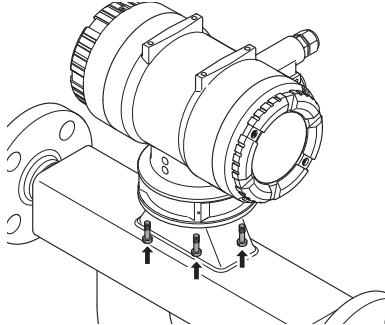
3. Rotate transmitter housing at angles of 90°, 180° or 270°.



4. Place transmitter housing.



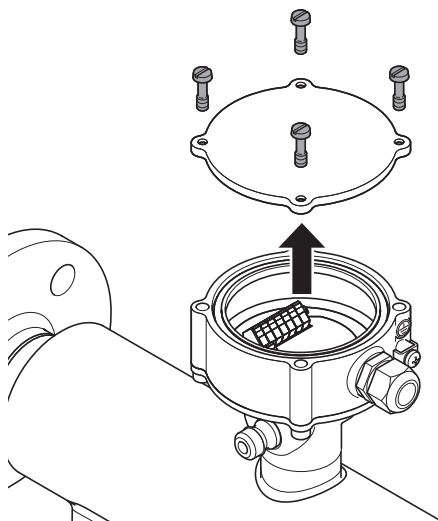
5. Tighten the four fixing screws.



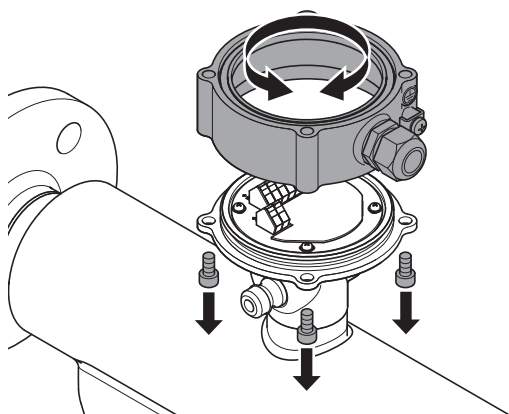
6.5.3 Rotating the terminal box (remote type)

The terminal box can be installed in any one of four orientations.

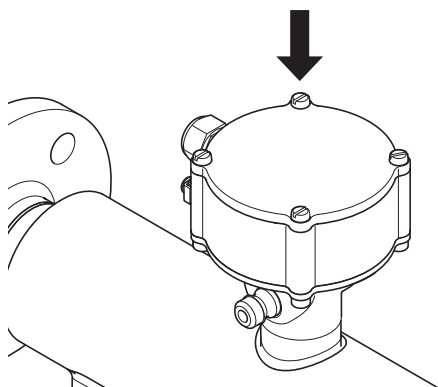
1. Loosen the four fixing screws and remove the cover.



2. Remove the cables so that none of the cables inside can accidentally become trapped and damaged.
3. By using an Allen wrench, remove the bottom fixing screws and rotate the terminal box at an angle of 90°, 180° or 270°.



4. Place the terminal box and tighten the bottom fixing screws using a minimum torque of 7.4 Nm.
5. Attach the cover and tighten the fixing screws using a minimum torque of 7.4 Nm.



6.5.4 Installing transmitter on pipe (remote type)

 **WARNING****Risk of overheating the transmitter due to increased ambient temperature**

Failure of measuring electronics

- ▶ Observe the maximum allowable ambient temperature for the transmitter.
 - ▶ Install the transmitter at a sufficient distance from heat sources. Also note the temperature of the fixing pipe.
-

 **WARNING****Short-circuit hazard caused by penetrating water**

Failure of measuring electronics

- ▶ In order to prevent any water from penetrating the flow meter by way of the cable, install the transmitter in a way so that the cable gland is not pointed upward.
-

 **CAUTION****Risk of injury and damage to the flow, meter if it is insufficiently attached to the pipe**

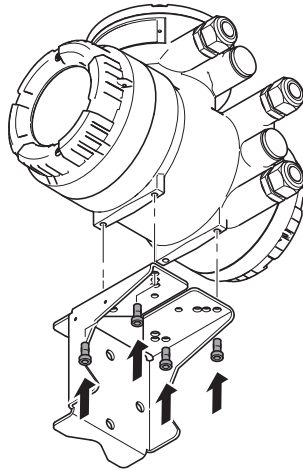
- ▶ Observe the installation notes below.
 - ▶ Tighten screws by using a minimum torque of 7.4 Nm.
-

NOTICE**Installation at high vibration levels**

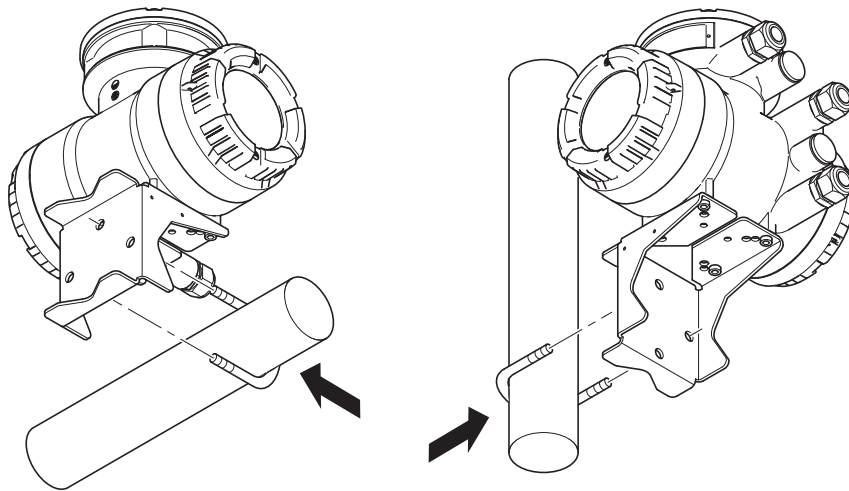
The mounting bracket for the pipe installation of the transmitter may not be suitable for installation environments with very high levels of vibration. In this case the user is advised to employ more rugged methods of fixation using the threaded bottom holes directly.

If it is a remote type transmitter, it can be mounted to a pipe size DN50 (2") using the angle bracket and retaining clip included in the delivery.

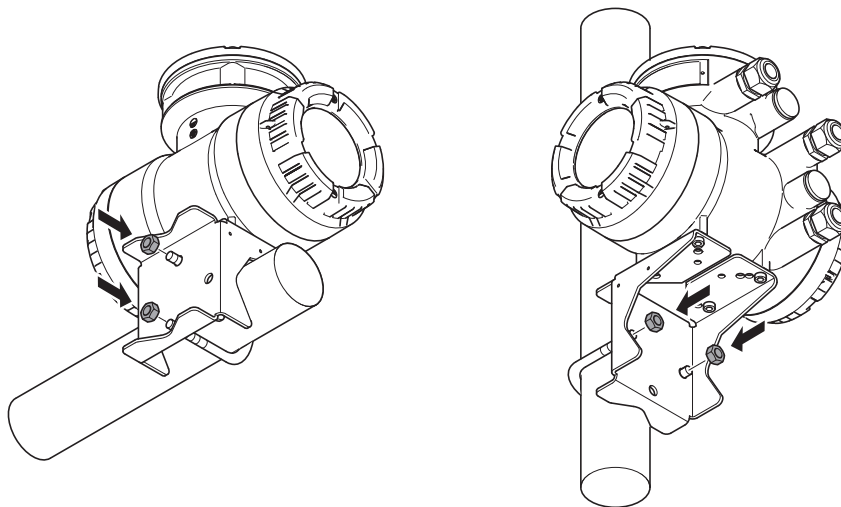
1. Screw angle bracket to bottom of transmitter.



2. Place retaining clip around pipe and slide through drill holes on angle bracket.



3. Fasten retaining clip to bracket using the nuts.



6.6 Installation check list

The following checks must be performed once the flow meter is installed in the pipe:

Check	Performed?
State and specification of device	
▪ Flow meter checked for external damage?	
▪ Does flow meter meet the specifications of the measuring point (process fluid temperature, process pressure, ambient temperature, measuring range, etc.)?	
Installation	
▪ Does flow direction on flow meter correspond to the actual flow direction in the pipe?	
▪ If not, has the appropriate parameter in the transmitter menu been switched?	
▪ Do measuring point number and nameplate labeling match the installation site?	
▪ Do mounting position and installation match usage (measurement of gas, liquid) in the process environment and under process conditions?	
▪ Is meeting the permissible ambient temperature for the transmitter ensured?	
Process environment and conditions	
▪ Is the flow meter protected from environmental influences (precipitation, direct insolation)?	

7 Wiring

7.1 General wiring rules

Be sure to handle the transmitter cover carefully so that there are no damages and foreign matter adhesion at its thread and O-ring when it is opened or attached.



DANGER

Life-threatening injuries from electric shock

- ▶ Switch off power supply.
- ▶ Secure power supply against inadvertent switch-on.
- ▶ Check that power supply is free of voltage.



DANGER

Life-threatening injuries from ignition of explosive atmospheres

- ▶ Wait 20 minutes before opening the housing until the capacitors have discharged and components have cooled off.
- ▶ Avoid electrostatically charging the device, e.g. by rubbing it with dry cloths.



DANGER

Explosion hazard in hazardous areas from electrostatic discharge or brush discharge

Life-threatening injuries or ignition of explosive atmospheres.

- ▶ Avoid actions that could lead to electrostatic discharges. For example, do not wipe the coated surface of the transmitter using a piece of cloth.



DANGER

Improper wiring in hazardous areas

When connecting flow meters in hazardous areas, the applicable Explosion Proof Type Manual must be observed.



WARNING

Risk of injury due to electrical shock

- ▶ Only have skilled personnel to connect the flow meter.
- ▶ Do not perform wiring outdoors if it is raining.



WARNING

Risk of injury due to electrical shock, as well as sparking and damage to the flow meter, if an inappropriate connecting cable is used

- ▶ It is imperative that an original connecting cable and original glands from Rota Yokogawa are used.
- ▶ Install cables tension-free.



WARNING

Risk of sparking and damage to the flow meter due to incorrect wiring

- ▶ Observe connection diagram for the connecting cable according to chapter *Connection terminals* [▶ 45].

⚠ WARNING

Risk of injury due to electrical shock, as well as damage to the flow meter due to insufficient clamping of the connecting wires

- ▶ Completely open connection terminal by using the operating tool.
- ▶ Insert connecting wires with wire end ferrules into the corresponding connection terminal up to the stop.
- ▶ Close connection terminal.

⚠ CAUTION

Don't install the connecting cable at ambient temperatures below -10 °C.

NOTICE

Wiring work must only be performed at max. 80 % humidity and temperatures up to 31 °C, linearly decreasing to 50 % relative humidity at 40 °C.

NOTICE

Although Rota Yokogawa considers the guidelines of EMC, please be aware that conducted and radiated electromagnetic emission may effect the EMC of adjacent areas.

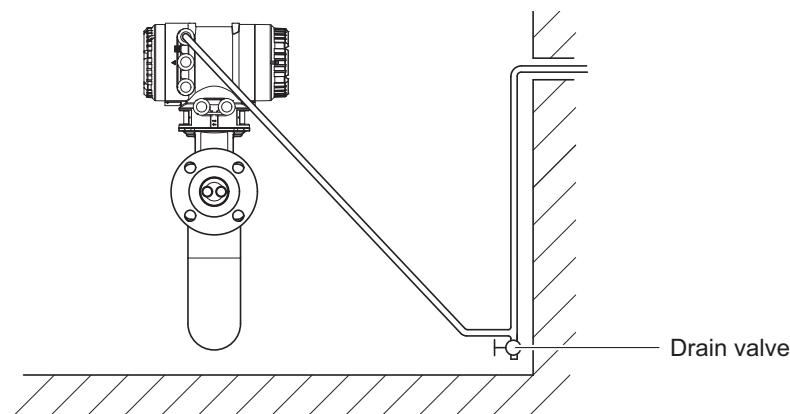
NOTICE

Be aware that improper earthing, false wiring and use of cable out of specification may lead to instrument damage and/or disturbance of other sensitive electrical equipment due to increased electromagnetic emissions/immunity.

NOTICE

Be aware that wrong input voltage may lead to disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.

- ▶ The applicable national standards must be considered for installation.
- ▶ Only sensors and transmitters with compatible model codes may be interconnected. If these instructions are not observed, flawless function of the flow meter cannot be guaranteed.
- ▶ In case of cabling in pipes (Conduit), guide the pipe through the opening in the wiring and use watertight gaskets to avoid that water runs in. Install the installation pipe at an angle, as shown in the figure below. Install a drain valve in the bottom end of the vertical pipe and regularly open that valve.



- ▶ Unused cable entries must be closed using blind plugs.
- ▶ Install cables hanging down to prevent water from flowing along the cable into the flow meter.
- ▶ The electrical connection between potential equalization system and grounding connection must be safe, see *Grounding connections* [▶ 43].
- ▶ Ensure that housing gaskets are positioned in the lining grooves and not damaged.

7.2 Grounding connections

⚠ WARNING

Risk of injury from electrical shock due to inadequate grounding

- ▶ Perform potential equalization at the grounding terminals provided for this purpose according to the figure "Grounding connections on transmitter and sensor".

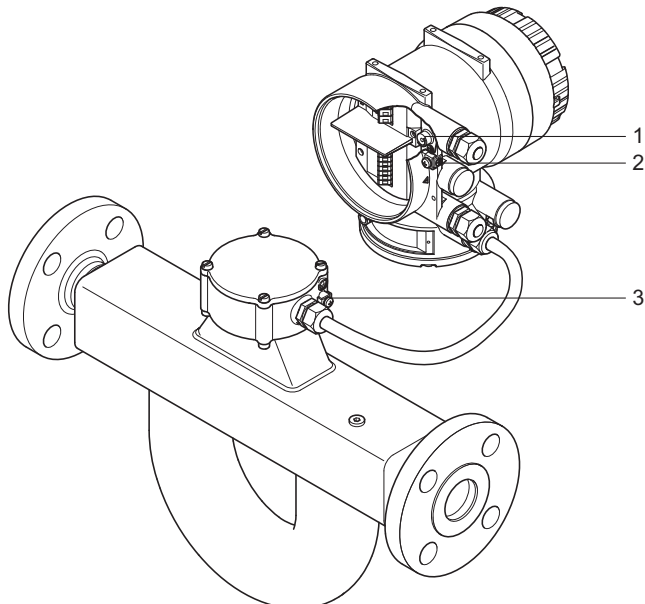


Fig. 23: Grounding connections on transmitter and sensor

- | | |
|---|---|
| 1 | Grounding screw in transmitter terminal box for grounding conductor |
| 2 | Grounding terminal on transmitter for potential equalization |
| 3 | Grounding terminal on sensor for potential equalization |

7.3 Connecting cable installation

With remote type flow meters, sensors and transmitters are connected by means of connecting cables.

CAUTION

Risk of damage to the flow meter due to incorrect sealing

In case of metric cable entry ensure appropriate IP rating and suitability of O-ring of used accessory (e.g. cable glands).

In case of NPT cable entry ensure appropriate sealing measures (e.g. use of sealing tape).

In order to obtain optimum measuring results and ensure compliance with the specification, it is imperative that an original connecting cable and original glands from Rota Yokogawa are used. In order to ensure the IP code, the cable must be professionally installed at the entries. If necessary, the cable may be shortened using the enclosed termination kit. Refer to the cable termination instructions enclose to each termination kit that is attached to each cable.

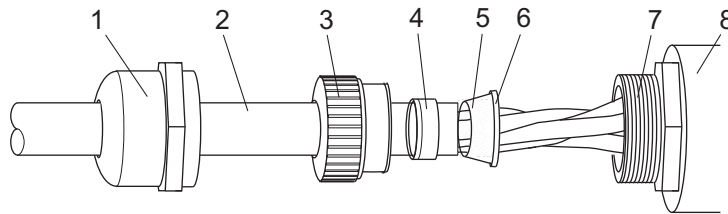


Fig. 24: Cable gland parts mounting

- | | | | |
|---|------------------|---|---------------------|
| 1 | Cap nut | 5 | Outer cable shield |
| 2 | Connecting cable | 6 | Outer cone part |
| 3 | Plastic part | 7 | Mounting thread |
| 4 | Inner cone part | 8 | Housing cable entry |

If the connecting cable, included in the delivery, is too short, additional lengths can be procured through the Yokogawa sales organization.

7.3.1 Connection terminals

The delivery includes an operating tool for connecting the connecting cable to the connection terminals.

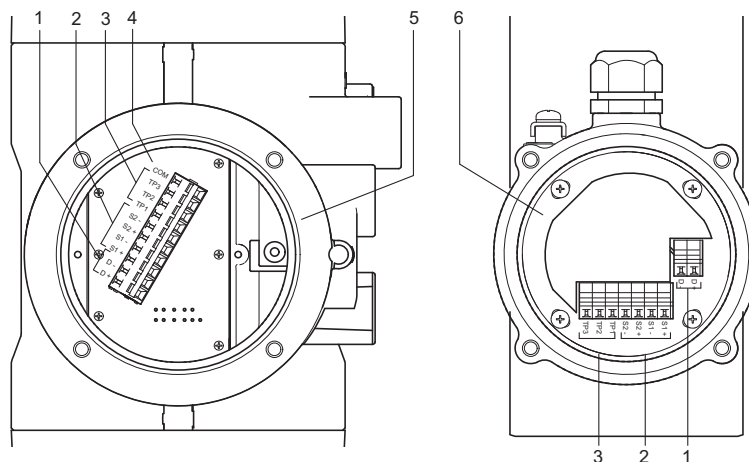


Fig. 25: Connection terminal circuits (transmitter on the left side, sensor on the right side)

- | | | | |
|---|---|---|------------------|
| 1 | Driver circuit (D+/D-) | 4 | Signal grounding |
| 2 | Sensor circuits (S1+/S1-, S2+/S2-) | 5 | Transmitter |
| 3 | Temperature measurement circuit (TP1, TP2, TP3) | 6 | Sensor |

Installation of standard connecting cable option L_...

