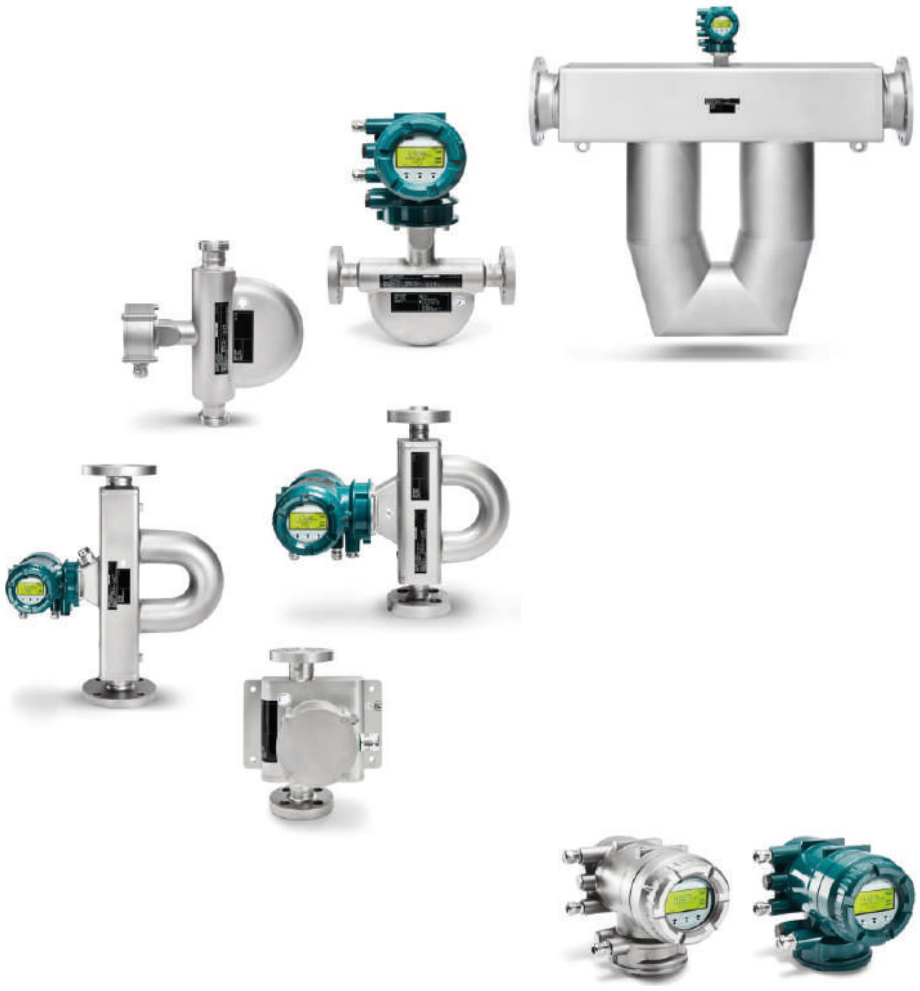
User's Manual

ROTA*MASS* Total Insight

Coriolis Mass Flow and Density Meter

General Instruction Manual

IM 01U10B00-00EN-R



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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 Specification Overview
- Rotamass 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 specification:

Document title	Document number
General Specifications:	
▪ Specification Overview	▪ GS 01U10B00-00␣␣-R[1)]
▪ Nano ▪ Supreme ▪ Giga ▪ Prime ▪ Intense ▪ Hygienic	▪ GS 01U10B01-00␣␣-R[1)] ▪ GS 01U10B02-00␣␣-R[1)] ▪ GS 01U10B03-00␣␣-R[1)] ▪ GS 01U10B04-00␣␣-R[1)] ▪ GS 01U10B05-00␣␣-R[1)] ▪ GS 01U10B06-00␣␣-R[1)]
▪ Spare Transmitter	▪ GS 01U10B21-00␣␣-R[1)]
Instruction Manuals:	
▪ Quick Reference Instruction Manual	▪ IM 01U10A00-00␣␣-R[1)]
▪ Quick Reference Instruction Manual for Spare	▪ IM 01U10A01-00␣␣-R[1)]

Document title	Document number
Explosion proof type Manuals:	
▪ Explosion Proof Type Manual ATEX	▪ IM 01U10X01-00␣␣-R[1)]
▪ Explosion Proof Type Manual IECEx	▪ IM 01U10X02-00␣␣-R[1)]
▪ Explosion Proof Type Manual FM	▪ IM 01U10X03-00␣␣-R[1)]
▪ Explosion Proof Type Manual INMETRO	▪ IM 01U10X04-00␣␣-R[1)]
▪ Explosion Proof Type Manual PESO	▪ IM 01U10X05-00␣␣-R[1)]
▪ Explosion Proof Type Manual NEPSI	▪ IM 01U10X06-00␣␣-R[1)]
▪ Explosion Proof Type Manual Korea-Ex	▪ IM 01U10X07-00␣␣-R[1)]
▪ Explosion Proof Type Manual EAC-Ex	▪ IM 01U10X08-00␣␣-R[1)]
▪ Explosion Proof Type Manual Japan Ex	▪ IM 01U10X09-00␣␣-R[1)]
▪ Explosion Proof Type Manual UKEx	▪ IM 01U10X11-00␣␣-R[1)]
▪ Addendum to Explosion Proof Type Manual for Low Temperature	▪ IM 01U10X10-00␣␣-R[1)]
Software Instruction Manuals:	
▪ Software Instruction Manual HART	▪ IM 01U10S01-00␣␣-R[1)]
▪ Software Instruction Manual FOUNDATION Fieldbus	▪ IM 01U10S02-00␣␣-R[1)]
▪ Software Instruction Manual Modbus	▪ IM 01U10S03-00␣␣-R[1)]
▪ Software Instruction Manual PROFIBUS PA	▪ IM 01U10S04-00␣␣-R[1)]

[1)] The "␣" symbols are placeholder for the corresponding language version of the document (EN, DE, etc.).

The complete product documentation is stored on the microSD card delivered with the device and is available at:

• Yokogawa Customer Portal (http://myportal.yokogawa.com/s/documents)

• Yokogawa Device Lifecycle Management app

Please enter the serial number of the device or scan the QR code on the device.

1.4 Explanation of safety instructions and symbols

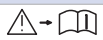
Signal words

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 type approval marking
	3-A Sanitary approval marking
	China RoHS marking
	Taiwan Safety (TS) marking
	Russia Pattern approval marking
	Belarus Pattern approval marking
	UKCA marking

1.5 Custody transfer applications

Find specific instructions in compliance to NTEP custody transfer applications in the following chapters:

- see *Identification [▷ 14]*
- see *Sealing [▷ 41]*
- see *Setting hardware write-protection and burnout-/ simulation-mode [▷ 83]*
- see *Ambient conditions [▷ 104]*

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 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 unproper 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 Software Instruction Manuals IM01U10S␣␣-00␣␣-R).
- 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 "8.1 Model code description").
- 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 ▪ 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) ▪ 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: ▪ 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
Blind plugs to close cables entries when not used (only non-Ex devices). For a device with Ex approval the please refer to the applicable Explosion Proof Type Manual.	1 unit	1 unit	1 unit	1 unit
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: ▪ microSD card (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

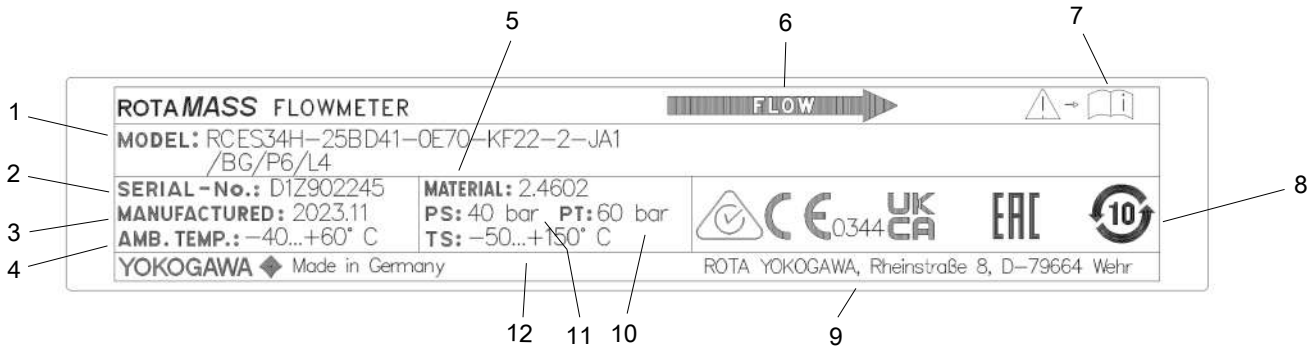
The sensor as well as the transmitter each contain a main nameplate and an additional nameplate that feature different information.

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.

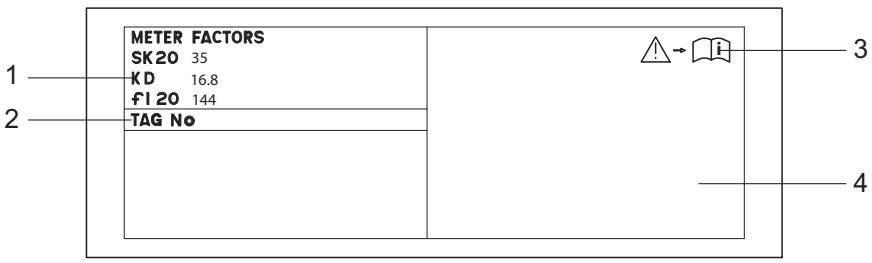
4.2.1.1 Sensor

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

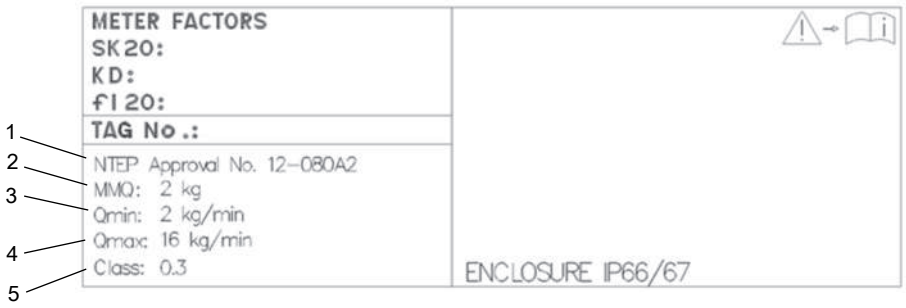
Additional sensor nameplate



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)

Additional sensor nameplate NTEP

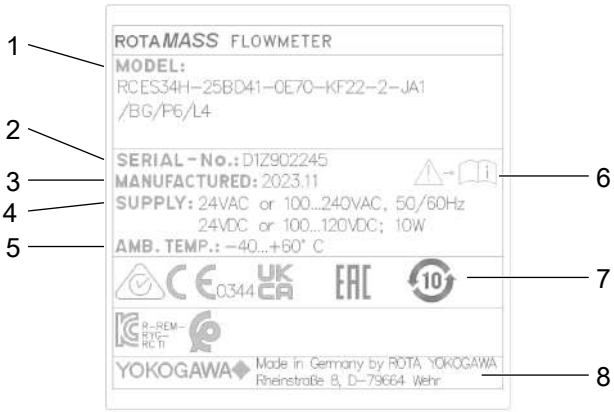
The additional sensor nameplate contains specific information about the NTEP custody approval:



1	NTEP Approval no.	4	Maximum Massfllow Q_{max}
2	Minimum Measured Quantity (MMQ)	5	Accuracy class
3	Minimum Massflow Q_{min}		

4.2.1.2 Transmitter

Main transmitter nameplate



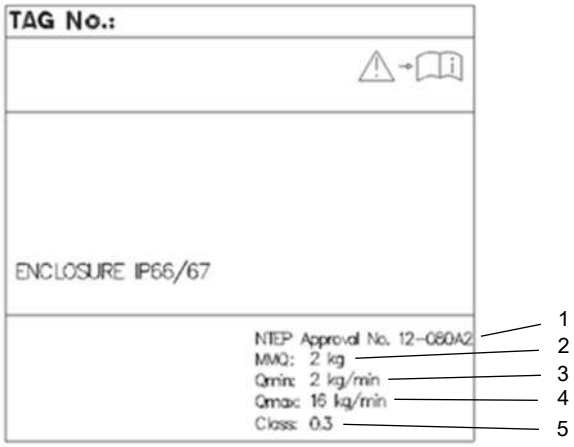
1	Model code	5	Ambient temperature range
2	Serial number	6	Warning that requires reading the documentation
3	Year of manufacture	7	Area for conformity marking
4	Power supply range	8	Manufacturer's address

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

Additional transmitter nameplate NTEP

The additional transmitter nameplate contains specific information about the NTEP custody approval:



1 NTEP Approval no.
2 Minimum Measured Quantity (MMQ)
3 Minimum Massflow Q_{min}
4 Maximum Massfllow Q_{max}
5 Accuracy class

Transmitter label

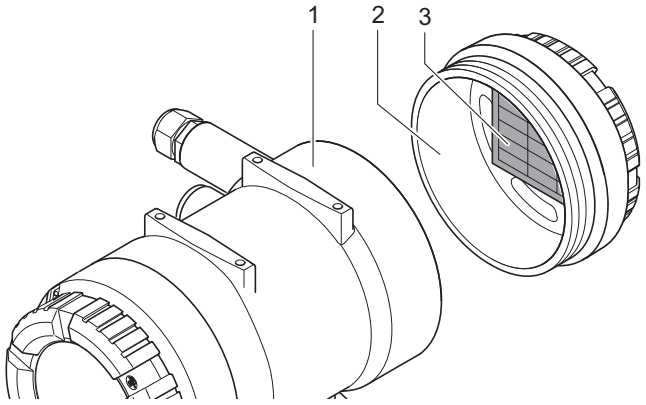
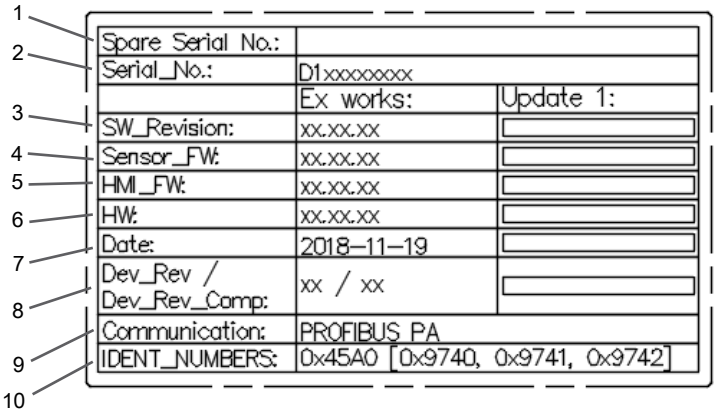


Fig. 1: Illustration label attachment

1	Transmitter
2	Transmitter back cover
3	Label



1	Spare serial number	6	Hardware revision
2	Serial number	7	Date of Ex works/ Update
3	Main software revision	8	Device Revision / Device Revision Compatibility
4	Sensor software revision	9	Type of Communication
5	Indicator software revision	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"

The product has a QR Code pasted for efficient plant maintenance work and asset information management. It enables confirming the specifications of purchased products and user's manuals. For more details, please refer to the following URL.

(http://www.yokogawa.com/qr-code)

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.

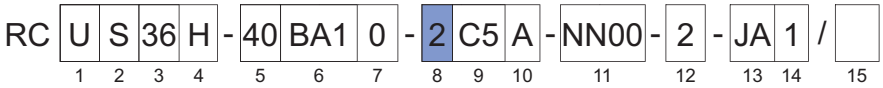


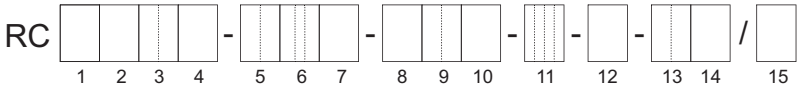
Fig. 2: Example of an model code

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.

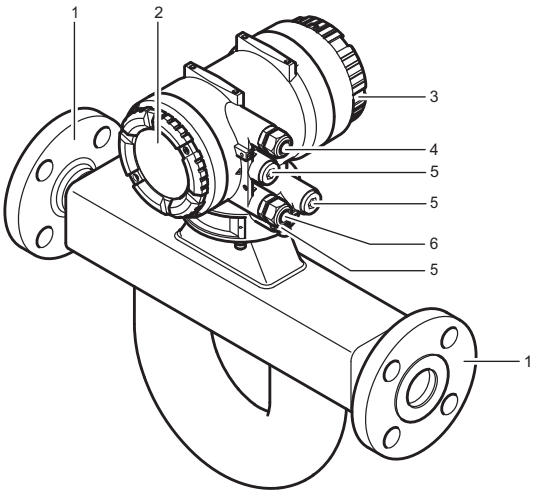
Device options (item 15) can be selected and specified individually by separating them with slashes.



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

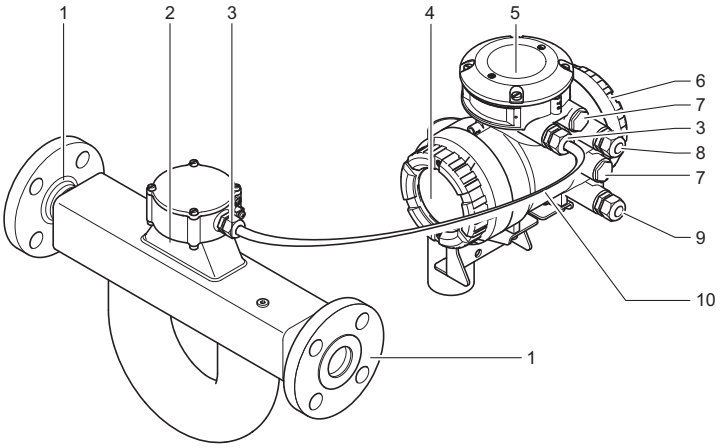
4.3 Flow meter components

Integral type



1 Process connections
2 Back cover for inputs and outputs, and power supply
3 Display cover

Remote type



1 Process connections
2 Terminal box
3 Cable entry for connecting cable
4 Display cover
5 Sensor connection cover

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).