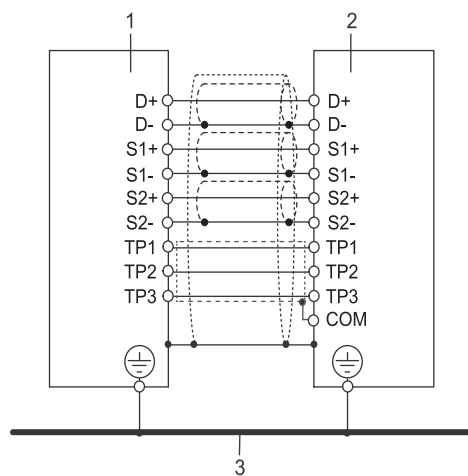


Fig. 26: Transmitter and sensor interconnection diagram

- | | |
|---|-------------------------------|
| 1 | Sensor |
| 2 | Transmitter |
| 3 | Potential equalization system |

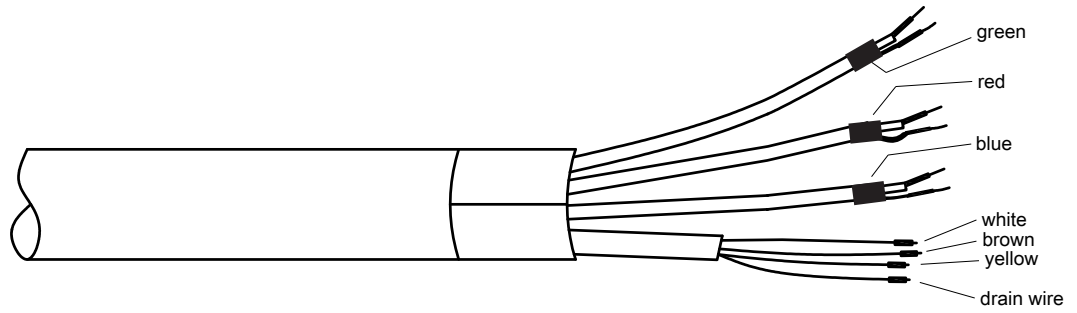


Fig. 27: Terminated standard connecting cable L_..., transmitter side

Connection scheme of standard connecting cable option L_...

Tab. 2: Version coaxial wire

Standard connecting cable option L_...			
Signal	Coaxial wire		
	Coaxial wire pair colour	Wire type	Wire colour
D+	green	Core wire	transparent
D-		Shield	black
S1+	red	Core wire	transparent
S1-		Shield	black
S2+	blue	Core wire	transparent
S2-		Shield	black

Tab. 3: Version single wire

Standard connecting cable option L_...		
Signal	Single wire	
	Wire type	Wire colour
TP1	Conductor	white
TP2		brown
TP3		yellow
COM ¹⁾	Drain wire ¹⁾	—

¹⁾ Present only at transmitter side

Installation of fire retardant connecting cable option Y_{...}

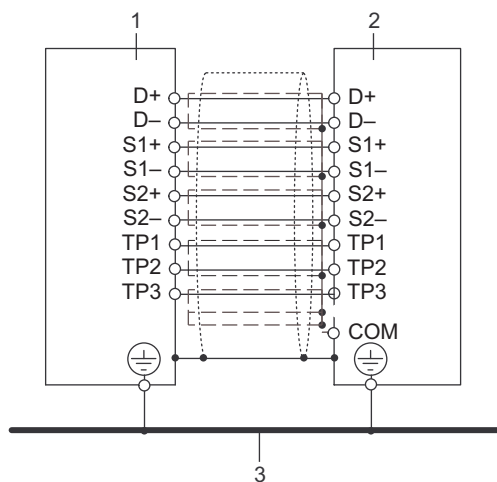


Fig. 28: Transmitter and sensor interconnection diagram

- 1 Sensor
- 2 Transmitter
- 3 Potential equalization system

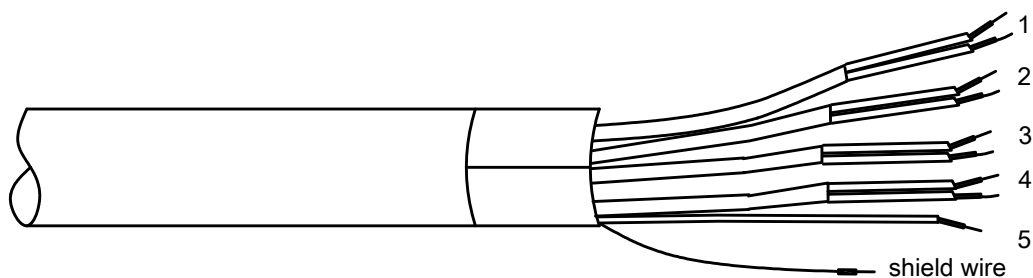


Fig. 29: Terminated fire retardant connecting cable Y_{...}, transmitter side

Connection scheme of fire retardant connecting cable option Y_{...}

Tab. 4: Version Y_{...}

Y _{...} -cable		
Signal	Conductor pair number ¹⁾	Conductor colour
D+	1	white
D-		blue
S1+	2	white
S1-		blue
S2+	3	white
S2-		blue
TP1	4	white
TP2		blue
TP3	5	white
COM ²⁾	Shield wire ²⁾	—

¹⁾ Conductor pair number refers to the numbers printed on the single conductors

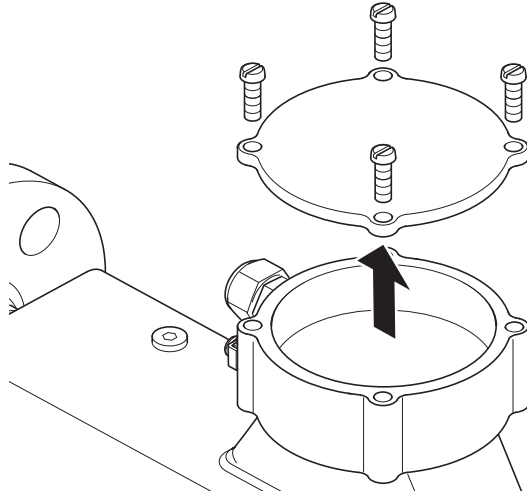
²⁾ Present only at transmitter side

7.3.2 Connecting the connecting cable to sensor

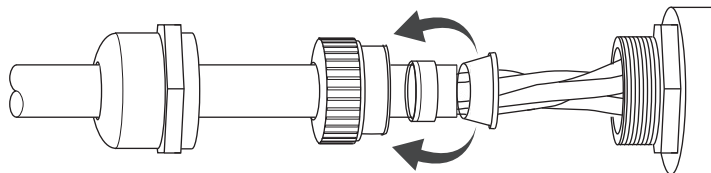
NOTICE Use the cable end without shield wire to connect to the sensor (observe labeling).

NOTICE If the cable is not terminated or was shortened, observe the separate instructions in the included terminating set.

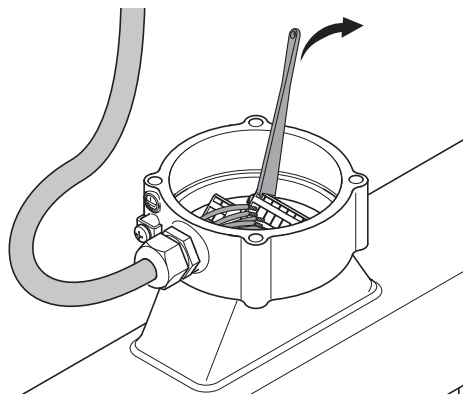
1. Loosen the four screws from the neck cover and remove cover.



2. Remove connector nut from cable gland and pull out clamped insert.
3. Push cable through connector nut and clamped insert.
4. Remove precut outer casing of cable.
5. Pull back outer shield of cable over clamped insert.



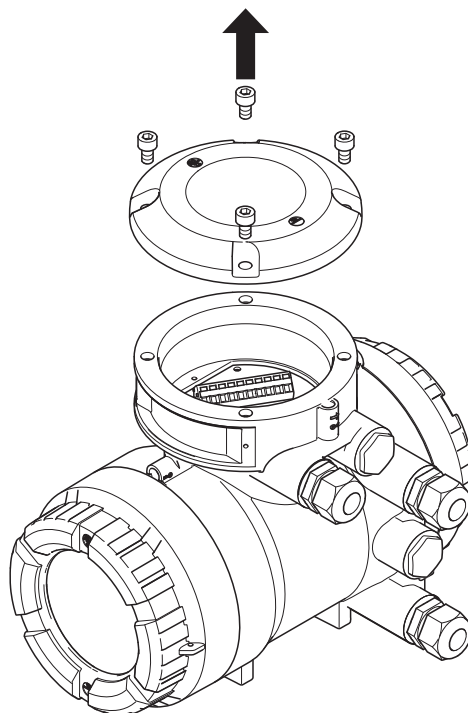
6. Feed cable through cable entry into sensor.
7. Use the operating tool to connect wires to connection terminals in accordance with terminal diagram, see *Connection terminals* [▶ 45].



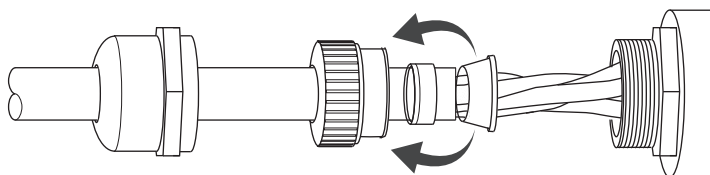
8. Assemble the cable gland and tighten connector nut.
9. Place cover onto sensor and fasten with four screws.

7.3.3 Connecting the connecting cable to transmitter

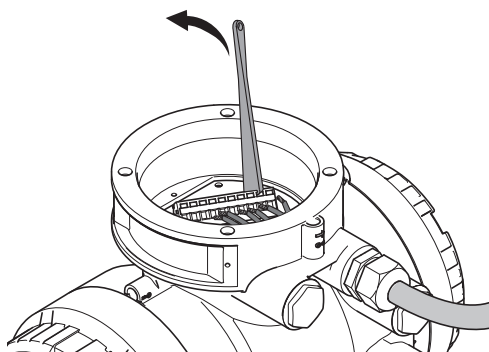
1. Loosen the four screws from the sensor connection cover and remove cover.



2. Remove connector nut from cable gland and pull out clamped insert.
3. Push cable through connector nut and clamped insert.
4. Remove precut outer casing of cable.
5. Pull back outer shield of cable over clamped insert.



6. Feed cable through cable entry into transmitter.
7. Use the operating tool to connect wires to connection terminals in accordance with terminal diagram, see *Connection terminals* [▶ 45].



8. Assemble the cable gland and tighten connector nut.
9. Place sensor connection cover onto transmitter and fasten with four screws.

7.4 Transmitter

7.4.1 Connection terminals

⚠ WARNING

Risk of injury from electrical shock due to inadequate grounding

- ▶ Use grounding screw to connect the grounding conductor.
- ▶ Use an M4 ring-type or forked cable lug for the grounding conductor of the power supply cable.

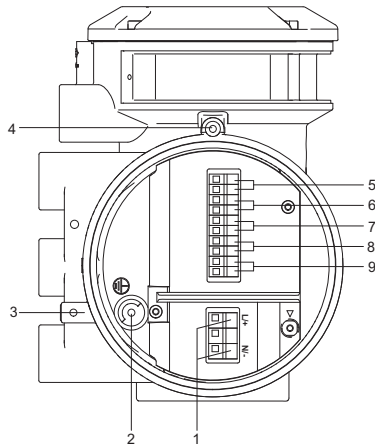


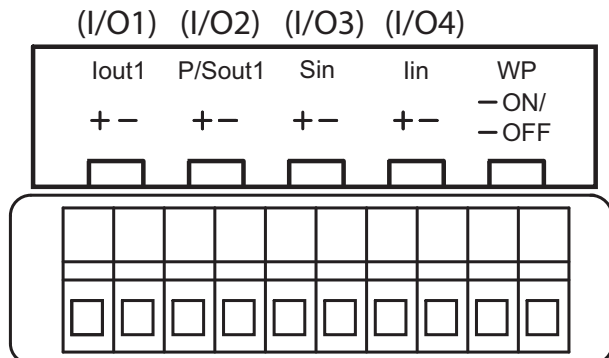
Fig. 30: Terminal for I/O outputs and power supply in transmitter

- | | | | |
|---|-----------------------------------|---|-----------------------------------|
| 1 | Power supply connection terminals | 6 | Connection terminals for I/O2 +/- |
| 2 | Grounding screw in terminal box | 7 | Connection terminals for I/O3 +/- |
| 3 | Grounding terminal | 8 | Connection terminals for I/O4 +/- |
| 4 | Locking screw | 9 | WP: Write-protection terminal |
| 5 | Connection terminals for I/O1 +/- | | |

7.4.2 HART and Modbus connection terminals

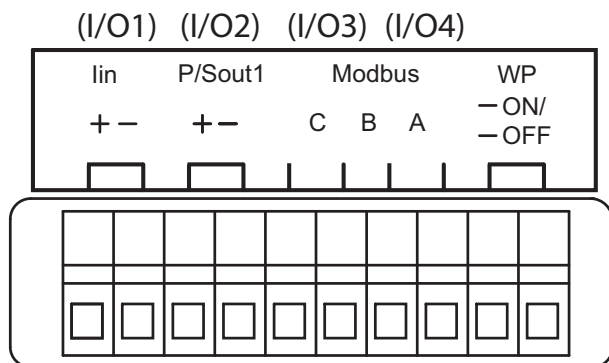
Depending on the flow meter specification, there are different configurations of the connection terminal. Following are configuration examples of the connection terminal (value JK and M7 on model code position 13 - see Inputs and outputs for details):

HART



- I/O1: Iout1 Current output (active/passive)
- I/O2: P/Sout1 Pulse or status output (passive)
- I/O3: Sin Status input
- I/O4: lin Current input (active/passive)
- WP: Write-protect bridge

Modbus

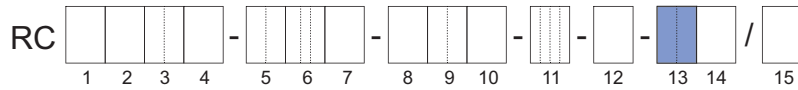


- I/O1: lin Current input (passive)
- I/O2: P/Sout1 Pulse or status output (passive)
- I/O3-I/O4: Modbus RS485 input/output
- WP: Write-protect bridge

7.4.3 Assignment of HART and Modbus

The table below shows possible connection terminal assignments for I/O outputs depending on model code position 13.

The following figure shows the relevant position of the model code:



Configuration of input/output terminals for HART communication

HART I/O

Tab. 5: Connection terminal assignment for HART

Model code Position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
JA	Iout1 Active	P/Sout1 Passive	–	–	Write-protect
JB	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iout2 Active	Write-protect
JC	Iout1 Active	P/Sout1 Passive	Sin	Iout2 Active	Write-protect
JD	Iout1 Active	P/Sout1 Passive	Sout Passive	P/Sout2 Passive	Write-protect
JE	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Passive	Write-protect
JF	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active Internal pull-up resistor	Write-protect
JG	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active	Write-protect
JH	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Active	Write-protect
JJ	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Active	Write-protect
JK	Iout1 Active	P/Sout1 Passive	Sin	Iin Active	Write-protect
JL	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Passive	Write-protect
JM	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Passive	Write-protect
JN	Iout1 Active	P/Sout1 Passive	Sin	Iin Passive	Write-protect
JP	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	–	Write-protect
JQ	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	P/Sout2 Passive	Write-protect

Model code Position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
JR	lout1 Passive	P/Sout1 Passive NAMUR	lout2 Passive	–	Write-protect
JS	lout1 Passive	P/Sout1 Passive NAMUR	lout2 Passive	P/Sout2 Passive NAMUR	Write-protect

- lout1 Analog current output with HART communication
- lout2 Analog current output
- lin Analog current input
- P/Sout1 Pulse or status output
- P/Sout2 Pulse or status output
- Sin Status input
- Sout Status output

Configuration of input/output terminals for Modbus communication

Modbus I/O

Tab. 6: Connection terminal assignment for Modbus

Model code position 13	Connection terminal assignment						
	I/O1 +/-	I/O2 +/-	I/O3 +	I/O3 -	I/O4 +	I/O4 -	WP
M0	–	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M2	lin Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M3	P/Sout2 Passive	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M4	P/Sout2 Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M5	P/Sout2 Active Internal pull-up resistor	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M6	lout1 Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M7	lin Passive	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect

- lout Analog current output, no HART
- lin Analog current input
- P/Sout1 Pulse or status output
- P/Sout2 Pulse or status output

7.4.4 HART and Modbus communication

HART communication

HART interface

For devices with HART communication, the HART interface, along with the analog signal, is available at the output *Iout1*. A load resistance of 230 – 600 Ω at *Iout1* is recommended.

How to connect to the communication tools is described in the applicable Software Instruction Manual (SW-IM) IM01U10S01-00__-R.