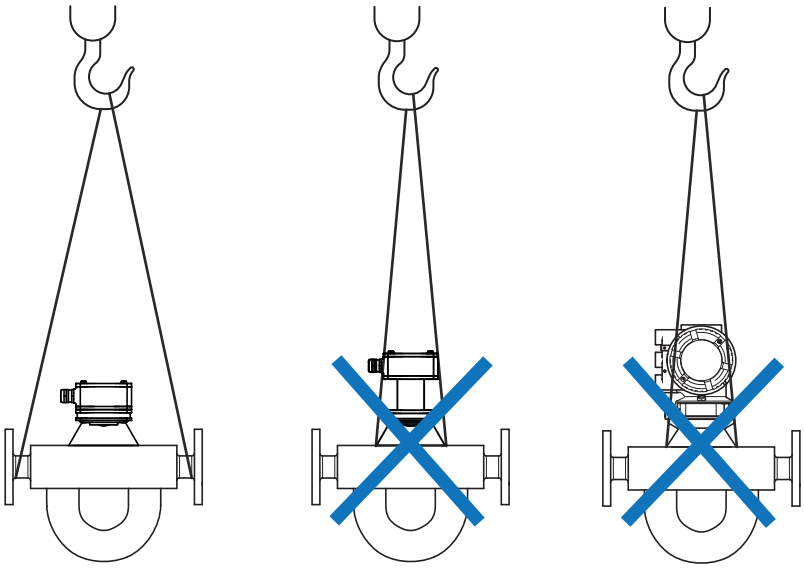


Fig. 3: Attachment of the transport ropes to the sensor independent of the design (impermissible attachment types are crossed out)

NOTICE

In case of integral design sensor might turn in the slopes. This is possible for the following sensor sizes specified in the table below.

Sensor	Sensor size
Supreme / Intense	≤ 38
Prime / Hygienic	≤ 40

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 *Operating Conditions [▷ 104]*.
- 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 [▷ 102]*.

6 Installation

6.1 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.

6.2 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␣␣-R) to prevent disturbance of other sensitive electrical equipment due to increased electromagnetic emissions.

6.2.1 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*.

6.2.2 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 to avoid exceeding maximum allowed transmitter temperature.

- Avoid installation sites susceptible to cavitation, such as immediately behind a control valve.
- Install flow meter far removed from motors, transformers or other transmitters.
- Avoid installation directly behind rotary and gear pumps to prevent fluctuations in pressure from interfering with the resonance frequency of the Rotamass measuring tubes.
- 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 ± 5°) 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 ≥ 5°) 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.

6.2.3 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.

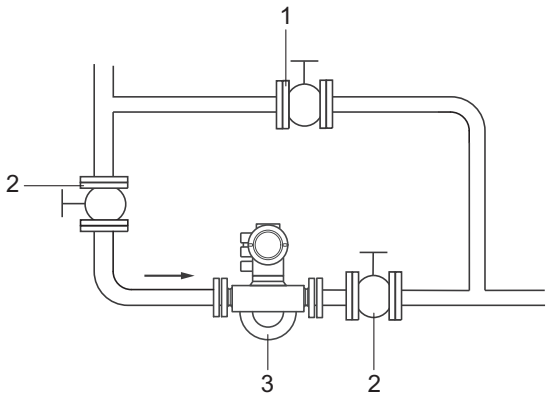


Fig. 4: Closing valves and bypass line

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.

6.2.4 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.

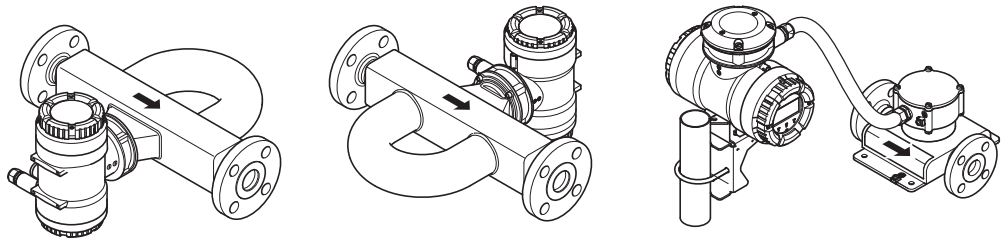


Fig. 5: Installation positions to be avoided: Flow meter in sideways position

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.

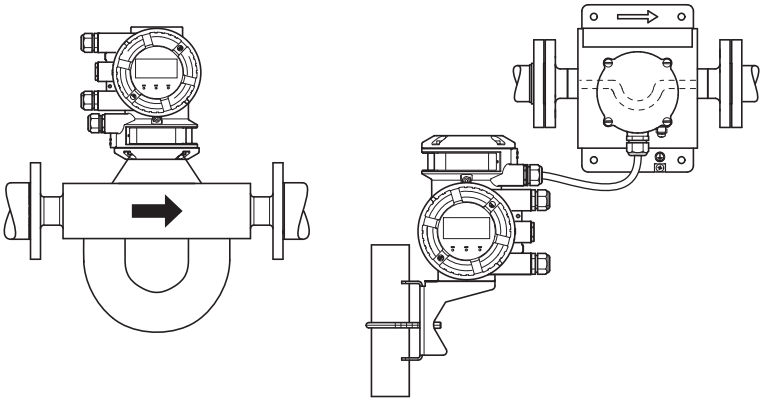


Fig. 6: Horizontal installation, measuring tubes downward

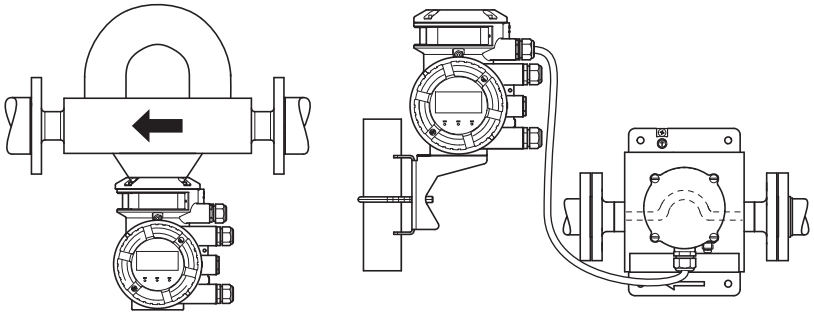


Fig. 7: Horizontal installation, measuring tubes upward

Vertical installation (recommended)

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

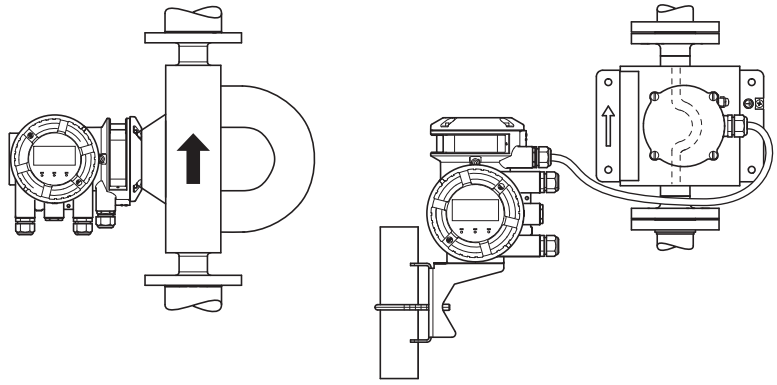


Fig. 8: Vertical Installation

6.3 Sensor installation

6.3.1 General installation rules

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

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

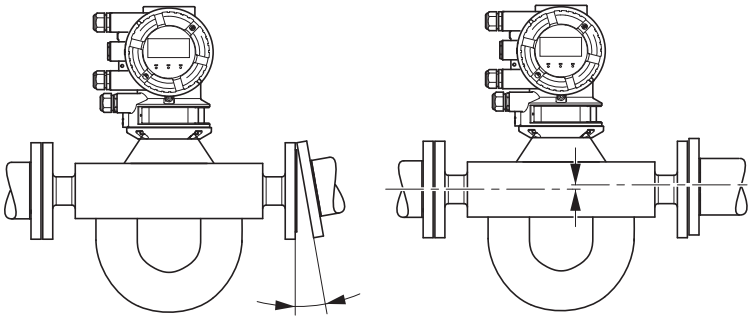


Fig. 9: Avoid: Slope and mismatch

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

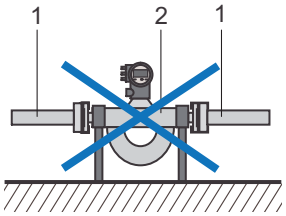


Fig. 10: Installation to be avoided: Fixing the sensor

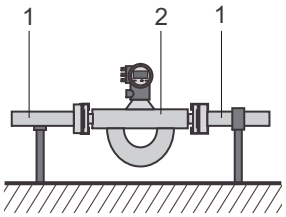


Fig. 11: Recommended installation: use the piping to support the sensor

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.

6.3.1.1 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.

6.3.1.2 Redundant installation

- If two flowmeters of the same size are installed in series mutual interference called cross talk may take place. Cross talk occurs due to the fact that both meters have the same resonance frequency.
- If serial installation is planned please contact your Yokogawa representative who can ensure that a frequency adjustment is made to one of the meters at the factory.

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.

Clamps

Model codes for process connections	Model code pos. 6
Clamps	HS4, HS8 and HS9

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

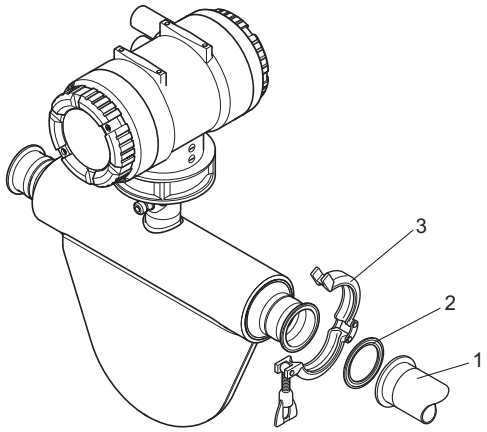


Fig. 12: Clamp connection

1 Terminal
2 Gasket
3 Terminal connector

Flanges

Model codes for process connections	Model code pos. 6
Flanges	B⎵⎵, C⎵⎵, E⎵⎵, F⎵⎵ and G⎵⎵

- 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.

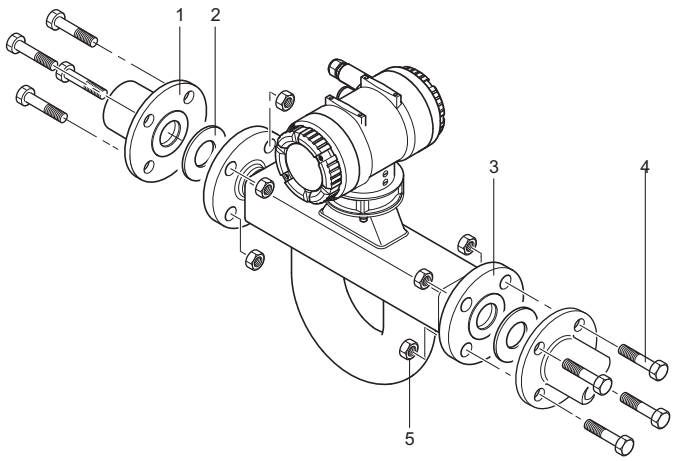


Fig. 13: Fixing the flange

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

Internal threads

Model codes for process connections	Model code pos. 6
Internal thread	TG9 and TT9

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

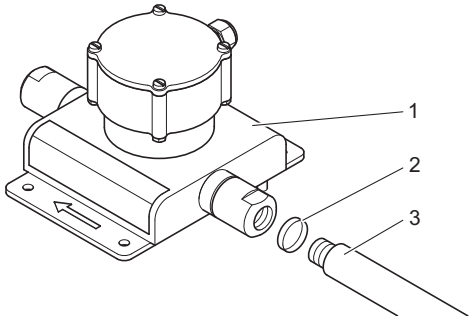


Fig. 14: Internal thread connection

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.

External threads

Model codes for process connections	Model code pos. 6
External thread	HS2 and HS6

For process connections with an external thread SMS connections and connections according DIN11851 must be installed in accordance with the following figure.

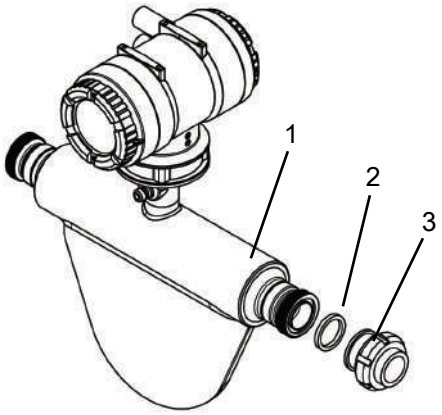


Fig. 15: Hygienic-thread connections

1 Sensor
2 Gasket
3 Coupling with nut

6.3.3 Installation Rotamass Nano (Option PD)

For the Rotamass Nano the sensor can be installed on a DN 50 (2") pipe by using a bracket and U-bolt assy.

Model code for	Model code pos. 15
Fixing device	/PD

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

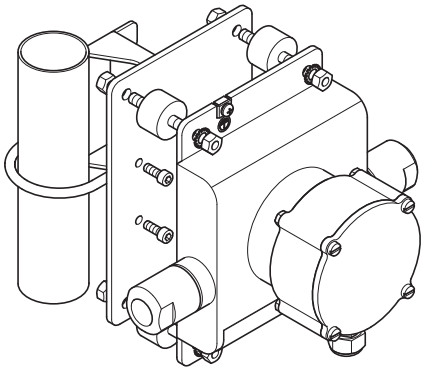


Fig. 16: 2" fixing device option /PD for Nano

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 tap have to be placed at the flow line at approximately 4 x DN 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).

4 – 20 mA analog input

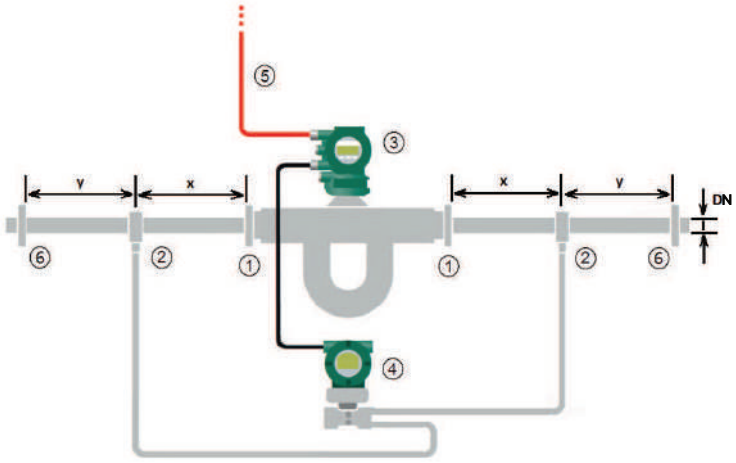


Fig. 17: Positioning of pressure taps / HART communication line

①	Mounting flanges	④	Differential pressure transmitter
②	Pressure taps	⑤	4 – 20 mA/ HART loop
③	Rotamass Total Insight	⑥	Other flow elements

Fieldbus

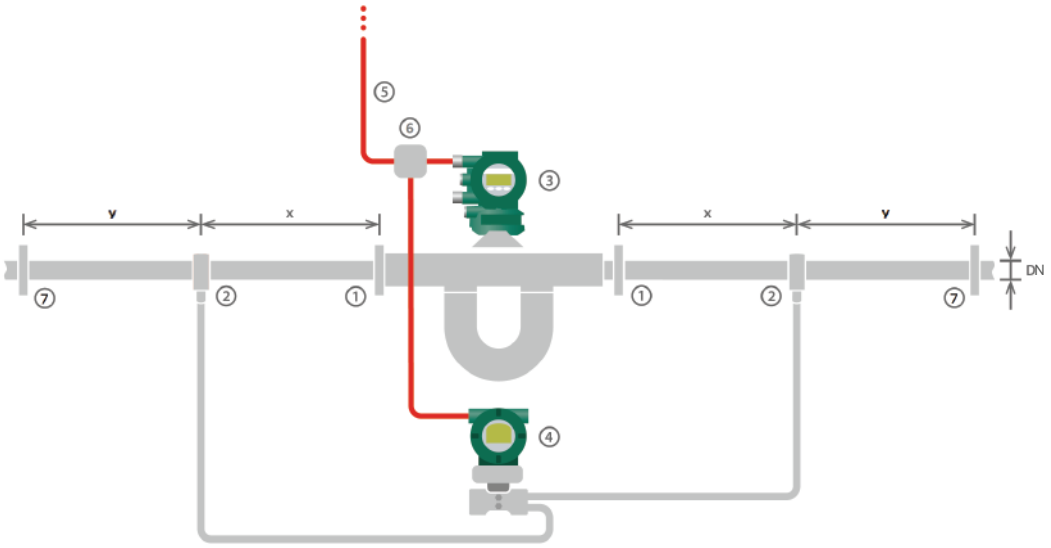


Fig. 18: Positioning of pressure taps / Fieldbus communication line

①	Mounting flanges	⑤	Fieldbus
②	Pressure taps	⑥	Fieldbus Junction box
③	Rotamass Total Insight	⑦	Other flow elements
④	Differential pressure transmitter		

x, y = minimum 4 x DN

x	Flow line upstream or downstream of the Rotamass Total Insight sensor
y	Flow line upstream or downstream of the pressure transmitter
DN	Nominal diameter of process line

6.3.5 Installation recommendation for dynamics pressure compensation

Analog input can be used to compensate remaining minor mass flow deviation. Correct position for pressure tap should be considered to optimize pressure measurement accuracy.

NOTICE	The needed pressure taps have to be placed at the flow line at approximately 4 x DN upstream or downstream of the Rotamass sensor. The pressure transmitter is directly connected via analog input to the Rotamass transmitter (analog input function must be available).

4 – 20 mA analog input

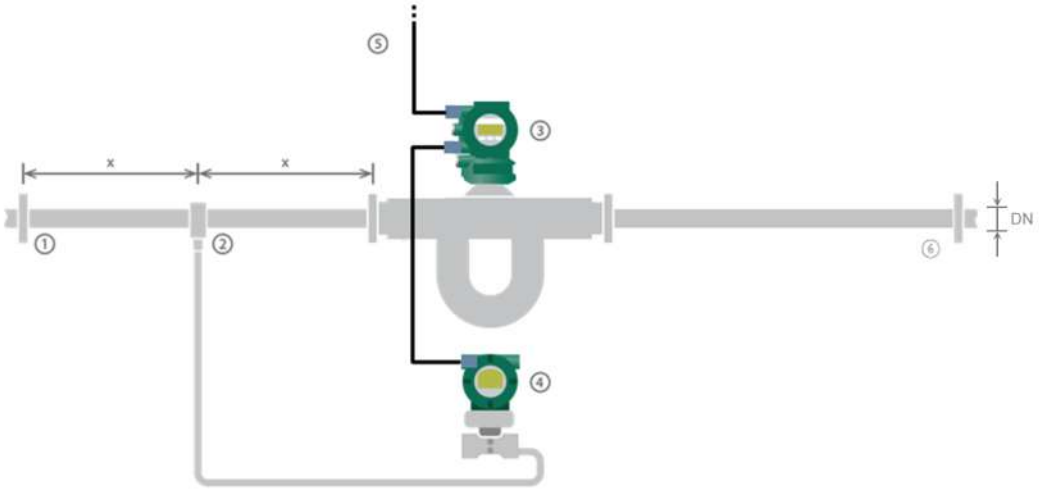


Fig. 19: Positioning of pressure tap

①	Mounting flanges	④	Differential pressure transmitter
②	Pressure taps	⑤	4 – 20 mA/ HART loop
③	Rotamass Total Insight	⑥	Other flow elements

x, y = minimum 4 x DN

x	Flow line upstream or downstream of the Rotamass Total Insight sensor
y	Flow line upstream or downstream of the pressure transmitter
DN	Nominal diameter of process line

6.4 Transmitter installation

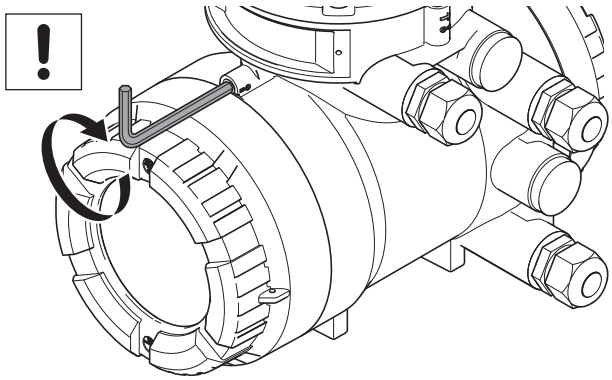
NOTICE	Make sure sensor and transmitter with same serial number are combined (except for spare sensor or universal spare transmitter).