Modbus communication

Modbus interface

Modbus interface of Rotamass Total Insight is implemented in accordance with "MODBUS over serial line specification and implementation guide V1.02", for details of instrumentation see website of the Modbus organization (<http://www.modbus.org/>).

Modbus connections

Tab. 7: Connection terminal assignment for Modbus

Terminal	Description
I/O3 -	Modbus C (Common)
I/O4 +	Modbus B (D1)
I/O4 -	Modbus A (D0)

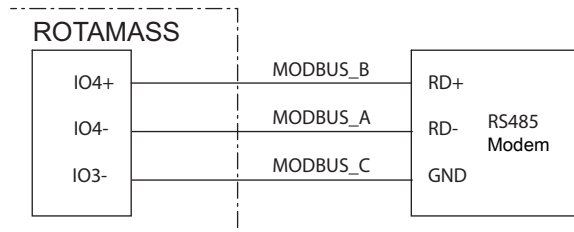


Fig. 31: MODBUS communication

Modbus cable

3-Wire cable (twisted pair (D0, D1) and Common) with shield should be used. Wire gauge should be AWG24 or wider.

Rotamass Total Insight has a RS485 electrical interface, operating in slave mode and communicating with the following default specification:

Default Modbus setting

- Modbus baud rate: 19200 bps
- Modbus transfer mode: RTU
- Modbus parity: Even
- Modbus stop bit: 1 stop bit

For further details, see applicable Software Instruction Manual (SW-IM) IM01U10S03-00__-R.

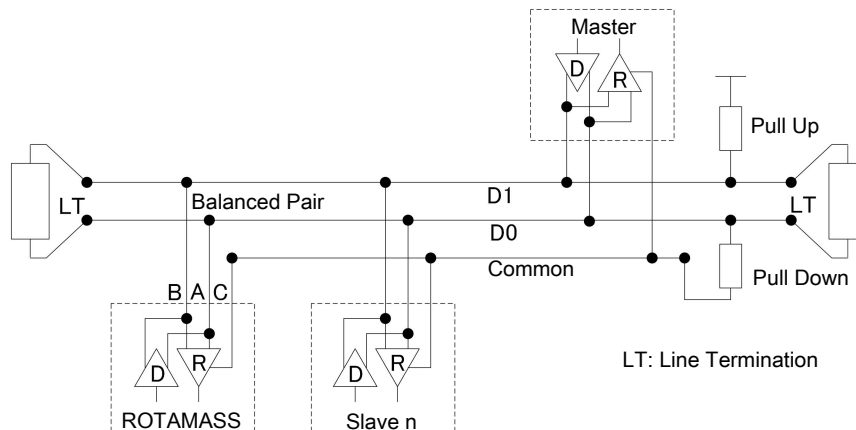


Fig. 32: Modbus connection

Output signals

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

Active current output *lout*

One or two current outputs are available depending on model code position 13.

Depending on the measured value, the active current output delivers 4 – 20 mA.

It may be used for output of the following measured values:

- Flow rate (mass, volume, net partial component flow of a mixture)
- Density
- Temperature
- Pressure
- Concentration

For HART communication devices, it is supplied on the current output *lout1*. The current output may be operated in compliance with the NAMUR NE43 standard.

	Value
Nominal output current	4 – 20 mA
Maximum output current range	2.4 – 21.6 mA
Load resistance	≤ 750 Ω
Load resistance for secure HART communication	230 – 600 Ω

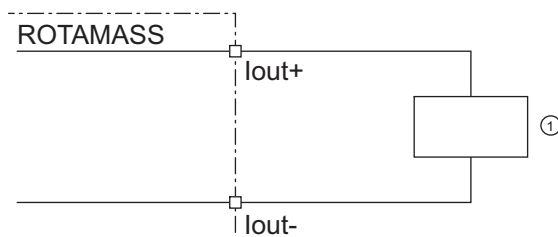


Fig. 33: Active current output connection *lout* HART

① Receiver

Passive current output *I_{out}*

	Value
Nominal output current	4 – 20 mA
Maximum output current range	2.4 – 21.6 mA
External power supply	10.5 – 32 V _{DC}
Load resistance for secure HART communication	230 – 600 Ω
Load resistance at current output	≤ 911 Ω

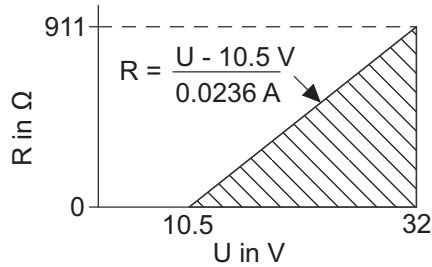


Fig. 34: Maximum load resistance as a function of an external power supply voltage

- R Load resistance
- U External power supply voltage

The diagram shows the maximum load resistance R as a function of voltage U of the connected voltage source. Higher load resistances are allowed with higher power supply values. The usable zone for passive power output operation is indicated by the hatched area.

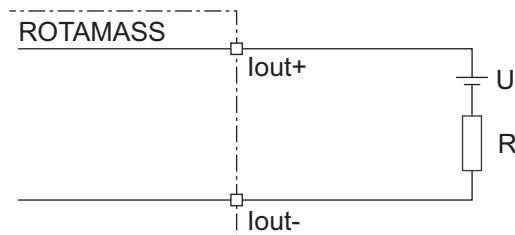


Fig. 35: Passive current output connection *I_{out}*

**Active pulse output
P/Sout**

Connection of an electronic counter

Maximum voltage and correct polarity must be observed for wiring.

	Value
Load resistance	> 1 kΩ
Internal power supply	24 V _{DC} ±20 %
Maximum pulse rate	10000 pulses/s
Frequency range	0 – 12.5 kHz

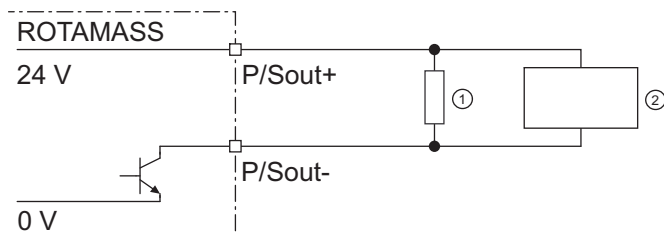


Fig. 36: Active pulse output connection P/Sout

- ① Load resistance
- ② Electronic counter

Connection of an electromechanical counter

	Value
Maximum current	150 mA
Average current	≤ 30 mA
Internal power supply	24 V _{DC} ±20 %
Maximum pulse rate	2 pulses/s
Pulse width	20, 33, 50, 100 ms

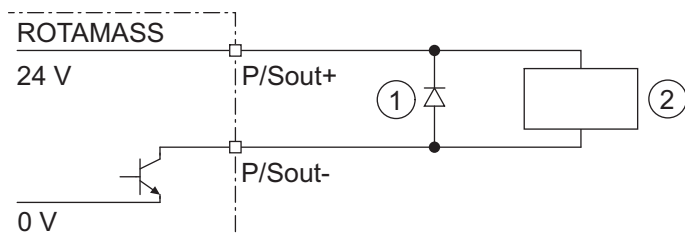


Fig. 37: Active pulse output P/Sout connection with electromechanical counter

- ① Protective diode
- ② Electromechanical counter

Active pulse output P/Sout with internal pull-up resistor

	Value
Internal power supply	24 V _{DC} ±20 %
Internal pull-up resistor	2.2 kΩ
Maximum pulse rate	10000 pulses/s
Frequency range	0 – 12.5 kHz

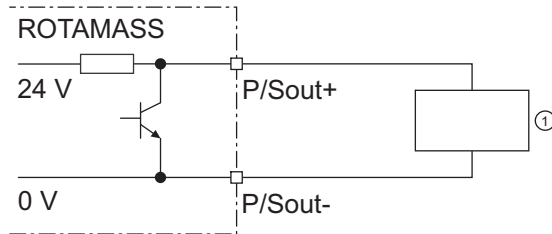


Fig. 38: Active pulse output P/Sout with internal pull-up resistor

- ① Electronic counter

Passive pulse output

	Value
Maximum load current	≤ 200 mA
Power supply	≤ 30 V _{DC}
Maximum pulse rate	10000 pulses/s
Frequency range	0 – 12.5 kHz

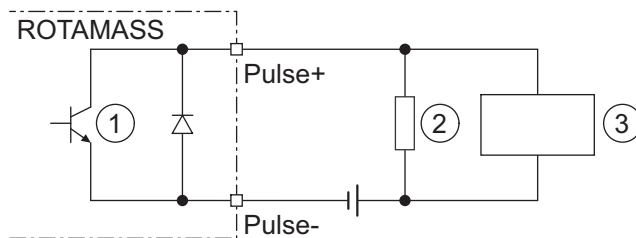


Fig. 39: Passive pulse output connection with electronic counter

- ① Passive pulse
- ② Load resistance
- ③ Electronic counter

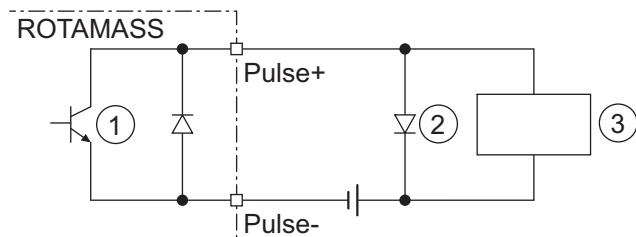


Fig. 40: Passive pulse output connection with electromechanical counter

- ① Passive pulse
- ② Protective diode
- ③ Electromechanical counter

Active status output P/Sout

Since this is a transistor contact, maximum allowed current as well as polarity and level of output voltage must be observed during wiring.

	Value
Load resistance	> 1 kΩ
Internal power supply	24 V _{DC} ±20 %

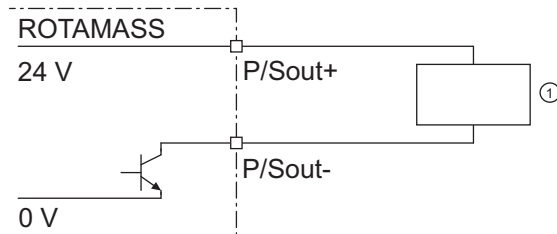


Fig. 41: Active status output connection P/Sout

- ① External device with load resistance

Active status output P/Sout with internal pull-up resistor

	Value
Internal pull-up resistor	2.2 kΩ
Internal power supply	24 V _{DC} ±20 %

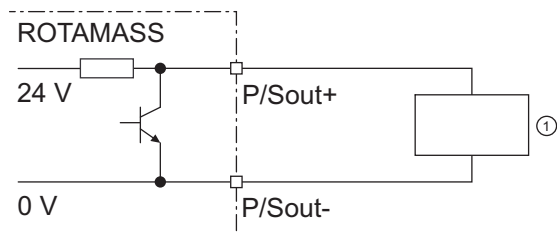


Fig. 42: Active status output P/Sout with internal pull-up resistor

- ① External device

Passive status output P/Sout or Sout

	Value
Output current	≤ 200 mA
Power supply	≤ 30 V _{DC}

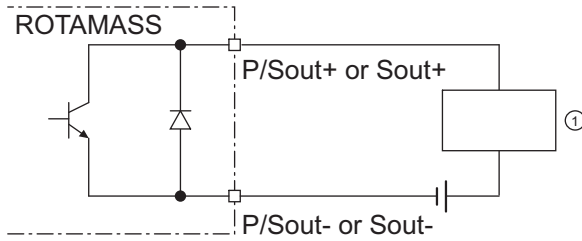


Fig. 43: Passive status output connection P/Sout or Sout

- ① External device

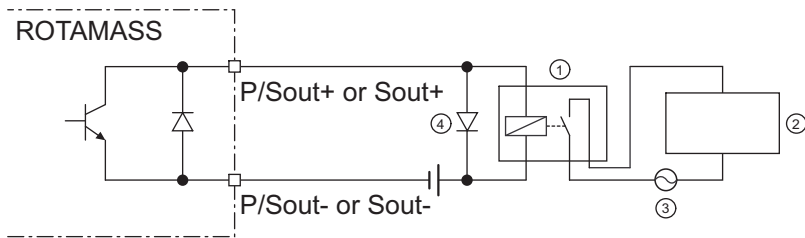


Fig. 44: Passive status output connection P/Sout or Sout for solenoid valve circuit

- ① Relay
- ② Solenoid valve
- ③ Magnetic valve power supply
- ④ Protective diode

A relay must be connected in series to switch alternating voltage.

Passive pulse or status output P/Sout (NAMUR)

Output signals according to EN 60947-5-6 (previously NAMUR, worksheet NA001):

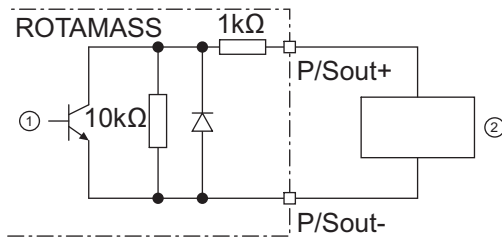


Fig. 45: Passive pulse or status output with switching amplifier connected in series

- ① Passive pulse or status output
- ② Switching amplifier

Input signals

Active current input *lin*

An individual analog power input is available for external analog devices.

The active current input *lin* is provided for connecting a two-wire transmitter with an output signal of 4 – 20 mA.

	Value
Nominal input current	4 – 20 mA
Maximum input current range	2.4 – 21.6 mA
Internal power supply	24 V _{DC} ±20 %
Internal load resistance Rotamass	≤ 160 Ω

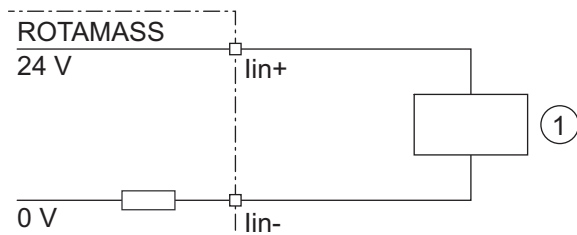


Fig. 46: Connection of external device with passive current output

① External passive current output device

Passive current input *lin*

The passive current input *lin* is provided for connecting a four-wire transmitter with an output signal of 4 – 20 mA.

	Value
Nominal input current	4 – 20 mA
Maximum input current range	2.4 – 21.6 mA
Maximum input voltage	≤ 32 V _{DC}
Internal load resistance Rotamass	≤ 160 Ω

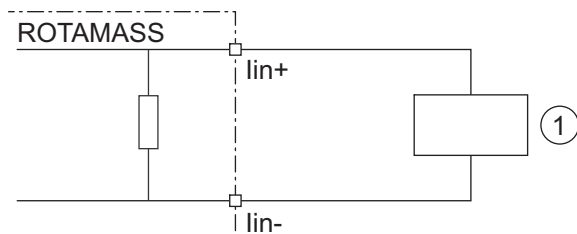


Fig. 47: Connection of external device with active current output

① External active current output device

Status input *Sin*



Do not connect a signal source with electric voltage.

The status input is provided for use of voltage-free contacts with the following specification:

Switching status	Resistance
Closed	< 200 Ω
Open	> 100 kΩ

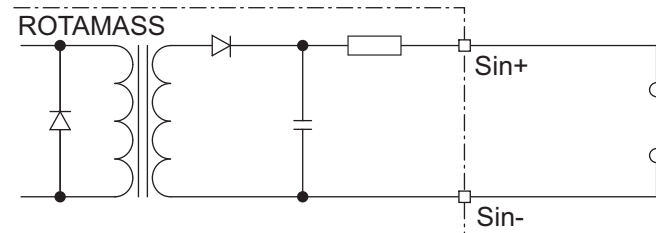
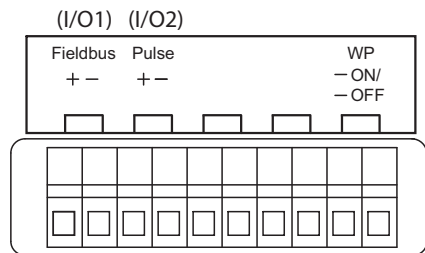


Fig. 48: Status input connection

7.4.5 PROFIBUS PA connection terminals

For the PROFIBUS PA version there is only one configuration of the connection terminal. Following is the configuration of the connection terminal (value G0 and G1 on model code position 13, see Inputs and outputs for details):

PROFIBUS PA

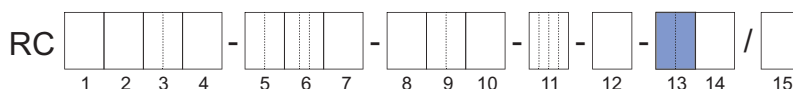


- I/O1: Fieldbus PROFIBUS PA communication
- I/O2: Pulse Pulse / Frequency output
- WP: Write-protect bridge

7.4.6 Assignment of PROFIBUS PA

The table below shows possible connection terminal assignments for I/O outputs depending on model code Position 13.

The following figure shows the relevant position of the model code:



Tab. 8: Connection terminal assignment for PROFIBUS PA

Model code position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
G0	PROFIBUS PA	Pulse Passive	–	–	Write-protect
G1	PROFIBUS PA (IS)	Pulse Passive (IS)	–	–	Write-protect

PROFIBUS PA: PA communication

Pulse Passive: Pulse / Frequency output

Intrinsically safe (IS) outputs are only available in combination with selecting Ex approval of the device, see *General Specifications (GS) GS01U10B_-00_-R, chapter Ex approval*.