6.4.1 Rotating and replacing the display

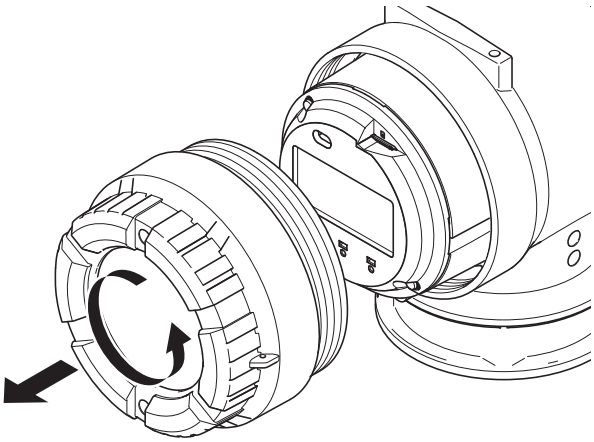
The transmitter display can be oriented in line with the flow meter installation position.

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

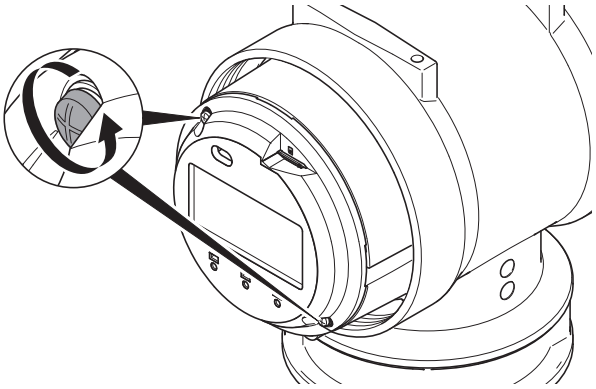
1. Switch off power supply.
2. Using an Allen wrench (size: 3.0), turn the locking screw on display screw plug clockwise to remove.



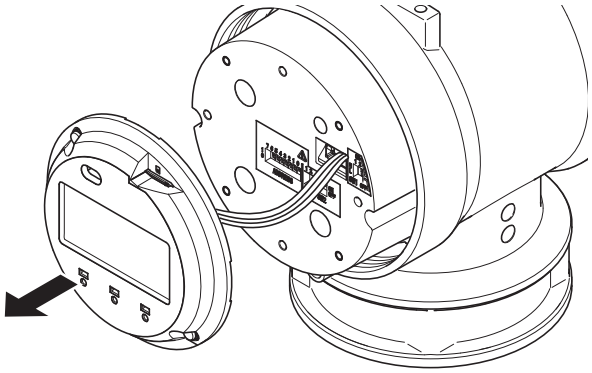
3. Unscrew display cover from transmitter housing.



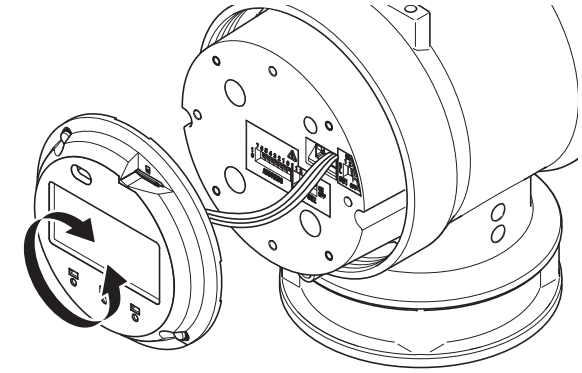
4. Remove the two screws from the display.

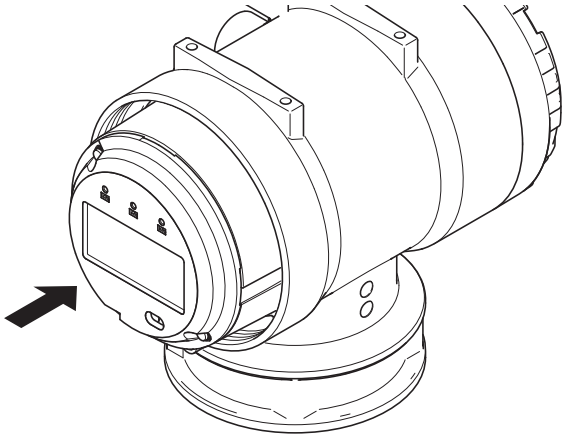


5. Remove the display from housing by pulling forward.



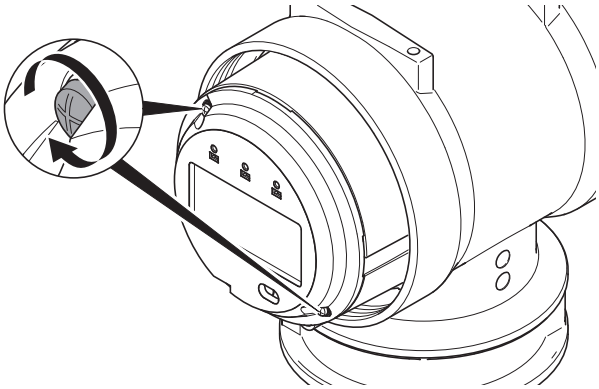
6. Rotate display and push back into housing in the orientation desired.



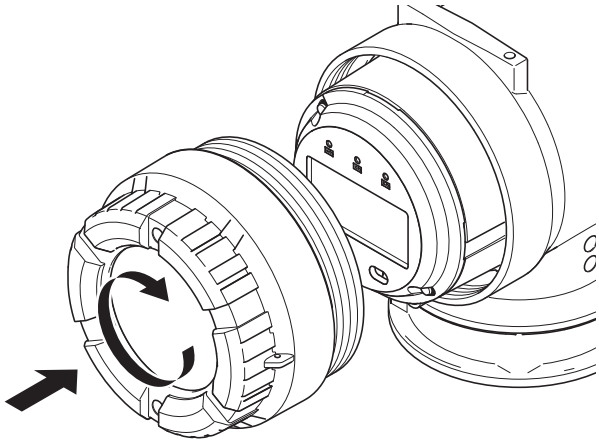


NOTICE The display can be removed and replaced by loosening the connector.

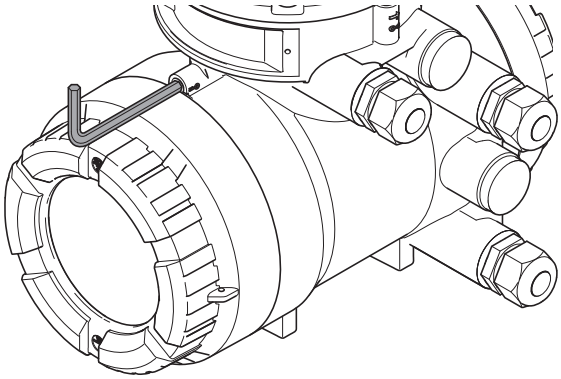
7. Tighten screws.



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.



6.4.2 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.

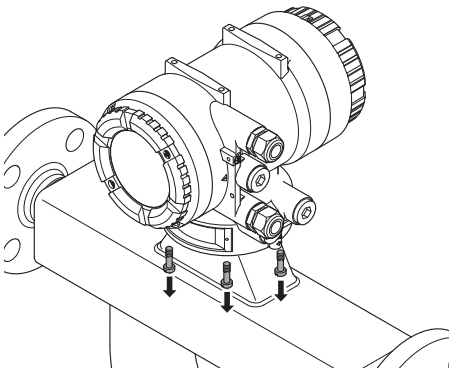
NOTICE

Damage to flow meter

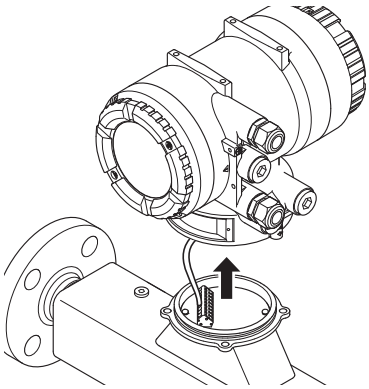
Rotating the transmitter housing several times in the same direction may damage the connection between sensor and transmitter.