7.4.7 PROFIBUS PA communication

PROFIBUS PA interface

PROFIBUS PA interface of Rotamass Total Insight is based on PROFIBUS PA protocol (Profile Revision R3.02 Compliant) and standard IEC61158, for details of instrumentation see website of the PROFIBUS/PROFINET organization (<https://www.profibus.com/>).

Output signals PROFIBUS PA

Digital communication signal based on PROFIBUS PA protocol.

PROFIBUS PA output signals

Maximum voltage and correct polarity must be observed for wiring.

	Value
Power supply	9 – 32 V _{DC}
Current draw	15 mA (maximum)

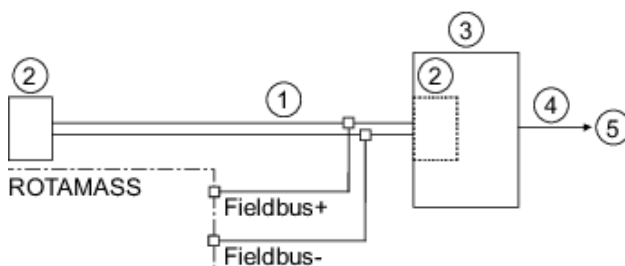


Fig. 49: PROFIBUS PA connection

- ① PROFIBUS PA
- ② Terminator
- ③ DP/PA-Coupler
- ④ PROFIBUS DP
- ⑤ Host

PROFIBUS PA cable

Tab. 9: PROFIBUS PA cable and transmissible length

Type of cable	Cable specifications	Max. length of cable (reference value)
Type A: Individually-shielded twisted pair cable	#18AWG (0.82 mm ²)	1.900 m

Default PROFIBUS PA setting

For further details, see applicable Software Instruction Manual (SW-IM) IM01U10S04-00_--R.

Passive pulse output (only for calibration)

	Value
Maximum load current	≤ 200 mA
Power supply	≤ 30 V _{DC}
Maximum pulse rate	10000 pulses/s
Frequency range	0 – 12.5 kHz

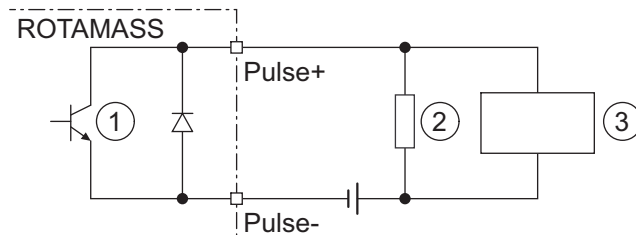


Fig. 50: Passive pulse output connection with electronic counter

- ① Passive pulse
- ② Load resistance
- ③ Electronic counter

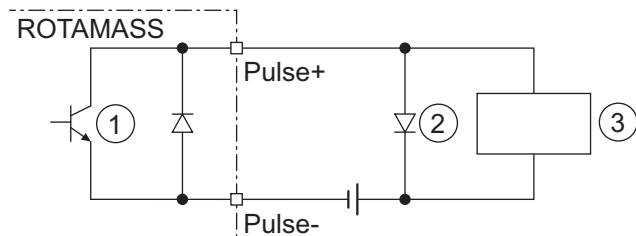


Fig. 51: Passive pulse output connection with electromechanical counter

- ① Passive pulse
- ② Protective diode
- ③ Electromechanical counter

7.4.8 Power supply

Power supply

Alternating-current voltage (rms):

- Power supply¹⁾: 24 V_{AC} +20 % -15 % or 100 – 240 V_{AC} +10 % -20 %
- Power frequency: 47 – 63 Hz

Direct-current voltage:

- Power supply¹⁾: 24 V_{DC} +20 % -15 % or 100 – 120 V_{DC} +8,3 % -10 %

¹⁾ for option MC_ (DNV GL approval) supply voltage is limited to 24 V; in addition NE21 testing indicates a tolerable area of 24 V_{DC} ±20 % under NE21 test conditions.

Power consumption

P ≤ 10 W (including sensor)

Power supply failure

In the event of a power failure, the flow meter data are backed up on a non-volatile internal memory. In case of devices with display, the characteristic sensor values, such as nominal diameter, serial number, calibration constants, zero point, etc. and the error history are also stored on a microSD card.

7.4.9 Connecting power supply and external devices

WARNING

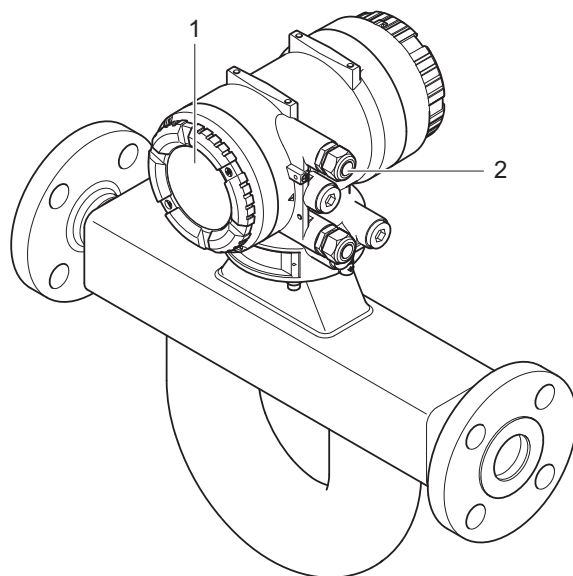
Risk of sparking and damage to the flow meter due to incorrect sealing

- ▶ In case of metric cable entry ensure appropriate IP rating and suitability of O-ring of used accessory (e.g. cable glands).
- ▶ In case of NPT cable entry ensure appropriate sealing measures (e.g. use of sealing tape).

NOTICE

Risk of damage to the flow meter due to incorrect power supply

- ▶ The specified power supply must be observed (see General Specifications).
- ▶ The power-supply cable must be designed for the power supply used with a minimum diameter of 0.5 mm.



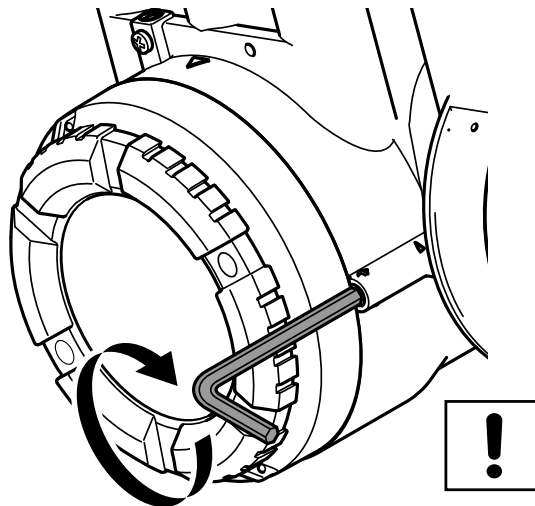
- 1 Transmitter back cover
2 Power supply cable gland

⚠ WARNING

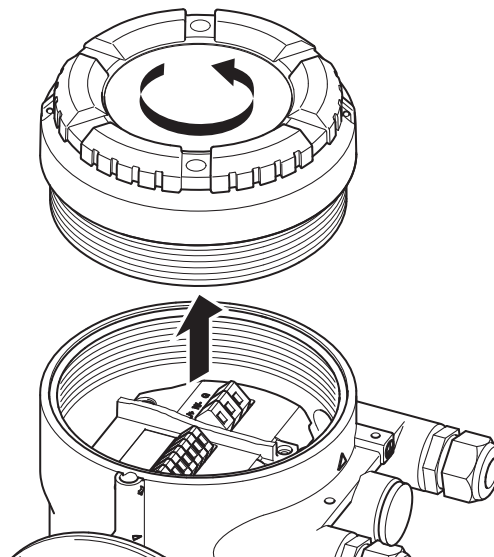
Risk of injury due to electrical shock

- ▶ The transmitter must be assigned an external, fixed-mount power switch or automatic circuit breaker in order to disconnect the transmitter from the power grid (compliant with IEC60947-1 and IEC60947-3). Power switch or automatic circuit breaker must disconnect all lines under current, but cannot disconnect the grounding conductor under any circumstances.
- ▶ The power switch or automatic circuit breaker must be installed near the transmitter and easily accessible. The "OFF" switch position must be clearly recognizable.

1. Switch off power supply.
2. Using an Allen wrench (Size: 3.0), tighten the locking screw on the back cover in clockwise direction.



3. Unscrew back cover from transmitter housing in counter-clockwise direction.

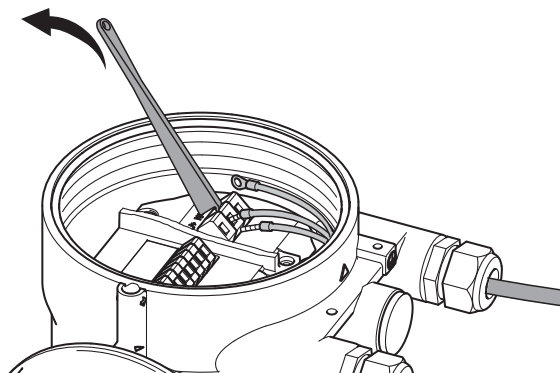


4. Attach cable glands.

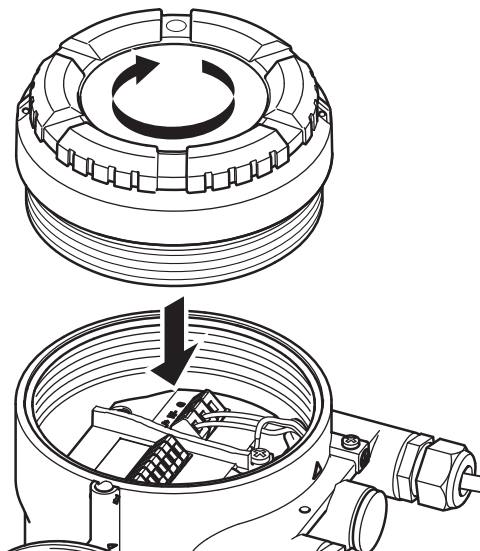
5. Connect wires to connection terminals.

NOTICE

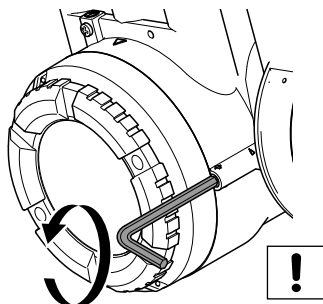
Connect the grounding conductor to the grounding screw (see chapter *Connection terminals* [▶ 50], figure 30, point 2).



6. Fit grounding conductor with a terminal lug and affix to grounding conductor.
7. Screw cable gland on tightly.
8. Screw back cover onto transmitter housing in clockwise direction.



9. Using an Allen wrench (Size: 3.0), loosen the locking screw in counter-clockwise direction.



7.5 Wiring check list

The following checks must be performed once the flow meter is connected electrically:



WARNING

Risk of injury from electrical shock due to insufficiently closed housing

- ▶ Before switching on the power supply, check that the housing covers of the transmitter have been properly installed.



WARNING

Risk of sparking and damage to the flow meter due to missing locking screw

- ▶ After wiring work, check that the housing cover has been installed and the locking screws have been tightened.

NOTICE

Risk of damage to the flow meter due to insufficiently secured cable inlets

- ▶ Install cables tension-free.
- ▶ Fit any unused cable entries with blind plugs.
- ▶ Completely install cable glands and screw together tightly.

NOTICE

Be aware that improper treatment of cable entry and/or cable terminal may lead to disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.

Check	Performed?
Are cables intact?	
Are power-supply and signal cables connected correctly?	
Do the cables have a lower point where liquid can drip immediately before they enter the cable glands?	
Are the cables installed tension-free?	
Is the power supply within the range specified on the nameplate?	
Are any unused cable entries fitted with blind plug?	
Are cable glands installed completely, tightly secured and watertight?	
Are housing covers installed and locking screws tightened?	

8 Commissioning

1. Activate external power switch.
 2. Perform check of piping installation.
 3. Check flow meter for device errors, warnings or alarms, see chapter on *Troubleshooting* [▶ 85].
 4. Configure the transmitter, and perform autozero, see chapter on *Default settings* [▶ 75].
- ⇒ Flow meter is ready for operation.

9 System configuration and operation

9.1 Operating options

The Rotamass Total Insight can be operated in different ways:

- IR (Infra-Red) switches on the display
- Digital communication (e.g. HART or Modbus)

The section below describes how to operate the system using the IR switches on the display.



The display is a device option and therefore not always available.

For more information on how to operate the transmitter and its functions, and on digital communication, see applicable Software Instruction Manual.

NOTICE

Be aware that all covers are closed before operating in order to prevent disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.

9.2 Display

All of the functions described here are also available via digital communication. Numerical values that are entered via the display are limited to 6 digits.

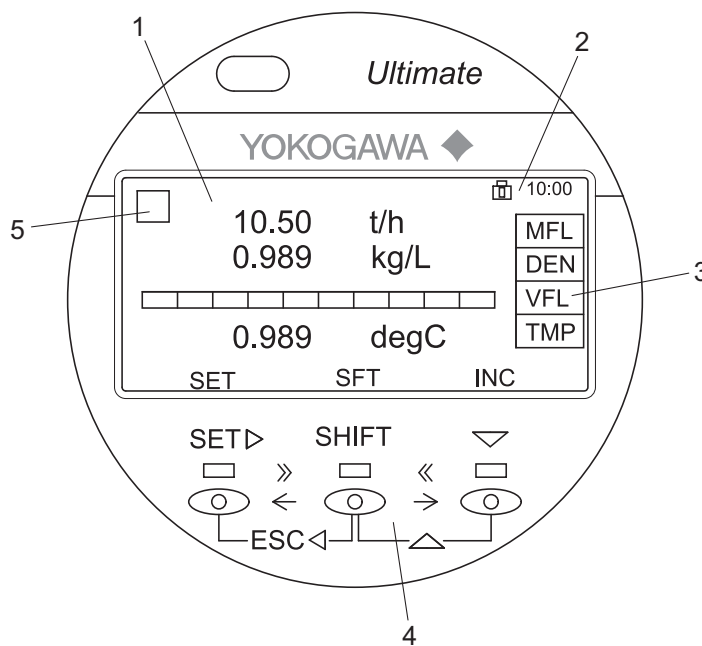


Fig. 52: Display layout

- | | | | |
|---|--------------------------------|---|--------------|
| 1 | Measured quantities and units | 4 | IR switches |
| 2 | Status icon and time | 5 | Alarm symbol |
| 3 | Measured quantity abbreviation | | |

The controls on the display are IR switches. They respond as soon as an object, such as a finger, is in close proximity. It is not necessary to apply pressure to the display surface.

NOTICE

Impairment of the display

If the device is operated for a longer period and is subjected to high temperatures or high humidity in the process, the display may be impaired.

- ▶ Replace display unit as described in *Rotating and replacing the display* [▶ 32]

Observe the following instructions to ensure that the IR switches are functional:

- ▶ Keep the display glass clean.
- ▶ Avoid exposure to direct sunlight.
- ▶ To increase the reflectivity of fingers (e.g. if they are very dirty) place some white tape on the fingertip.













IR switch functions

IR switch	Display	Function
SET ▶	SET	<ul style="list-style-type: none"> ▪ Apply setting ▪ Enter data ▪ Apply parameter
SHIFT	SHT	<ul style="list-style-type: none"> ▪ Move cursor right or to the next position ▪ Change function and display of SET and ▼
▼	INC	<ul style="list-style-type: none"> ▪ Increment parameter or value ▪ Change position of the decimal point ▪ Select next menu item













The IR switch function changes as follows when used with the SHIFT key:

Key combinations	Display	Function
SHIFT + SET ▶	ESC	<ul style="list-style-type: none"> ▪ Cancel and switch to parent menu
SHIFT + ▼	DEC	<ul style="list-style-type: none"> ▪ Decrement parameter or number ▪ Select previous menu item







Status icons

Status icon	Description	Status icon	Description
	System alarm tripped		Process alarm tripped
	Settings alarm tripped		Warning tripped
	Write protection disabled		Write protection enabled
	Device error (no write access)		Device busy (no write access)
	microSD card ready		Access to microSD card
	Error accessing microSD card		Process variable has bad status

Status icons HART

Status icon	Description	Status icon	Description
	Upload parameter enabled		Download parameter enabled
	Total health result: good (only indicated when display total health result is active)		Total health result: warning (only indicated when display total health result is active)
	Total health result: bad state (only indicated when display total health result is active)		Tube Health Check with result: OK
	Tube Health Check with result: warning		Tube Health Check with result: error
	Stop batch		Resume batch
	Batch running		SIL mode

Status icons Modbus, PROFIBUS PA

	Total health result: good (only indicated when display total health result is active)		Total health result: warning (only indicated when display total health result is active)
	Total health result: bad state (only indicated when display total health result is active)		Tube Health Check with result: OK
	Tube Health Check with result: warning		Tube Health Check with result: error

For status icon placement on the display see figure at *Display* [▶ 70], No. 1, 2 or 5.

Measured quantities and identifications List of measured quantity abbreviations and identification on the display

Tab. 10: Regular display

Abbreviation	Measured quantity or identification
MFL	Mass flow
DNS	Density
TMP	Temperature
VFL	Volume flow
RFD	Reference density
RLD	Relative density
CVF	Corrected volume flow
PRS	Pressure
TT1 – TT6	Totalizer 1 – 6
TAG	Customer-Device identification
LTG	Customer-Device identification, long version
VEL	Velocity
CNC	Concentration
NM1, NM2	Net mass flow rate 1, 2
NV1, NV2	Net volume flow rate 1, 2
NCV	Corrected net volume flow rate
DRC	Drive current
VSC	Viscosity
HT1	24hours totalizer 1
HT2	24hours totalizer 2
HT3	24hours totalizer 3
GVF	Gas void fraction



The following values are only available for the trend display to record data on the microSD card. Additional information about data recording can be found in the applicable Software Instruction Manual.