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

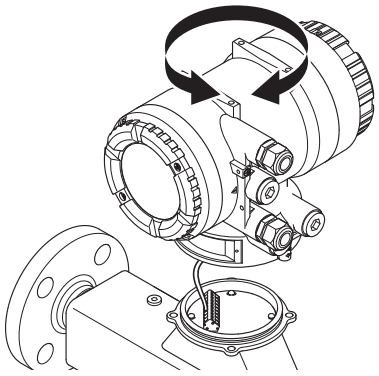
1. By using an Allen wrench, remove the four fixing screws.



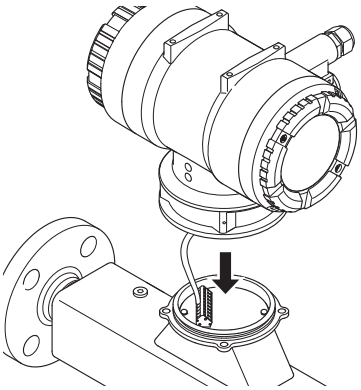
2. Lift transmitter housing.



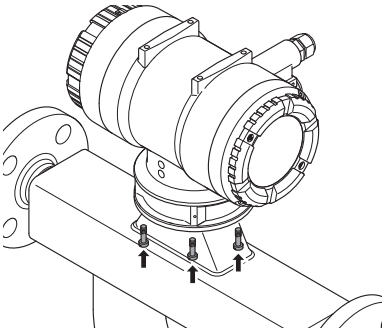
3. Rotate transmitter housing at angles of 90°, 180° or 270°.



4. Place transmitter housing.



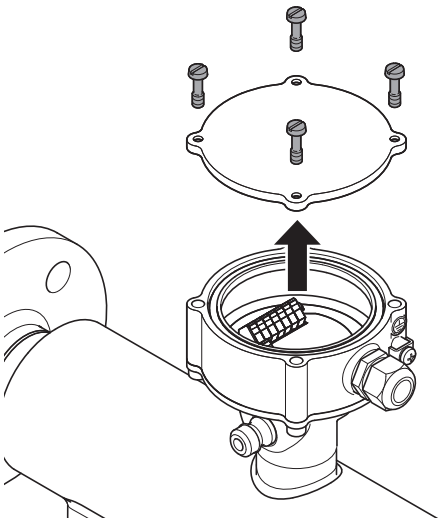
5. Tighten the four fixing screws.



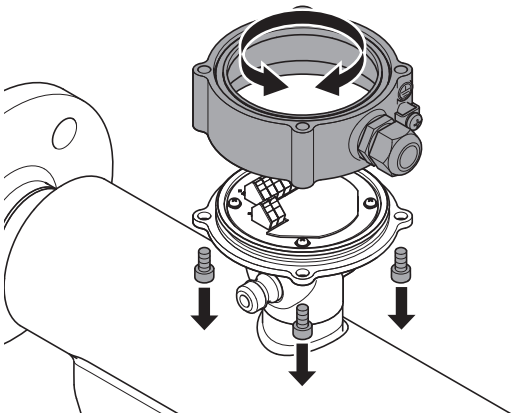
6.4.3 Rotating the terminal box (remote type)

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

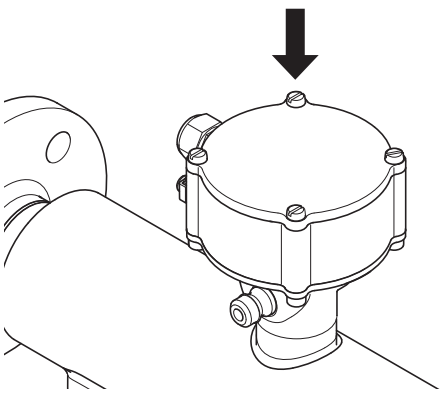
1. Loosen the four fixing screws and remove the cover.



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.



6.4.4 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.

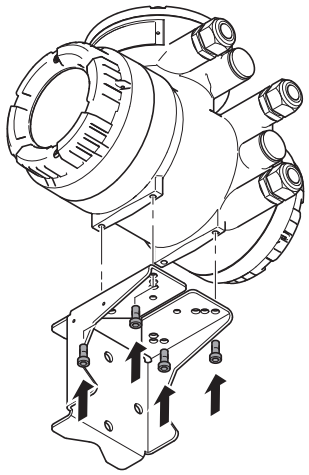
NOTICE

Installation at high vibration levels

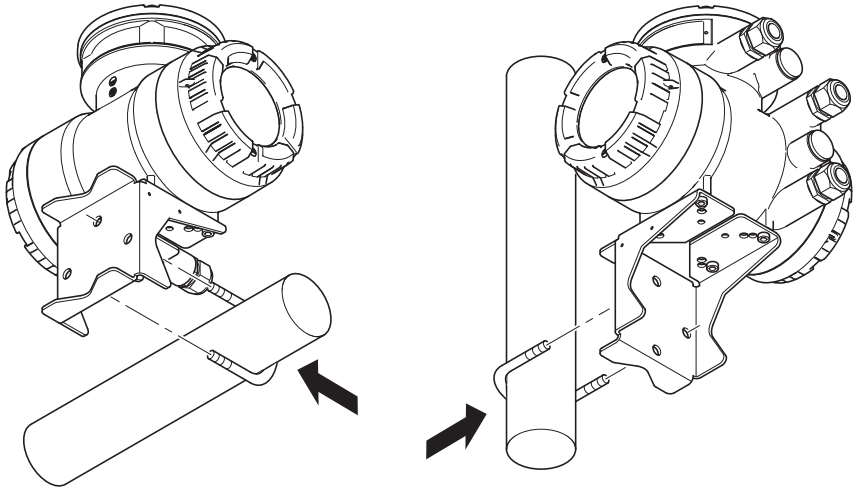
The mounting bracket for the pipe installation of the transmitter may not be suitable for installation environments with very high levels of vibration. In this case the user is advised to employ more rugged methods of fixation using the threaded bottom holes directly.

If it is a remote type transmitter, it can be mounted to a pipe size DN 50 (2") using the angle bracket and retaining clip included in the delivery:

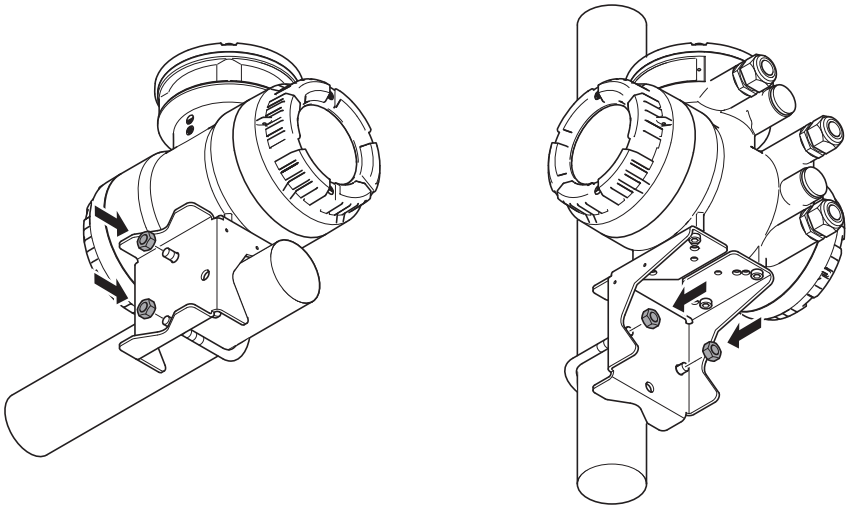
1. Screw angle bracket to bottom of transmitter.



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



3. Fasten retaining clip to bracket using the nuts.



See figure below (Fig. 20) for possible transmitter mounting alternatives (recommended for sanitary applications, then consider appropriate screws like hexagon head).

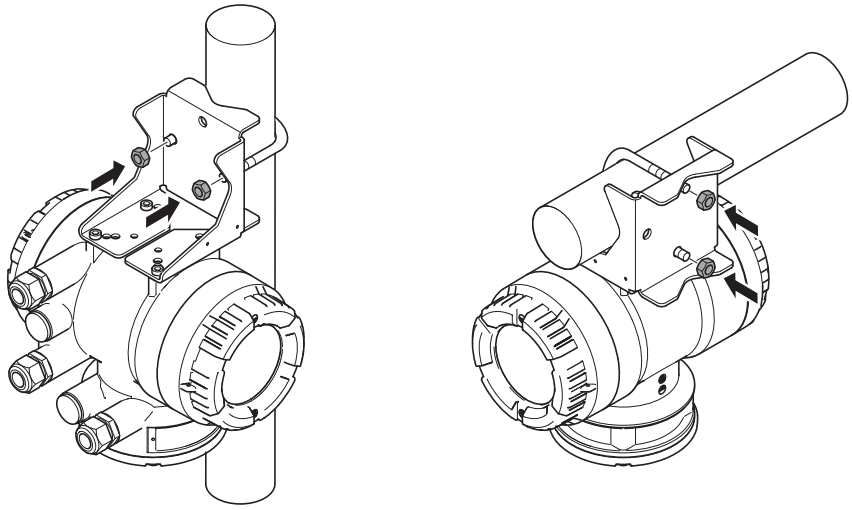


Fig. 20: Hanging installation for remote transmitter

6.4.5 Sealing

Undetected manipulation of hardware, like write protection switch, can be prevented against unauthorized access by conducting wire seal through holes in the housing.

Transmitter sealing

Transmitter sealing is done by blocking front window cover and the transmitter main housing.