Only use the microSD card included with the Rotamass Total Insight. Functionality of the device cannot be guaranteed if other cards are used.

Tab. 11: Trend display

Abbreviation	Measured quantity or identification
MFL	Mass flow
DNS	Density
TMP	Temperature
VFL	Volume flow
PRS	Pressure
CNC	Concentration
NM1	Net mass flow rate 1
NV1	Net volume flow rate 1
PHS	Phase shift
FRQ	Resonance frequency
DRG	Drive gain
DRC	Driving current
MBT	Transmitter temperature
VSC	Viscosity

9.3 Default settings

9.3.1 Setting display language

1. Press **[SET]** switch for 2 seconds to enter [*Operation level*].
2. Press **[▼]** switch 1 time to enter [*Operator*].
3. Press **[SET]** switch to enter [*Device setup*].
4. Press **[▼]** switch until the menu [*Lang*] is selected.
5. Press **[SET]** switch to enter the [*Lang*] menu.
6. Press **[▼]** switch repeatedly until the desired language appears.
7. Press **[SET]** switch to select the desired language.
8. Press **[SET]** switch to confirm the language selected.
 - ⇒ Display switches to the next higher menu level.

9.3.2 Setting date

1. Press **[SET]** switch for 2 seconds to enter [*Operation level*].
2. Press **[▼]** switch until the [*Maintenance*] menu is selected.
3. Press **[SET]** switch to enter the [*Device setup*] menu.
4. Press **[▼]** switch until the [*Detailed setup*] menu is selected.
5. Press **[SET]** switch to enter the [*Detailed setup*] menu.
6. Press **[▼]** switch until the [*Date/Time*] menu is selected.
7. Press **[SET]** switch to enter the [*Date/Time*] menu.
 - ⇒ Menu [Date] is preselected.
8. Press **[▼]** switch until the menu [*Set date*] is selected.
9. Press **[SET]** switch to enter the menu [set date].
 - ⇒ Date on display is flashing.
10. Press **[▼]** switch until the desired year is displayed.
11. Press **[SHIFT]** switch to switch to the display of the month.
12. Press **[▼]** switch until the desired month is displayed.
13. Press **[SHIFT]** switch to switch to the display of the day.
14. Press **[▼]** switch until the desired day is displayed.
15. Press **[SET]** switch to apply the date set.
16. Press **[SET]** switch to confirm the date set.
 - ⇒ Display switches to the next higher menu level.

9.3.3 Setting time

1. Press **[SET]** switch for 2 seconds to enter [*Operation level*].
2. Press **[▼]** switch until the [*Maintenance*] menu is selected.
3. Press **[SET]** switch to enter [*Device setup*].
4. Press **[▼]** switch until the [*Detailed setup*] menu is selected.
5. Press **[SET]** switch to enter [*Detailed setup*].
6. Press **[▼]** switch until the [*Date/Time*] menu is selected.
7. Press **[SET]** switch to enter [*Date/Time*].
8. Press **[▼]** switch until the [*Set time*] menu is selected.

9. Press [**SET**] switch to enter [*Set time*].
 - ⇒ Time on display is flashing.
10. Press [**▼**] switch until the desired number for the hour is displayed.
11. Press [**SHIFT**] switch to set the minutes.
12. Repeat the two previous steps for minutes and seconds.
13. Press [**SET**] switch to apply the time set.
14. Press [**SET**] switch to confirm the time set.
 - ⇒ Display switches to the next higher menu level.

9.3.4 Setting zero point

In order to avoid systematic flow rate measurement deviations, performance of a zero point adjustment is recommended before starting measuring operations. For two- or multi-phase fluids, the factory-set zero point value is preferable to a manual zero point adjustment.

1. Flush flow meter with fluid and check valves for tightness.
2. Close valves in front of and after the flow meter and stop the flow.
3. Wait until density, temperature and pressure are stabilized.
4. In case of fluids, compare the density displayed on the Rotamass Total Insight with the fluid density in order to rule out gas accumulations in the measuring tube.
5. In applications with increased process pressure, ensure that the process pressure and its unit of measurement are set correctly.
6. Perform autozero.

9.3.5 Performing autozero



To ensure ideal measuring results, performance of a second autozero process is recommended after several days of operation and stabilization of the installation conditions.

1. Press [**SET**] switch for 2 seconds to enter [*Operation level*].
2. Press [**▼**] switch until the [*Maintenance*] menu is selected.
3. Press [**SET**] switch to enter [*Device setup*].
4. Press [**▼**] switch until the [*Diag/Service*] menu is selected.
5. Press [**SET**] switch to enter [*Diag/Service*].
6. Press [**▼**] switch until the [*AZ*] menu is selected.
7. Press [**SET**] switch to enter [*AZ*].
 - ⇒ Menu [*Exe*] is preselected.
8. Press [**SET**] switch to enter [*Exe*].
 - ⇒ Parameter [*Not exe*] appears.
9. Press [**▼**] switch until [*Exe*] is selected.
10. Press [**SET**] switch.
 - ⇒ Parameter [*Exe*] flashes.
11. Press [**SET**] switch to start autozero.
 - ⇒ Progress bar appears to indicate status of autozero, after completion display switches to next higher menu level.

9.4 Advanced settings



Explosion hazard

- ▶ When the housing is opened in hazardous areas, the applicable Explosion Proof Type Manual must be observed, see chapter Operation, maintenance and repair.

9.4.1 Setting hardware write-protection

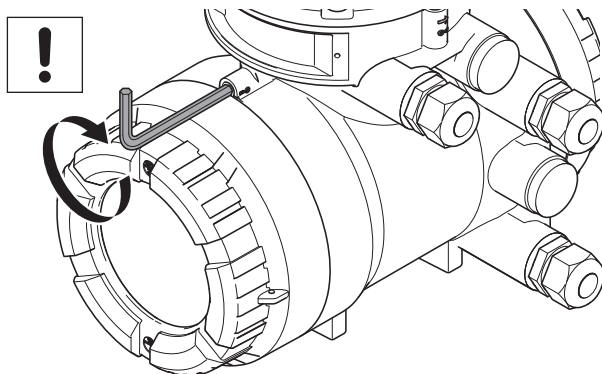
The flow meter can be protected from unauthorized access. If the software write-protection via password is not adequate, an additional hardware write-protection can be set on the main board of the transmitter. With the write-protection active, the transmitter display can still be operated, any changes to settings or parameters are not saved and therefore not effective.

Write-protection can also be activated without removing the display. To do this, remove the jumper from the write-protection terminal (see *Connection terminals* [▶ 50]).

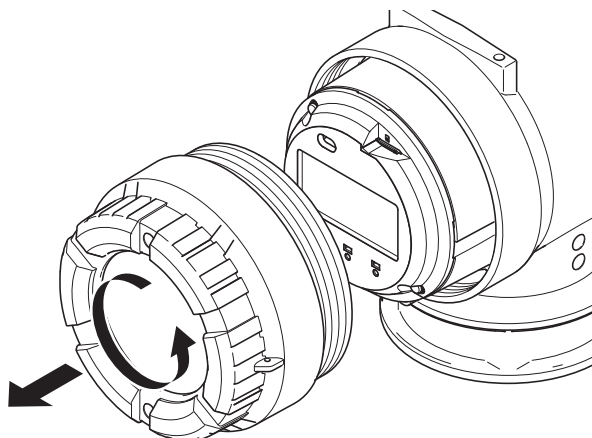


It is not possible to release the hardware write-protection via HART, Modbus or other communication software.

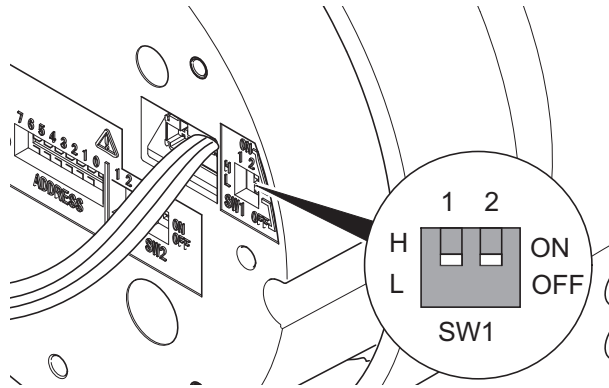
1. Switch off power supply.
2. Loosen the locking screw by turning it clockwise with an Allen wrench (size: 3.0).




3. Unscrew display cover from transmitter housing.



- On the main board, set DIP switch 2 to the ON position using a sharp-pointed object.



- Screw display cover back onto transmitter housing.
- Tighten the locking screw by turning it counterclockwise with an Allen wrench (size: 3.0).



⇒ Symbol  appears in the top right corner of the display.

Setting the Burnout mode

The flow meter is equipped with a Burnout function. The Burnout mode can be set via DIP SW1-1 behind the display.

Factory setting

The factory setting of the Burnout mode is *High*.

SW1-1 position	Burnout mode	Output value if Burnout in mA
H  L	High	21.6
H  L	Low	2.4

9.4.2 Modbus hardware setting

Switch settings

1. Switch off power supply.
2. Loosen the locking screw by turning it clockwise with an Allen wrench (size: 3.0).

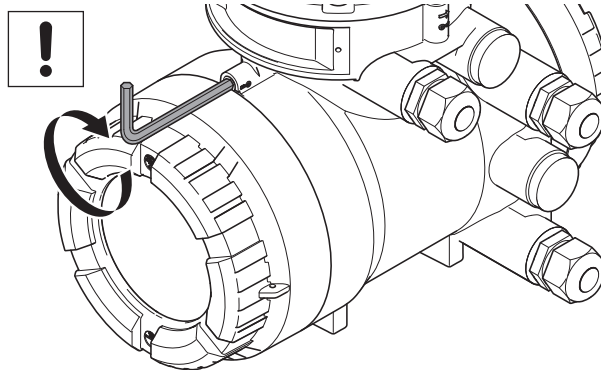
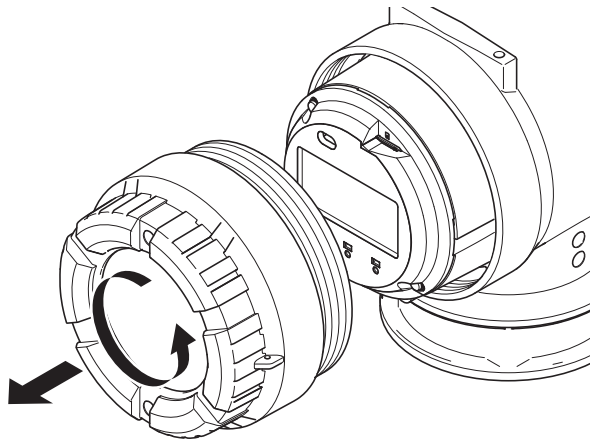
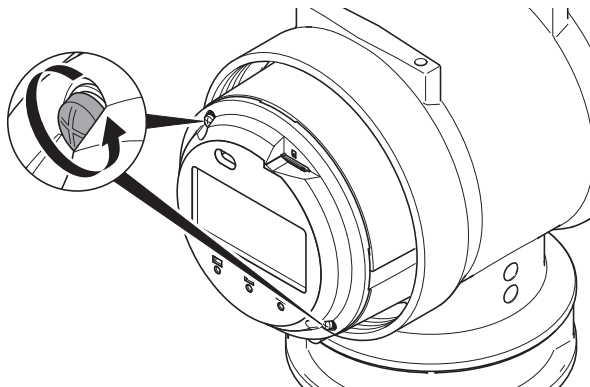


Fig. 53:

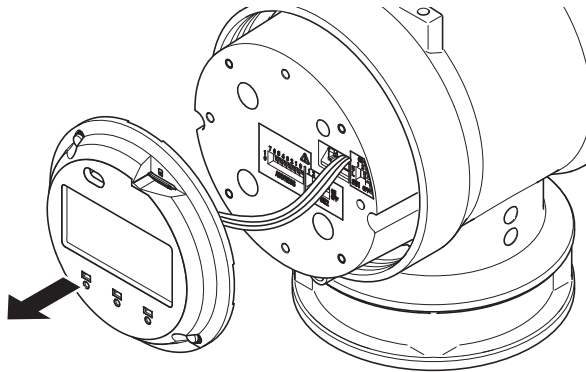
3. Unscrew display cover from transmitter housing.



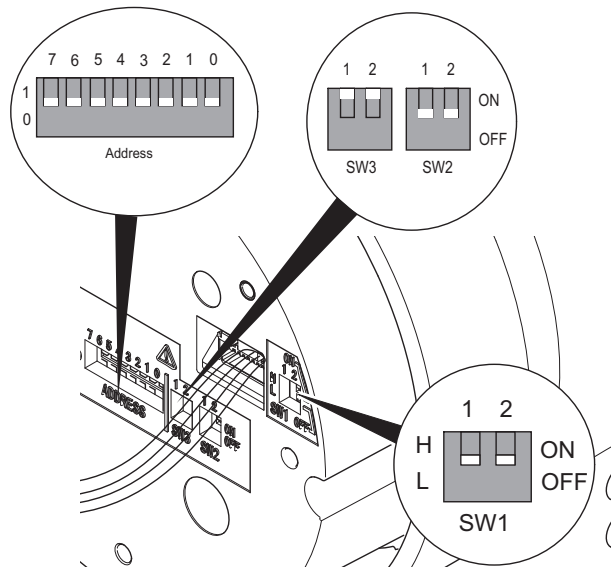
4. Remove 2 screws from the display.



5. Remove the display from housing by slowly pulling forward.
 - ⇒ The switch can be seen.



6. Set the desired address.



7. Push display into housing.
8. Fasten the display with 2 screws.
9. Screw display cover back onto transmitter housing.
10. Tighten the locking screw by turning it counterclockwise with an Allen wrench (size: 3.0).

Default settings

Switches		
Address	SW 3	SW 2
0	ON	OFF

Address switch

SW (ADDRESS: 7)

Device address	Position	Description
Hardware	1	Address SW" settings between position 0 and 6 are the device address.
Software	0	Parameter value setting is the device address. Factory setting

SW (ADDRESS: 0-6)

Hardware address can be set from 1 to 127.

e.g.: If only address switch "6" is set to 1, the resulting address is 64.

$$(1 * 2^6 + 0 * 2^5 + 0 * 2^4 + 0 * 2^3 + 0 * 2^2 + 0 * 2^1 + 0 * 2^0)$$

Address has to be set always between 1 and 127. If address switch is set to 0, address is automatically converted to 1.

When hardware switch is active, then address value based on the hardware address is stored in the device.

SW2

Line termination of two ends on the bus are required to communicate Modbus. One termination mode can be selected by SW2, see below table for setting.

Termination mode	Configuration
Bus end	Available when both SW2-1 and SW2-2 are "ON" (Resistance is 150 Ω)
Not bus end	Available when both SW2-1 and SW2-2 are "OFF"

Both SW2-1 and SW2-2 have to be set at the same position.

SW3

When bus is idle state, it becomes unstable in potential without pull up to D1 and pull down to D0. SW3 can be set, see below table for setting.

Pull up and Pull down mode	Configuration of Pull up and Pull down
Used	Available when both SW3-1 and SW3-2 are "ON" (Resistance is 600 Ω)
Not used	Available when both SW3-1 and SW3-2 are "OFF"

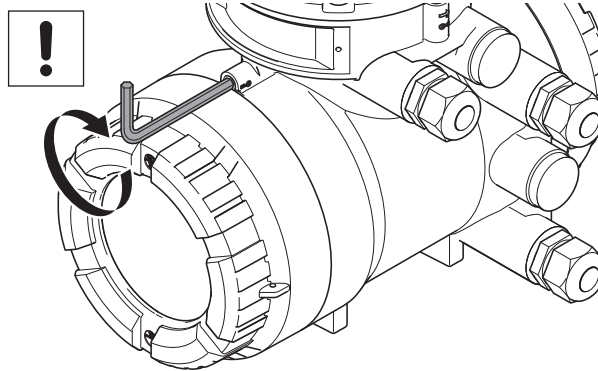
Both SW3-1 and SW3-2 have to be set at the same position.

9.4.3 PROFIBUS PA hardware setting

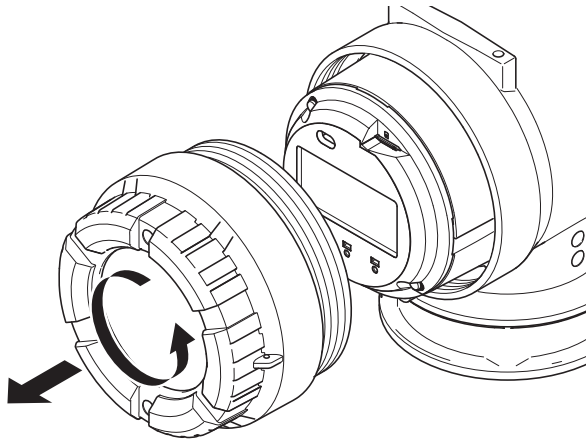
Access to Hardware DIP switches

Open the front cover

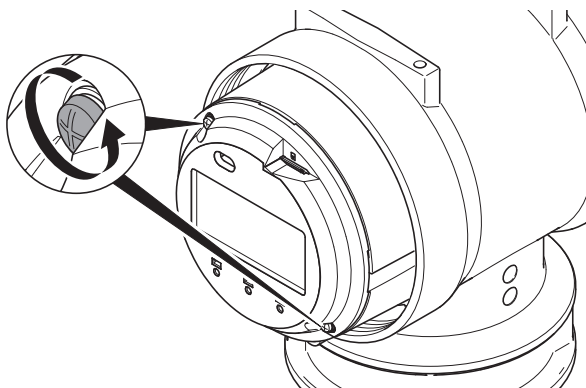
1. Switch off power supply.
2. Loosen the locking screw by turning it clockwise with an Allen wrench (size: 3.0).



3. Unscrew display cover from transmitter housing.

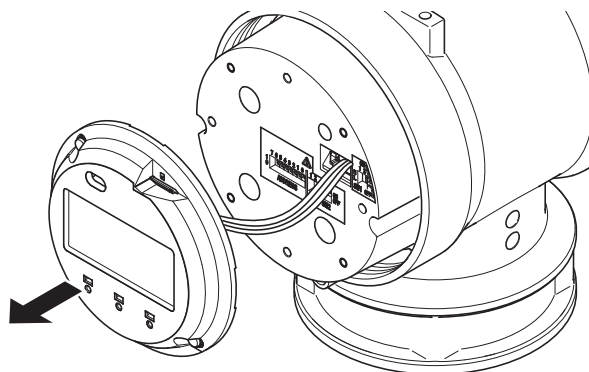


4. Remove 2 screws from the display.

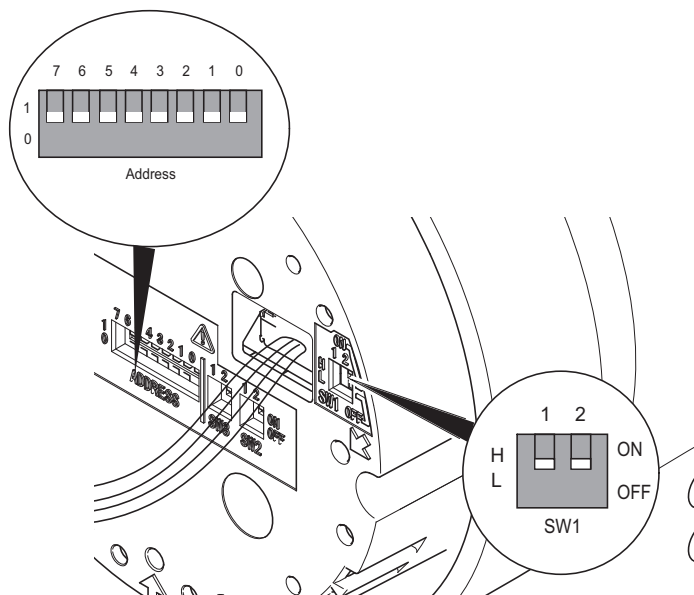


5. Remove the display from housing by slowly pulling forward.

⇒ The switch can be seen.



6. Set the desired address and switch position.



7. Push display into housing.
8. Fasten the display with 2 screws.
9. Screw display cover back onto transmitter housing.
10. Tighten the locking screw by turning it counterclockwise with an Allen wrench (size: 3.0).

Setting hardware write-protection

The flow meter is equipped with a Write protection function. It can be set via DIP SW1-2 behind the display. Use a sharp-pointed object to set the switch.

The flow meter can be protected from unauthorized access. If the software write-protection via WRITE LOCKING is not adequate, an additional hardware write-protection can be set on the main board of the transmitter. With the write-protection active, the transmitter display can still be operated, any changes to settings or parameters are not saved and therefore not effective.





Write-protection can also be activated without removing the display. To do this, remove the jumper from the write-protection terminal (see Inputs and outputs).




It is not possible to release the hardware write-protection via PROFIBUS PA communication software.

Factory setting

The factory setting of the Write protection mode is *Low*.

SW1 position	SW1-1	SW1-2
	Not applicable	Write protect state
H  L 	-	Protected
H  L 	-	Not protected

Symbol  appears in the top right corner of the display, when SW1-2 is set to *High*.

Setting the bus address

This section describes the procedure to set bus address in the transmitter. Every device in PROFIBUS PA must be assigned a unique address in the range of 0(0x00) to 126(0x7e). If it is not specified at the time of order, 126(0x7e) is the factory default. Do not change to 0, 1 or 2 as these are used by master devices. There are two ways to set bus address: by using communication tools or by hardware switch in device.

Hardware Address Switch (ADDRESS: 7)

Device address	Mark	Description
Hardware	1	"Hardware Address Switch" settings between 0 and 6 are device addresses.
Software	0	Parameter setting is device address. Factory setting.

Hardware Address Switch (ADDRESS: 0 – 6)

Numbers of these address switches show the square of each number.

Example: If only the address SW-6 is 1, address shows 64.

$$1 * 2^6 + 0 * 2^5 + 0 * 2^4 + 0 * 2^3 + 0 * 2^2 + 0 * 2^1 + 0 * 2^0$$

Address has to be set always between 0 and 126. If address switch is set to 127, the address is automatically converted to 126. Hardware Address Switch change has to be performed to reflect hardware switch status after powering off a device.

Software address setting

Device address can be set by PROFIBUS PA software tool if hardware address setting is not active. For further details, see applicable Software Instruction Manual (SW-IM) IM01U10S04-00_--R.

10 Troubleshooting

All error messages and error codes that may appear in operation are described in the Software Instruction Manual. Possible malfunctions that may occur during commissioning are explained below and remedying them is explained. If you cannot remedy the malfunction using these explanations, contact the Yokogawa service center.

10.1 Malfunction of operation

Tab. 12: Different kinds of malfunction of operation: causes and remedies

Malfunction	Possible causes	Remedy
Display on transmitter not functioning	Power supply disconnected	<ul style="list-style-type: none"> Ensure that the unit is connected to the power supply, see [▶ 65]
	Settings cannot be made via IR switches	<ul style="list-style-type: none"> Check cable connections between display and main board and connect properly, if necessary.
Settings cannot be made via IR switches	Incorrect settings in write-protect menu item	<ul style="list-style-type: none"> Switch off write-protect menu item via digital communication or hardware switch.
Field communicator is not detected	HART DD not installed on field communicator	<ul style="list-style-type: none"> Install HART DD file on field communicator.
	Field communicator not connected	<ul style="list-style-type: none"> Connect field communicator with Rotamass Total Insight, see software instruction manual.
PROFIBUS PA Host does not detect Rotamass Total Insight	PROFIBUS PA EDD not installed on the Host	<ul style="list-style-type: none"> Install PROFIBUS PA EDD¹⁾ on the Host
	PROFIBUS PA GSD file is not installed on the Host	<ul style="list-style-type: none"> Install PROFIBUS PA GSD²⁾ file on the Host
	PROFIBUS DP/PA coupler is not connected to the Host	<ul style="list-style-type: none"> Connect PROFIBUS DP/PA coupler with Host
	PROFIBUS PA modem is not connected to the DP/PA coupler	<ul style="list-style-type: none"> Connect PROFIBUS PA modem with DP/PA coupler
	Rotamass Total Insight is not connected to the PROFIBUS PA modem	<ul style="list-style-type: none"> Connect PROFIBUS PA modem with Rotamass Total Insight

¹⁾ meaning of "EDD": Electronic device description. The EDD describes the digital communication characteristics of intelligent field instrumentation and equipment parameters (device status, diagnostic data and configuration details).

²⁾ meaning of "GSD": The GSD file and Ident number are necessary for PROFIBUS communication. Before starting communication, the device must be specified by the GSD file in the host system and the Ident number of the device.

You can download the GSD file from <http://www.profibus.com/products/gsd-files/>.

10.2 Zero point unstable

Tab. 13: Different kinds of malfunction for zero point unstable: causes and remedies

Malfunction	Possible causes	Remedy
Zero point unstable	Measuring tube not completely filled with fluid	<ul style="list-style-type: none"> – Check that the measuring tube in the sensor is completely filled with fluid. Correct installation, see [▶ 20].
	Bubbles or solids in the fluid	<ul style="list-style-type: none"> – Check pipe and sensor installation, see [▶ 25]. – Correct installation, see [▶ 20].
	No electrical grounding	<ul style="list-style-type: none"> – Ground transmitter and sensor, see [▶ 43], and [▶ 65]. – Check correct connection of connecting cable shield on transmitter.
	Flow meter installed in proximity to facilities with strong electro-magnetic field	<ul style="list-style-type: none"> – Ground transmitter and sensor, see [▶ 43], and [▶ 65]. – Install flow meter as far away as possible from these electric devices.
	Mechanical strain from traction or pressure	<ul style="list-style-type: none"> – Eliminate cause for mechanical tension.
	Terminal board or connection terminals of transmitter or sensor soiled or damp	<ul style="list-style-type: none"> – Clean terminal board and connection terminals. – Clean transmitter and/or sensor. – Dry transmitter and/or sensor. – Seal transmitter and/or sensor tightly.
	Influence of external vibration	<ul style="list-style-type: none"> – Install mechanical dampers. – Increase parameter <i>mass flow damping</i> (see applicable software instruction manual).

10.3 Display deviating

Tab. 14: Different kinds of malfunction for display deviating: causes and remedies

Malfunction	Possible causes	Remedy
Flow rate displayed deviates from actual flow rate	Zero point set incorrectly	– Set zero point, see [▶ 76]
	Highest and lowest value for mass flow set incorrectly	– Match settings of flow meter and reading system. – Check LRV and URV process parameters, see Software Instruction Manual.
	Measuring tubes not completely filled with fluid	– Correct installation, see [▶ 25]
	Bubbles in fluid	– Check pipe and installation, see [▶ 25]. – Correct installation, see [▶ 25]
	Connecting cable incorrectly connected for remote type	– Check cable connections and correct, if necessary, see [▶ 45].
Density displayed deviating from actual density	Density unit, highest and lowest value for density set incorrectly	– Match settings of flow meter and reading system. – Check LRV and URV process parameters, see Software Instruction Manual.
	Fixed density	– Check whether the <i>Val sel</i> parameter is set correctly. If a fixed value is selected, ensure that the parameter <i>Fix val</i> is set correctly, see Software Instruction Manual. – Set parameter <i>Val sel</i> to <i>Meas val</i> , see Software Instruction Manual.
	Analog output trim was performed incorrectly	– Correctly perform trimming, see applicable Software Instruction Manual.
	No electrical grounding	– Ground transmitter and sensor, see [▶ 43]. – Check correct connection of connecting cable shield on transmitter.
	Bubbles in fluid	– Check pipe and installation, see [▶ 25].
	Connecting cable incorrectly connected for remote type	– Check cable connections and correct, if necessary, see [▶ 45].
	Faulty temperature measurement	– Check temperature measurement circuits TP1 – TP3 of connecting cable.
	Corrosion and erosion	– If corrosion or erosion due to corrosive fluids is suspected, contact Yokogawa and have density and mass flow recalibrated, if necessary.
Contaminated measuring tubes	– Clean measuring tubes.	

Malfunction	Possible causes	Remedy
Temperature displayed deviating from actual temperature	Temperature unit, highest and lowest value for temperature set incorrectly	<ul style="list-style-type: none"> – Match settings of flow meter and reading system. – Check LRV and URV process parameters, see Software Instruction Manual.
	Non-adjustable temperature	<ul style="list-style-type: none"> – Check whether the <i>Func sel</i> parameter is set correctly. If a fixed value is selected, ensure that the <i>Fix val</i> is set correctly, see Software Instruction Manual. – Set parameter <i>Func sel</i> to <i>Inter val</i>.
	Analog output trim was performed incorrectly	<ul style="list-style-type: none"> – Correctly perform trimming (see applicable Software Instruction Manual).
	Connecting cable incorrectly connected for remote type	<ul style="list-style-type: none"> – Check cable connections and correct, if necessary, see [▶ 45].
	Incorrect temperature measurement with remote type	<ul style="list-style-type: none"> – Check temperature measurement circuit by measuring resistance between TP1/TP2 and TP1/TP3. Each value must be between 50 – 200 Ω. – Check temperature measurement circuit TP2/TP3 and make sure that resistance is < 10 Ω. – Connect Pt100 simulator and check temperature measurement.
Output signal deviating from measured quantity	Incorrect parameter	<ul style="list-style-type: none"> – Check parameter <i>LRV</i> and <i>URV</i> of the corresponding output signal, and correct, if necessary.
	Incorrect measured quantity	<ul style="list-style-type: none"> – Check measured quantity output and, if necessary, correct; check parameter <i>Sel</i>, see Software Instruction Manual.

11 Maintenance and repair

Applicable country-specific regulations for opening and repairing electrical devices must be observed.

DANGER

Risk of injury and damage to the flow meter due to ignition after sparking, if there is mechanical impact

- ▶ Avoid strong mechanical impacts on the flow meter during maintenance work.

WARNING

Risk of injury due to electrical shock, as well as damage to the flow meter, due to insufficiently trained personnel

- ▶ Only have skilled personnel maintain and repair the flow meter.

WARNING

Risk of injury due to electrical shock, as well as damage to the flow meter

- ▶ Do not perform maintenance outdoors during rain.

WARNING

Risk of injury from slipping or falling flow meter

- ▶ Observe notes about the transport of the flow meter in chapter *Transport* [▶ 18]; these also apply accordingly during maintenance work.

WARNING

Risk of injury due to electrical shock, as well as damage to the flow meter, due to maintenance work in areas at risk of explosion

- ▶ When maintaining the flow meter in areas at risk of explosion, compliance with the applicable Explosion Proof Type Manual is mandatory.

WARNING

Risk of injury from electrical shock due to insufficiently closed housing

- ▶ After completion of the maintenance work, check that the housing covers of the transmitter have been properly installed.

WARNING

Risk of open/ close the transmitter cover

- ▶ Please be sure to handle the transmitter cover carefully so that there are no damages and foreign matter adhesion at its thread and O-ring when it is opened or closed. Keep checking their condition and clean the threads in case of adhering the foreign matter. Replace the cover in case the threads receive damages. Replace the O-ring if there is any scarring or transformation and apply silicone based grease at the O-ring in case of the shortage and exhaustion of grease.

WARNING

Risk of opening the gas-filling-plug of the sensor

- ▶ When opening the gas-filling-plug of the sensor, ensure that the sensor housing is pressure-less and free of hazardous fluids.

NOTICE

Risk of damage to the flow meter due to electrostatic discharge (ESD)

- ▶ When performing maintenance work on the flow meter, appropriate ESD protective measures must be taken.

NOTICE Be aware that all covers are closed before operating in order to prevent disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.



The need for maintaining the Rotamass Total Insight depends on process and environmental conditions. Maintenance-free operation is possible for many processes. Contact the responsible Yokogawa sales organization for details.

11.1 Exterior cleaning



Risk of injury due to electrical shock, as well as damage to the flow meter, due to unskilled cleaning

- ▶ For CIP or SIP cleaning, limit the steam temperature to max. 230°C.
 - ▶ Observe the maximum permissible ambient temperature for the transmitter during cleaning (especially for the integral type).
-

1. Regularly remove soiling on display glass pane or nameplate by using a soft, dry cloth.
2. Use only cleaning agents that do not corrode the surface of the flow meter.

11.2 Recalibration and calibration service

For recalibration, flow meters should be sent to the manufacturer Rota Yokogawa GmbH in Wehr/Germany. The option of having on-site calibration performed by a Yokogawa technician is available in some countries. For additional information regarding service products and their availability, go to the Yokogawa homepage or contact a local Yokogawa sales partner.

11.3 Dry Verification

Additionally to this User's Manual the Dry Verification procedure MP 208-008-2019 can be conducted for devices with option VR in combination with option TC (Tube Health Check).

11.4 Impairment of the display



Impairment of the display

If the device is operated for a longer period and is subjected to high temperatures or high humidity in the process, the display may be impaired.

- ▶ Replace display unit as described in *Rotating and replacing the display* [▶ 32]
-

11.5 List of replacement parts

Replacement parts may be reordered using the *Customer Maintenance Part List (CMPL)*, which is available on the included CD/ DVD.

12 Sensor replacement

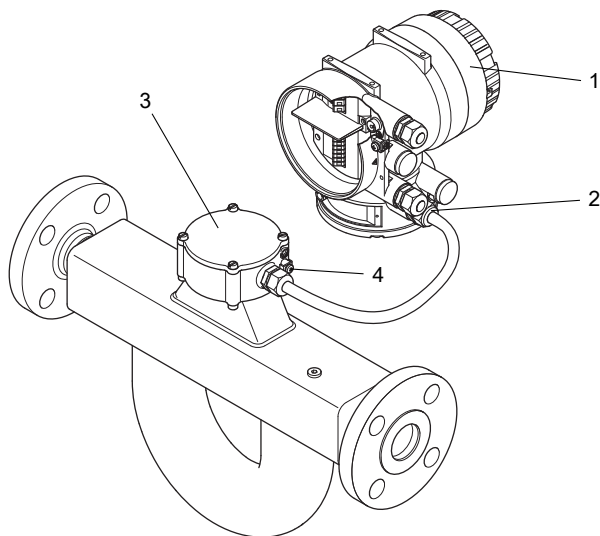
12.1 Dismantling of the defective sensor

The defective Rotamass Total Insight sensor has to be dismantled. The dismantling flow depends on the flow meter type (integral or remote).