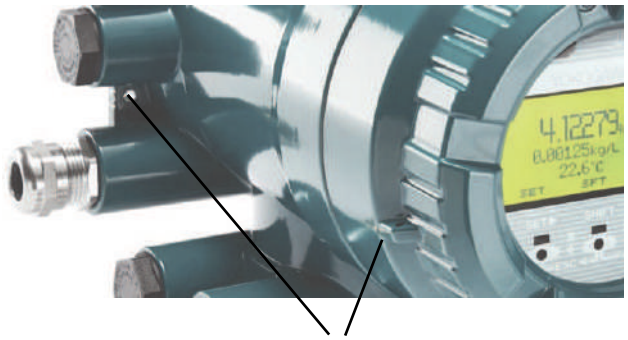


Fig. 21: Transmitter sealing

Sensor sealing

For integral type devices the main housing of the transmitter is also sealed to the sensor with a physical seal using the same hole on the right side of the main transmitter housing and a drilled mounting screw on the base.

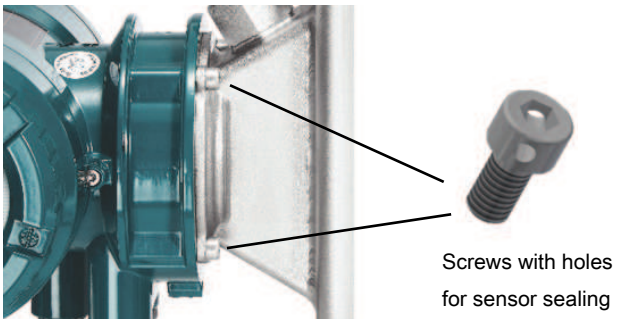


Fig. 22: Sensor sealing for integral type devices

For remote type devices the sensor terminal box is sealed to the sensor neck with a physical seal using the drilled mounting screws on the top and on the base of the sensor terminal box.

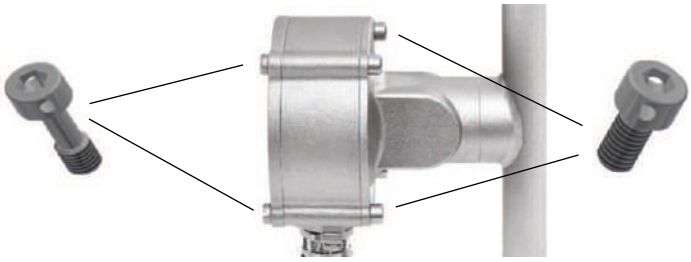


Fig. 23: Sensor sealing for remote type devices

6.5 Sanitary installation requirements

In order to comply with the requirements of the European Hygienic Engineering and Design Group (EHEDG) or 3-A Sanitary standards, the following aspects need to be considered.

The sensor is designed for cleaning without dismantling (CIP).

Model codes for sanitary installation requirements	
3-A	3-A Sanitary standards in combination with process connection types HS2, HS4, HS8 and HS9
EHEDG	EHEDG in combination with process connection type HS2, HS4, HS8 and HS9

EHEDG

- Vertical sensor installation (see *Installation position [▷ 25]*, fig. 8) is recommended to ensure self-draining of the device.
- Process connection and gasket should be combined according to latest version of EHEDG position paper “Easy cleanable Pipe couplings and Process connections", e.g.
  - DIN 11851 process connections with k-flex gasket system by Kieselmann GmbH
  - Tri-Clamp process connection with T-seals from Combifit International B.V.
- Do not use aggressive cleaning agents or chemical which can affect the product contact surface.

3-A

- Vertical sensor installation (see *Installation position [▷ 25]*, fig. 8) is recommended to ensure self-draining of the device.
- Horizontal sensor installation (see *Installation position [▷ 24]*, fig. 6 and 7) shall be drained by air purge.
- Cleaning-in-place (CIP) requires standard mininum flow velocity of 1.5 m/s, determined at process connection cross-section.
- Inner diameter of adjecent pipe must match inner diameter of process connection.
- DIN 11851 process connections must be used with special sanitary gasket, such as k-flex gasket system by Kieselmann GmbH or similar.
- Transmitter mounting is restricted to hanging installation (see *Installing transmitter on pipe (remote type) [▷ 39]*, fig. 20)

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

6.6 Insulation and heat tracing

⚠ 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.

Model codes for	Model code pos. 15
Insulation and heat tracing	/T␣␣

6.6.1 Insulation

Starting with fluid temperatures of approx. 80 °C above or below the ambient temperature, insulating the sensor is recommended to maintain best accuracy under process conditions. These measures are also sensible with increased requirements for fluid temperature stability.

6.6.2 Heat tracing

Sensor heating is possible by means of heat tracing via heat carrier fluid flowing trough additional stainless steel pipes along the sensor. The operator is responsible for temperature control of the heat carrier considering pressure and temperature specifications (refer to General Specifications).

Heat tracing process connection is mounted with compression fitting, mounted finger tight only for final onsite adjustment! Make sure final installation is tightened properly. Stress from the external piping should be avoided.

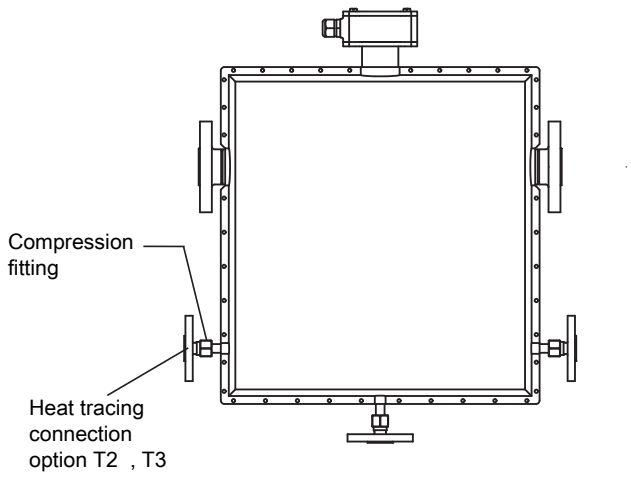


Fig. 24: Position of compression fitting for heat tracing process connection

6.6.3 Customer 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.

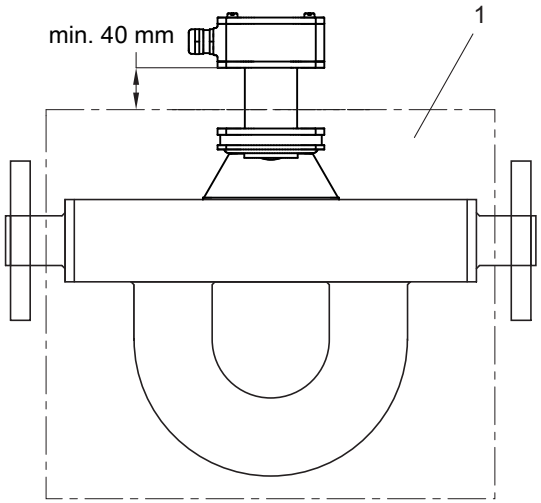


Fig. 25: Customer-supplied insulation

1 Insulation box

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

6.7 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 clothes or by impact.

⚠ 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 [▶ 49]*.

⚠ 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 to prevent cable damage from installation stresses.

NOTICE	Wiring work must only be performed at max. 80 % humidity and temperatures up to 31 °C. Above 31 °C allowable humidity is linearly decreasing to 50 % 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.

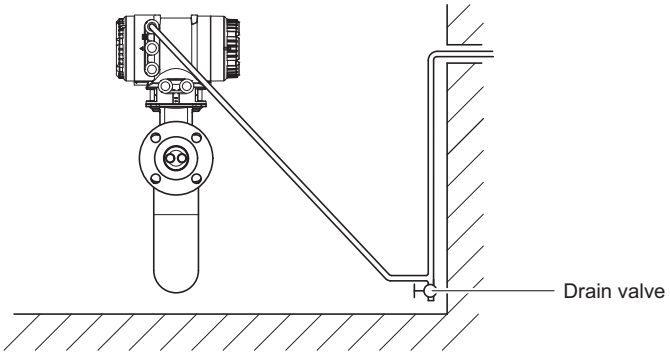


Fig. 26: Installation pipe at an angle

- 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 [▸ 47]*.
- 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”.

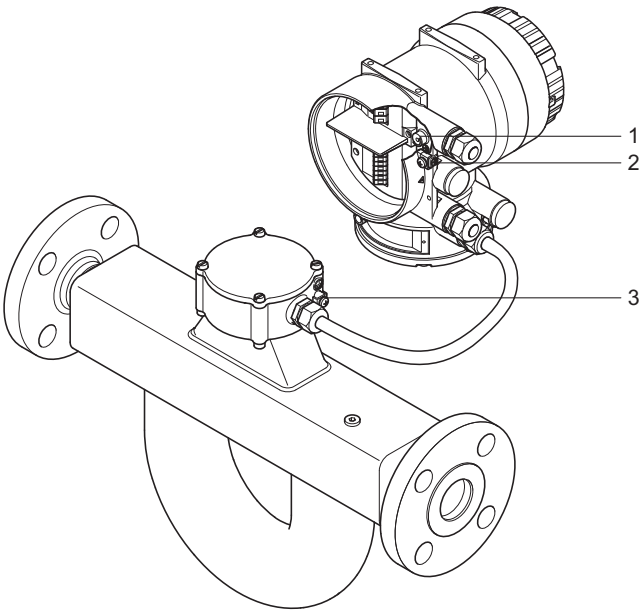


Fig. 27: Grounding connections on transmitter and sensor

1	Grounding screw inside transmitter terminal box for grounding conductor
2	Grounding terminal housing on transmitter for potential equalization
3	Grounding terminal housing 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. For figure with Remote type design please see *Flow meter components [19]*.

⚠ 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.