The rules according to the Explosion Proof Type Manual IM 01U10X0_-00_-R apply, especially the chapter "Operation, maintenance and repair".

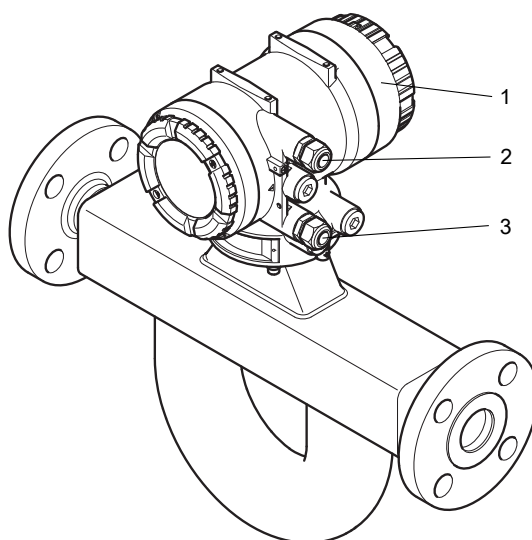
12.1.1 Connecting interfaces

Remote type



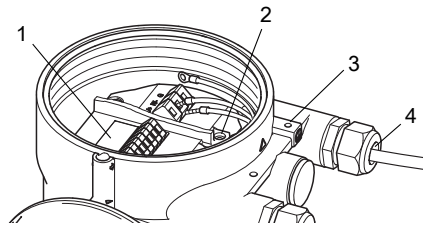
- 1 Display (if available)
- 2 Communication cable entry
- 3 Terminal cover
- 4 Grounding terminal for external potential equalization (sensor)

Integral type



- 1 Display (if available)
- 2 Power supply cable entry
- 3 Communication cable entry

Transmitter housing back cover



- 1 Terminal box power and I/O
- 2 Grounding screw for connecting grounding conductor
- 3 Grounding terminal for external potential equalization (transmitter)
- 4 Power supply cable entry

12.1.2 Disconnect remote type sensor



WARNING

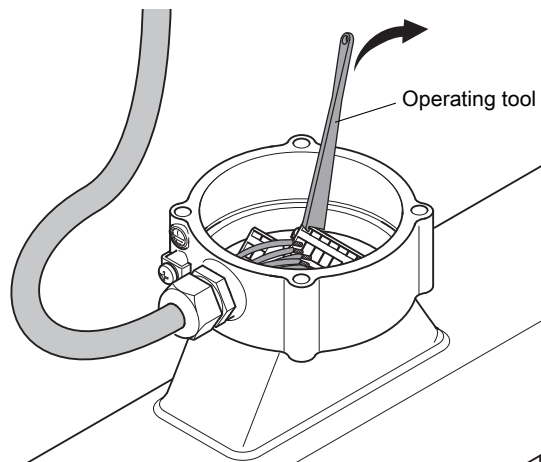
Life-threatening injuries from electric shock

- ▶ Switch off power supply and communication.
- ▶ Secure against inadvertent switch-on.

Disconnecting power, communication and grounding

After power down and breaking all power cable connections from L/+ N/- and grounding for the power circuit (except potential equalization connection of external grounding terminal) the sensor has to be disconnected by the following procedure:

1. Open the terminal cover.



2. Disconnect all cables with the operating tool.
3. Remove the cable gland and cable.
4. Disconnect the sensor potential equalization.

12.1.3 Disconnect integral type sensor

WARNING

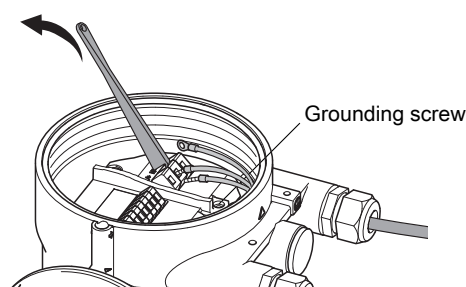
Life-threatening injuries from electric shock

- ▶ Switch off power supply and communication.
- ▶ Secure against inadvertent switch-on.

Disconnecting power, communication and grounding

After power down and breaking all power cable connections from L/+ N/- and grounding for the power circuit (except potential equalization connection of external grounding terminal) the sensor has to be disconnected by the following procedure:

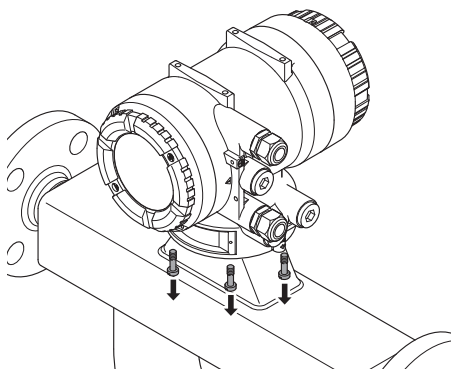
1. Remove locking screw of the "Terminal box power and I/O connection" and remove the back cover.
2. Disconnect the communication and I/O cables (avoid short circuit!).
3. Remove the cable gland and cable.
4. Disconnect the power cables from L/+ and N/- "Power supply connection terminals".



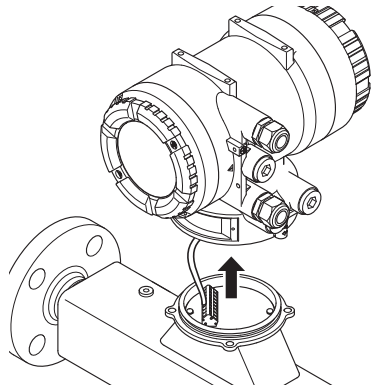
5. Remove "Grounding screw for connecting grounding conductor".
6. Remove potential equalization from "Grounding terminal for potential equalization" (if used).

Remove transmitter and disconnect from defective sensor

1. After disconnection the transmitter is removed by unscrewing the four clamping bolts.



2. Lift the transmitter housing:



3. Turn the transmitter housing around for disconnection.
4. Disconnect all wires from the sensor with the operating tool.

12.1.4 Remove defective sensor

After disconnection the sensor has to be dismantled according to chapter 14.1 *Decontamination and return shipment* [▶ 107].

12.2 Installation of the Spare sensor

For the installation of the Spare sensor, please refer to chapter 6.3 *Sensor installation* [▶ 25].

12.3 Parameter setting

12.3.1 Relevant settings and parameter storage

Relevant settings

For the exchange of the sensor two kinds of parameters are relevant to ensure a proper operation of the flowmeter:

- **sensor related parameters** (liquid or gas select, mass flow- or volume flow unit, temperature unit...)
- **sensor specific parameters** (SK20, KD, fl20)

The sensor exchange has no impact on system related setting (e.g. device ID, device tag).

Delivered parameters

The Spare sensor is delivered with parameters according to the ordered model code and as documented on the calibration certificate.

Storage location of parameters


Both parameter types, sensor related parameters and sensor specific parameters, are stored on the microSD card and product DVD in the file "Factory.PAR".

In addition, the sensor specific parameters can be found on:

- the calibration certificate of the sensor:

Results: Flow Calibration	Density Calibration
Sensor Coefficient SK20: 103,0	Density Coefficient KD: 2,7933 kg/l
Auto Zero Value: - 0,0 kg/h	Frequency FL20: 383,305 Hz

- the additional nameplate of the sensor:

METER FACTORS	
SK20 35	
KD 16,8	
FL20 144	
TAG No	

Communication possibilities

There are two possibilities to configure the transmitter with all relevant settings to ensure a possibilities proper operation:

- Parameter setting via communication tool like 475 Configurator or DTM
- Parameter setting via transmitter display, if available

12.3.2 Parameter setting procedure

The coupling of the existing transmitter with the spare sensor can be executed with the following procedure:

1. Set the process parameter units to standard units.
Please refer to chapter 13.3.3 *Set up process variable units* [▶ 102].
2. Copy and rename the file "Factory.PAR", available on the delivered microSD card or product DVD, to the microSD card of the existing transmitter.



The use of the microSD card is possible only for transmitters with display (indicated on model code position 14 = 1)

3. Run the function "Download sensor constants from microSD card". Please refer to chapter 13.3.4 *Set up sensor relevant and sensor specific parameters* [▶ 103].

12.4 Wiring

For the wiring of Spare sensor and existing transmitter, please refer to chapter 7. *Wiring* [▶ 41].

12.5 Commissioning

1. Activate external power switch.
2. Perform check of piping installation.
3. Check flow meter for device errors, warnings or alarms, see chapter *Troubleshooting*.
4. Configure the transmitter, and perform autozero, see chapter *System configuration and operation*. Flow meter is ready for operation.

13 Transmitter replacement

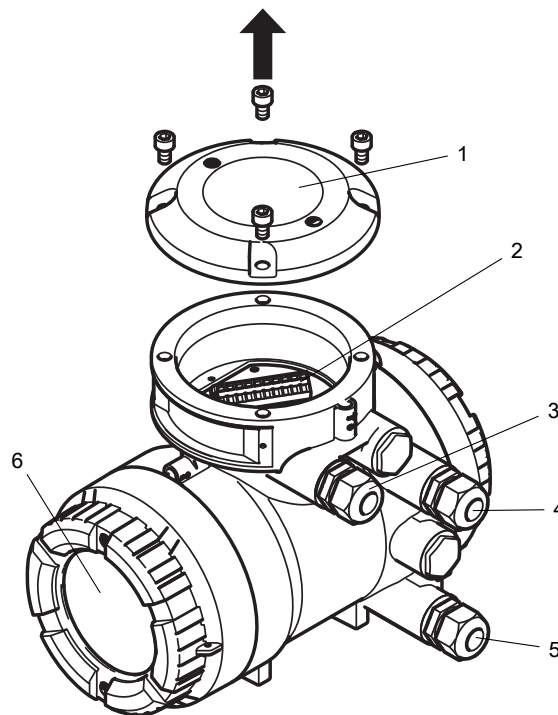
13.1 Dismantling of the defective transmitter

The defective Rotamass Total Insight transmitter has to be dismantled. The dismantling flow depends on the flow meter type (integral or remote).

The rules according to the Explosion Proof Type Manual IM 01U10X0 _-00 _ _-R apply, especially the chapter “Operation, maintenance and repair”.

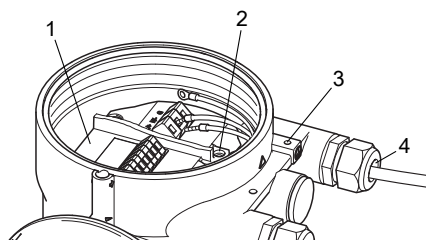
13.1.1 Connecting interfaces

Transmitter



- 1 Terminal box cover (remote type only)
- 2 Terminal box sensor connection
- 3 Sensor communication cable entry (remote type only)
- 4 Communication cable entry
- 5 Power supply cable entry
- 6 Display, if available

**Transmitter housing
back cover**



- 1 Terminal box power and I/O
- 2 Grounding screw for connecting grounding conductor
- 3 Power supply cable entry
- 4 Grounding terminal for external potential equalization

13.1.2 Disconnect remote type transmitter



WARNING

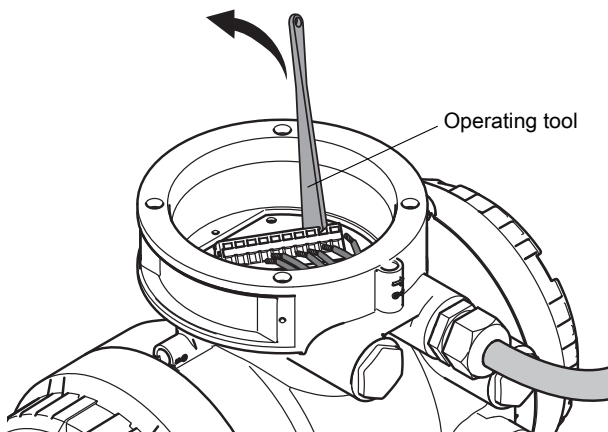
Life-threatening injuries from electric shock

- ▶ Switch off power supply and communication.
- ▶ Secure against inadvertent switch-on.

**Disconnecting
power, communi-
cation and
grounding**

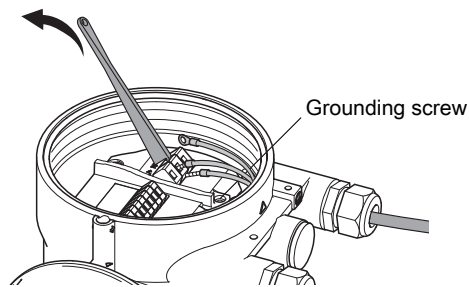
After power down and breaking all power cable connections from L/+ N/- and grounding for the power circuit (except potential equalization connection of external grounding terminal) the transmitter has to be disconnected by the following procedure:

1. Open the terminal box sensor connection.
2. Disconnect all cables with the operating tool.



3. Remove the cable gland and cable.
4. Remove locking screw of the "Terminal box power and I/O connection" and re-move the back cover.
5. Disconnect the communication and I/O cables (Avoid short circuit!).
6. Remove the cable gland and cable.

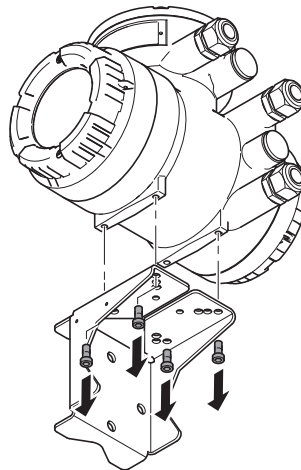
7. Disconnect the power cables from L/+ and N/- “power supply connection terminals”.



8. Remove “Grounding screw for connecting grounding conductor”.
9. Remove potential equalization from “Grounding terminal for potential equalization”.

13.1.3 Remove defective transmitter

After disconnection the transmitter has to be removed by unscrewing the four clamping bolts.



The mounting bracket (U-bracket) remains for the installation of the spare transmitter.

13.1.4 Disconnect integral type transmitter

⚠ WARNING

Life-threatening injuries from electric shock

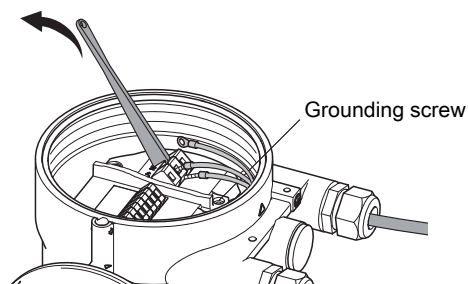
- ▶ Switch off power supply and communication.
- ▶ Secure against inadvertent switch-on.

Disconnecting power, communication and grounding

After power down and breaking all power cable connections from L/+ N/- and grounding for the power circuit (except potential equalization connection of external grounding terminal) the transmitter has to be disconnected by the following procedure:

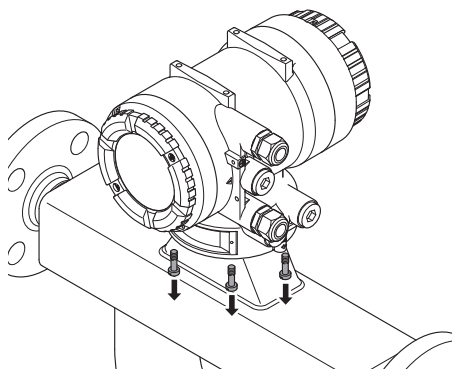
1. Remove locking screw of the “Terminal box power and I/O connection” and remove the back cover.
2. Disconnect the communication and I/O cables (avoid short circuit!).
3. Remove the cable gland and cable.

4. Disconnect the power cables from L/+ and N/- "Power supply connection terminals".

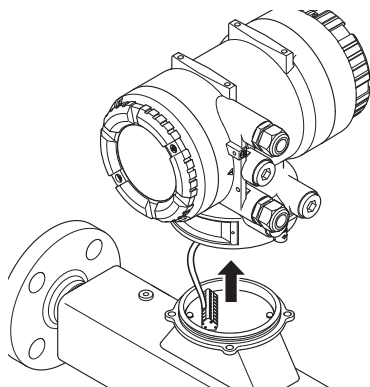


5. Remove "Grounding screw for connecting grounding conductor".
 6. Remove potential equalization from "Grounding terminal for potential equalization" (if used).
1. After disconnection the transmitter is removed by unscrewing the four clamping bolts.

Remove defective transmitter and disconnect from sensor

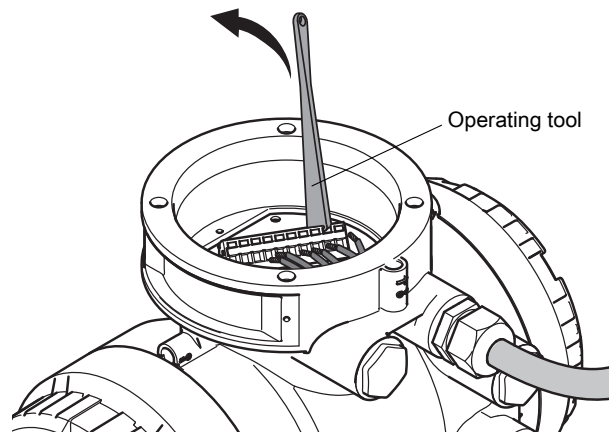


2. Lift the transmitter housing:



3. Turn the transmitter housing around for disconnection.

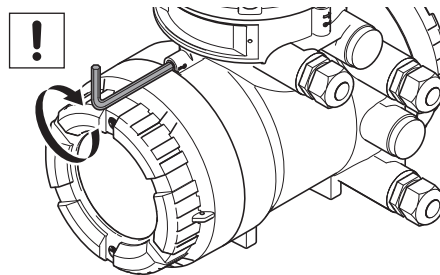
4. Disconnect all wires from the transmitter with the operating tool.



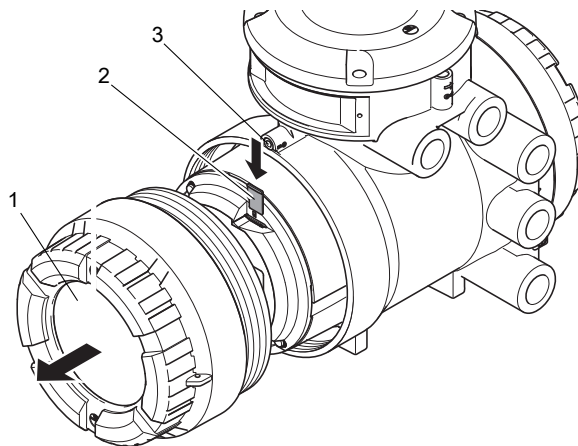
13.1.5 Remove microSD card (transmitter with display only)

In case of defective transmitter with display the microSD card can be used to set up the Spare transmitter by following the procedure after removal of transmitter:

1. Remove locking screw of the front cover



2. Unscrew the front cover and remove the microSD card



- 1 Front cover
- 2 microSD card
- 3 Locking screw

13.2 Installation of the Spare transmitter

For the installation of the Spare transmitter, please refer to chapter 6.5 *Transmitter installation* [▶ 32].

13.3 Parameter setting

13.3.1 Relevant settings and parameter storage

Relevant settings	<p>The Rotamass Total Insight transmitter has four kinds of relevant parameters which must be adjusted to ensure a proper operation of the flowmeter:</p> <ul style="list-style-type: none"> ▪ System relevant parameters - a device can be identified in one of the three following ways: <ul style="list-style-type: none"> – <i>device identifier</i> (ID) – fixed value by manufacturer – <i>device</i> (HART) <i>tag</i> – <i>address</i> (HART, Modbus, PROFIBUS PA) ▪ sensor related parameters (liquid or gas select, mass flow- or volume flow unit, temperature unit...) ▪ sensor specific parameters (SK20, KD, fl20) ▪ customer specific parameters (lowcut and URV)
Storage location of parameters	<p>System relevant parameters are stored on the microSD card and product DVD of the Spare transmitter in the file "Factory.PAR".</p> <p>Sensor relevant parameters and sensor specific parameters are available on the microSD card and product DVD of the defective transmitter in the file "Factory.PAR".</p>
Delivered parameter setting	<p>The default setting of sensor specific and sensor related parameters in the spare transmitter is based on Nano 06 sensor made of stainless steel for standard process fluid temperature range.</p> <p>Model Code: RCUN06K – 50NNNN -0NN _ - _ _ _ _ - _ - _ _ _ / _</p>

13.3.2 Setting methods

Configuring the Spare transmitter with the sensor settings always needs a backup file of the defective transmitter.

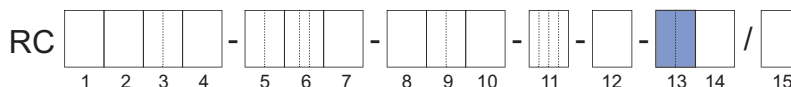
- If the microSD card from the defective transmitter is available, insert it into the Spare transmitter.
- If it is not available, copy the "Factory.PAR" file from the product DVD to the microSD card of the Spare transmitter and insert this one.



The factory backup file of the defective transmitter is stored on the DVD in the directory "YOKOGAWA" attached to the defect Rotamass Total Insight at delivery time. Please make sure to use a differing file name in case of coping to μSD of the Spare transmitter

The method to set up the Spare transmitter properly depends on the following model code positions of the defective Rotamass Total Insight in comparison to the Spare Transmitter:

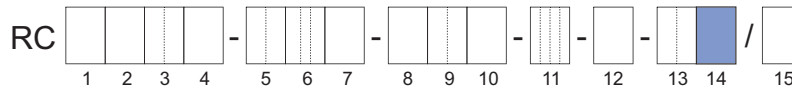
Inputs and Outputs



1. Position 13: Communication type and I/O Configuration

EXAMPLE: JE = HART with I/O1 – 4 defined (defined acc. to GS)

Display



1. Position 14: Display

Model code Position 14 – possible values	Mapping
0	Without display
1	With display

Only Essential transmitters can be delivered without a display (value E in MS code position 1). Transmitter without a display don't have a microSD card.

EXAMPLE: Defective transmitter MS-Code is "RCUS36S-25BD40-0D70-NN00-2-JB1/Z" and means for position 13 HART communication with I/O assignments for I/O 1 – 4 (JB) and with a display (1), position 14.

Setting method has to follow table 15.

Tab. 15: Method overview to set the spare transmitter in dependency of defective transmitter's model code

Defective transmitter model code:	Setting method for sensor parameters	
	Setup with backup file	
Pos. 13 values:	By display ¹⁾	By FieldMate
J(HART_)	Possible	Recommended from Rev.3
M_(Modbus)	Possible	Recommended
G_(PROFIBUS PA)	Possible	Recommended

¹⁾ Before using the display the factory backup file of the DVD has to be copied to the microSD of the Spare Transmitter.

The "Recommended" setting method should be used.

13.3.3 Set up process variable units

For Spare transmitter:

Set the Spare transmitter measurement units to the values from the file "Customer_Settings_YourDeviceSerialNumber.csv" found on the DVD of Spare transmitter.

For Spare sensor:

Set the existing transmitter measurement units to the values from the file "Customer_Settings_YourDeviceSerialNumber.csv" found on the DVD of Spare sensor.

EXAMPLE, see table below:

MASS_FLOW	MASS flow unit	R/W3	5	0:g/s 1:g/min 2:g/h 3:kg/s 4:kg/min 5:kg/h 6:kg/d 7:t/min 8:t/h 9:t/d 10:lb/s 11:lb/min 12:lb/h 13:lb/d 14:User unit
------------------	-----------------------	-------------	----------	--

For this device, configured for mass flow measurement, all relevant parameters like Qnom, Qmax are saved in kg/h in the factory-backup file.

To change the mass flow unit over the display, please execute the following sequence:

1. Set user level "Specialist"
2. Go to menu item "[Easy setup wizard] ► [Std dev var] ► [Mass] ► [Unit]"
3. Choose unit corresponding to the saved value in the Customer_Settings file, for example "[kg/h]"
4. Set chosen Unit "[kg/h]"
5. Check process unit of the exchange transmitter

This parameter is also available in additional menus. The values can be set in each of these menus:

- Basic setup
- Detailed setup

Execute this procedure for all other relevant process parameter units in your device corresponding described in the *IM 01U10S0_-00_-R*.



WARNING

If the units for the measurement parameters aren't adjusted the measurement will be faulty and the transmitter may show configuration error.



Please note your user settings of the units down before you change it. After the pairing process you should set the units back to your origin settings!

13.3.4 Set up sensor relevant and sensor specific parameters

For Spare transmitter:

Set the Spare transmitter sensor parameters to the values from microSD card of the defective transmitter by display.

For Spare sensor:

Set the sensor parameters in the existing transmitter to the values from microSD card of the Spare sensor by display.

1. Set user level "Specialist"
2. Go to menu item "[Diag/Service] ► [Param bkup/restore] ► [Restore]"
3. Choose sub menu item "[Bkup name]". Put in the backup name of the defective transmitter user configuration file; for example "UsrPlant"
4. Go to menu item "[Diag/Service] ► [Param bkup/restore] ► [Restore]"
5. Execute "[Download sensor constant from microSD]"
6. Check all sensor relevant settings of the exchange transmitter

13.3.5 Set up customer specific parameters

The default setting for customer specific parameters is as follows:

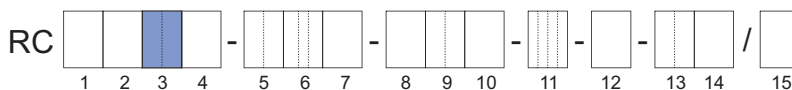
Tab. 16: Assignment: default setting for customer specific parameters

Parameter name:	Default Setting:		Parameter adjustment:
	Value	Unit	
[Mass flow lowcut]	0.0105	kg/h	Recommended if meter size is >06
[Net mass flow 1 lowcut] ¹⁾			
[Net mass flow 2 lowcut] ¹⁾			
[Mass flow URV]	21.000	kg/h	Recommended if meter size is >06
[Net mass flow 1URV] ¹⁾			
[Net mass flow 2URV] ¹⁾			
[Volume flow URV]	21.000	L/h	
[Liquid gas select]	Liquid	None	Needed if sensor is a gas device
[Max permissible pressure]	10.000	Bar	Automated with restoration flow

¹⁾ Relevant only if options AC_ are available for the Spare transmitter

Depending on the model code of the defective transmitter these parameters should be adjusted:

Meter size



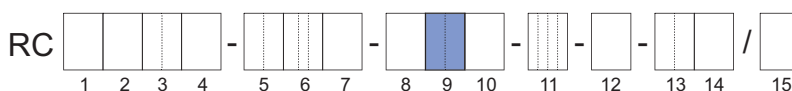
The following parameter values are recommended to set, if needed:

Tab. 17: Overview: setting values for parameters [... lowcut] and [... URV]

Parameter name:	Recommend RMTI parameter setting values:			
	[... lowcut] ¹⁾		[... URV] ¹⁾	
Meter size:	Setting value:		Setting value:	
	Value	Unit	Value	Unit
06	0.0105	kg/h	21.0	kg/h
08	0.0225		45.0	
10	0.0850		170.0	
15	0.1850		370.0	
20	0.4750		950.0	
25	0.0800		1600.0	
34	1.5000		3000.0	
40	2.3500		4700.0	
36	5.0000		10000.0	
50	10.0000		20000.0	
38	16.0000		32000.0	
80	25.5000		51000.0	
39	50.0000		100000.0	
1H	85.0000		170000.0	
1F	125.0000		250000.0	
2H	250.0000		500000.0	

¹⁾ “...” Mass flow low cut and URV values compared to parameter values in table 17.

Mass flow and density accuracy



The parameter [Liquid gas select] has to be set to “Gas” if the mass flow and density accuracy value is 50 or 70.

13.3.6 Set up system related parameters

It is necessary for usage in the plant that the system related parameters like TAGs and communication Address fit to the system settings. Therefore these settings have to be adapted in the Universal Spare Transmitter. The Address and TAGs for the exchange device should be the same as for the defective device in the plant.

Adapt TAG and Address [HART] by display:

1. Set user level "Specialist"
2. Go to menu item "[Detailed setup] ► [Dev info] ► [Order info] ► [Tag]"
3. Choose sub menu item "[Tag]". Put in TAG of the defective transmitter
Choose sub menu item "[Long tag]". Put in Long TAG of the defective transmitter⁴⁾
4. Set "[Tag]" and "[Long tag]"
5. Go to menu item "[Detailed setup] ► [Dev info] ► [HART info] ► [Poll addr]"
6. Set "[Poll addr]"

⁴⁾ The TAG and Long TAG are stored in the "Customer_Setting_...csv"-file attached to the DVD, microSD of the defective transmitter.



For hardware settings, please refer to chapter 9.4 *Advanced settings* [► 77].

13.4 Wiring

For the wiring of Spare transmitter and existing sensor, please refer to chapter 7. *Wiring* [► 41].

13.5 Commissioning

1. Activate external power switch.
2. Perform check of piping installation.
3. Check flow meter for device errors, warnings or alarms, see chapter *Troubleshooting*.
4. Configure the transmitter, and perform autozero, see chapter *System configuration and operation*. Flow meter is ready for operation.

14 Dismantling and disposal

14.1 Decontamination and return shipment

**DANGER**

Use of fluids that are a health hazard may result in caustic burns or poisoning

- ▶ When removing the flow meter, avoid touching the fluid and breathing gas residues left in the sensor.
 - ▶ Wear protective clothing and a breathing mask.
-

Note the following items before returning the shipment:

- ▶ Clean flow meter thoroughly. No harmful chemicals must remain in or on the flow meter. Rota Yokogawa only accepts completely drained and cleaned flow meters.
- ▶ The form "Decontamination Declaration" must be filled in completely and sent to Yokogawa along with the flow meter.
- ▶ Package flow meter in a shockproof manner for transport. Use original packaging, if possible.

14.2 Disposal

Prior to disposal of the flow meter, please take note of the following:

- ▶ Comply with the applicable national regulations in the event of disposal or recycling.
- ▶ Do not dismantle flow meter until all fluid residues have been removed and dispose the parts individually.

Declaration of Decontamination

Legal regulations for the safety of our employees and operating equipment determine that we need the declaration of decontamination before your order can be handled.

Please make sure to include it with the shipping documents, attached to the outside of the packaging you use for shipment.

Customer data		
Company:		
Address:		
Contact person:		E-Mail:
Phone no.:		Fax no.:
Reference/Order no.:		
Instrument data*		
Type:		Serial no.:
Type:		Serial no.:
*If not enough, note on separate sheet		
Process data:		
Process fluid:		
Fluid is:	<input type="checkbox"/> toxic <input type="checkbox"/> corrosive <input type="checkbox"/> explosive <input type="checkbox"/> biological hazardous <input type="checkbox"/> unknown if dangerous <input type="checkbox"/> non hazardous	Remarks:
Cleaning agent:		
Kind of cleaning :		
Other remarks / Reason of return:		

We hereby confirm that this statement is filled in completely and truthfully. The returned instruments were carefully cleaned and are thus free from product residue and dirt. I agree that if this arrangement does not match with the instruments, they will be sent back to the above mentioned customer address at our expenses.

Name

Date

Signature

15 Specifications

Specifications for sensor and transmitter are listed in the *General Specifications* of the corresponding product family.

15.1 Ambient conditions

Rotamass Total Insight can be used at demanding ambient conditions.

In doing so, the following specifications must be taken into account:

The air surrounding the device is considered as ambient temperature.



Allowed process fluid and ambient temperature ranges in hazardous areas depend on classifications defined by applications, see Explosion Proof Type Manual IM 01U10X__-00__-R.

Allowed ambient and storage temperature of Rotamass Total Insight depends on the below components and their own temperature limits:

- Sensor
- Transmitter
- Connecting cable between sensor and transmitter (for remote design type)

Ambient temperature

Maximum ambient temperature range ¹⁾		
integral type:		-40 – 60 °C (-40 – 140 °F)
remote type		
with standard cable (option L__):	Sensor ²⁾ :	-50 – 80 °C (-58 – 176 °F)
	Transmitter:	-40 – 60 °C (-40 – 140 °F)
with fire retardant cable ³⁾ (option Y__):	Sensor ²⁾ :	-35 – 80 °C (-31 – 176 °F)
	Transmitter:	-35 – 60 °C (-31 – 140 °F)

¹⁾ If the device is operating outdoors make sure that the solar irradiation does not increase the surface temperature of the transmitter higher than the allowed maximum ambient temperature. Transmitter display has limited legibility below -20 °C (-4 °F)

²⁾ Check derating for high fluid temperature, see Process fluid temperature range, Process conditions and Allowed ambient temperatures for sensor.

³⁾ Lower temperature specification valid for fixed installation only

Storage temperature

Maximum storage temperature range		
integral type		-40 – 60 °C (-40 – 140 °F)
remote type		
with standard cable (option L__):	Sensor:	-50 – 80 °C (-58 – 176 °F)
	Transmitter:	-40 – 60 °C (-40 – 140 °F)
with fire retardant cable (option Y__):	Sensor:	-35 – 80 °C (-31 – 176 °F)
	Transmitter:	-35 – 60 °C (-31 – 140 °F)

Further ambient conditions

Ranges and specifications	
Relative humidity	0 – 95 %
IP code	IP66/67 for transmitters and sensors when using the appropriate cable glands
Allowable pollution degree in surrounding area acc. EN 61010-1	4 (in operation)

Ranges and specifications	
Vibration resistance acc. IEC 60068-2-6	Transmitter: 10 – 500 Hz, 1g Sensor: 25– 100 Hz, 4g
Electromagnetic compatibility (EMC) <ul style="list-style-type: none"> ▪ IEC/EN 61326-1, Table 2 ▪ IEC/EN 61326-2-3 ▪ NAMUR NE 21 recommendation ▪ DNVGL-CG-0339, chapter 14 This includes <ul style="list-style-type: none"> ▪ Surge immunity acc.: <ul style="list-style-type: none"> – EN 61000-4-5 for lightning protection ▪ Emission acc.: <ul style="list-style-type: none"> – IEC/EN 61000-3-2, Class A – IEC/EN 61000-3-3, Class A – NAMUR NE 21 recommendation – DNVGL-CG-0339, chapter 14 	Immunity assessment criterion: The output signal fluctuation is within $\pm 1\%$ of the output span.
Maximum altitude	2000 m (6600 ft) above mean sea level (MSL)
Overvoltage category acc. IEC/EN 61010-1	II

15.2 Lifetime definition

Lifetime for Rotamass Total Insight: 20 years at ambient temperature ≤ 40 °C.



This value is based on stable environmental condition for safety applications, see Safety Manual IM 01U10D__-00__-R.



TRADEMARKS

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Modbus:	registered trademark of SCHNEIDER ELECTRIC USA, INC.
PROFIBUS:	registered trademark of PROFIBUS Nutzerorganisation e.V., Karlsruhe, DE
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