Standard cable option L___ and the fire retardant cable option Y___

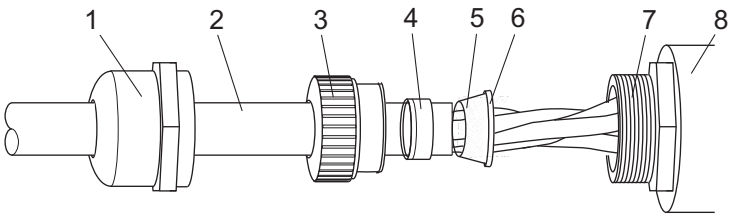


Fig. 28: Cable gland parts mounting

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

Steel armoured cable (option /LAC)

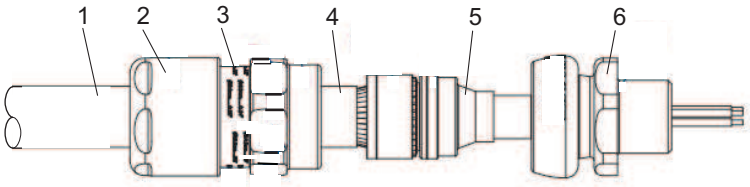


Fig. 29: Cable gland parts mounting

1	Connecting cable	4	Armour (braid) clamp ring
2	Backnut	5	Armour spigot
3	Middlenut	6	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.

Transmitter

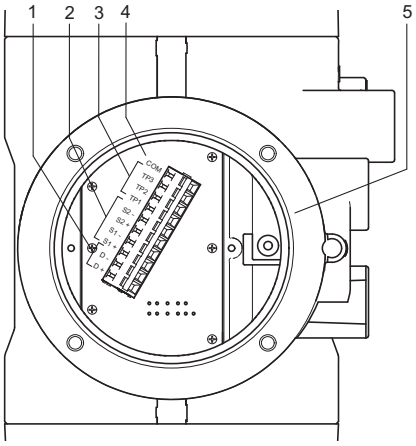


Fig. 30: Connection terminal circuit for transmitter

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

Sensor connection variant 1 + 2

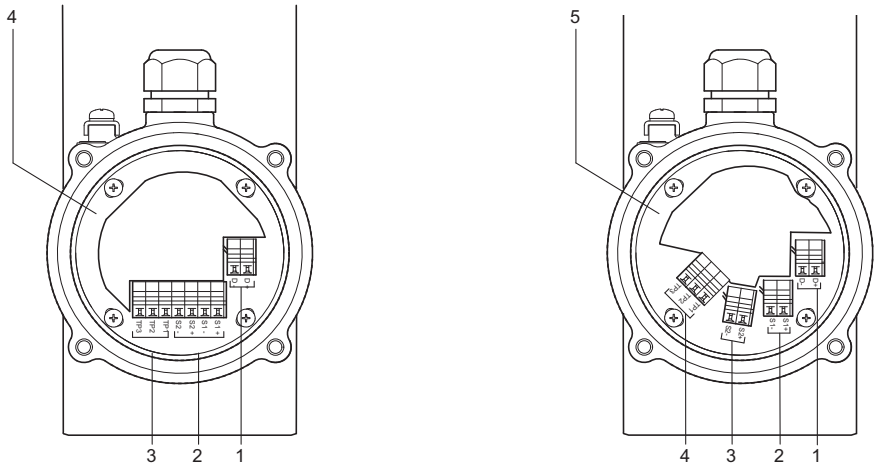


Fig. 31: Representation of variants 1 + 2: Connection terminal circuits for the sensor

Sensor connection variant 1:			
1	Driver circuit (D+/D-)	4	Sensor
2	Sensor circuits (S1+/S1-, S2+/S2-)		
3	Temperature measurement circuit (TP1, TP2, TP3)		

Sensor connection variant 2:			
1	Driver circuit (D+/D-)	4	Temperature measurement circuit (TP1, TP2, TP3)
2	Sensor circuit (S1+/S1-)	5	Sensor
3	Sensor circuit (S2+/S2-)		

Installation of standard connecting cable option L⎵⎵⎵

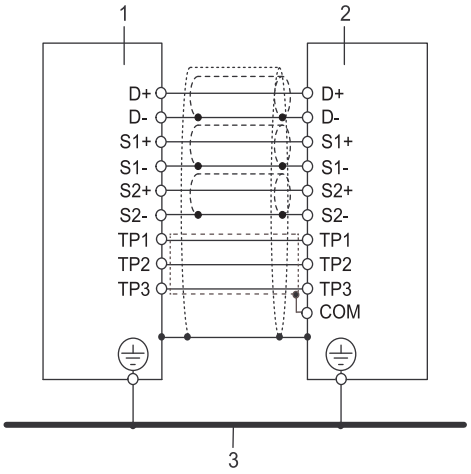


Fig. 32: Transmitter and sensor interconnection diagram

1 Sensor
2 Transmitter
3 Potential equalization system

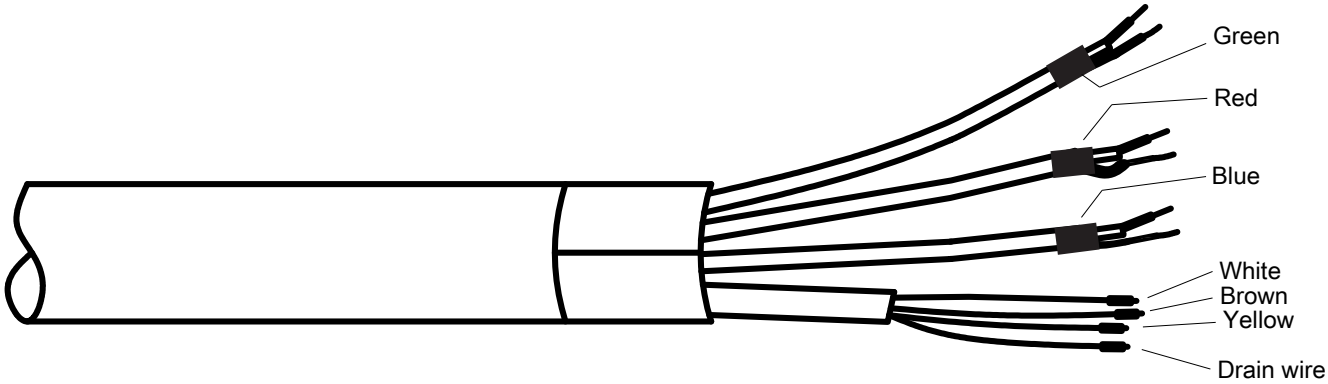


Fig. 33: Terminated standard connecting cable L⎵⎵⎵, transmitter side. Also applicable to option /LAC (steel armoured cable).

Connection scheme of standard connecting cable option L⎵⎵⎵ without and with option /LAC

Tab. 2: Version coaxial wire

Standard connecting cable option L⎵⎵⎵ without and with option /LAC			
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⎵⎵⎵ without and with option /LAC		
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⎵⎵⎵

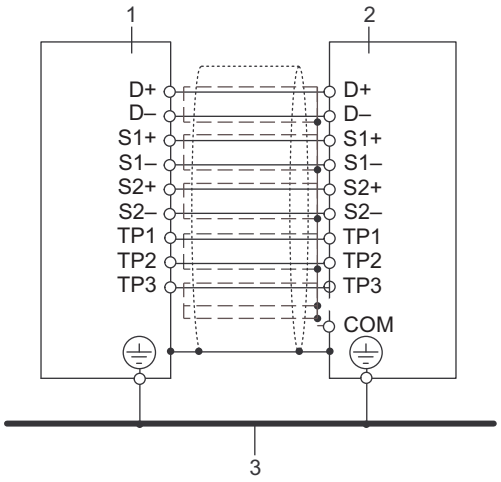


Fig. 34: Transmitter and sensor interconnection diagram

1 Sensor
2 Transmitter
3 Potential equalization system

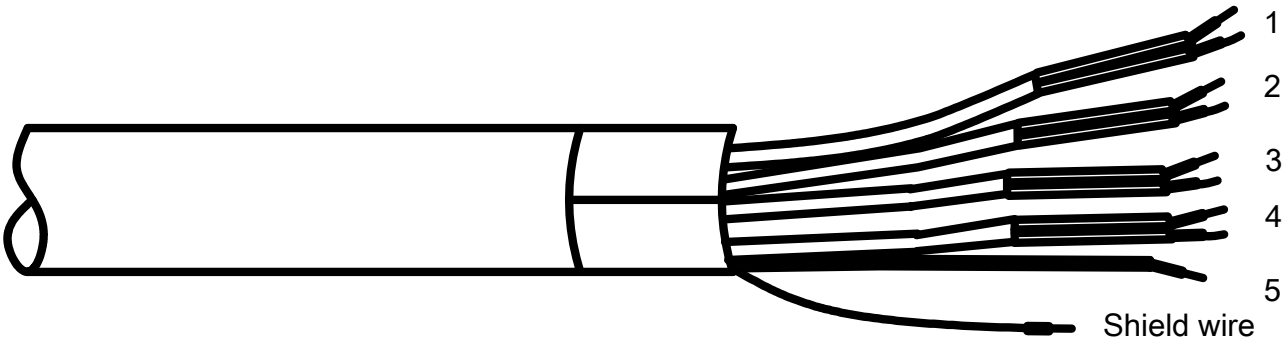


Fig. 35: Terminated fire retardant connecting cable Y⎵⎵⎵, transmitter side

Connection scheme of fire retardant connecting cable option Y␣␣␣

Tab. 4: Version Y␣␣␣

Fire retardant connecting 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

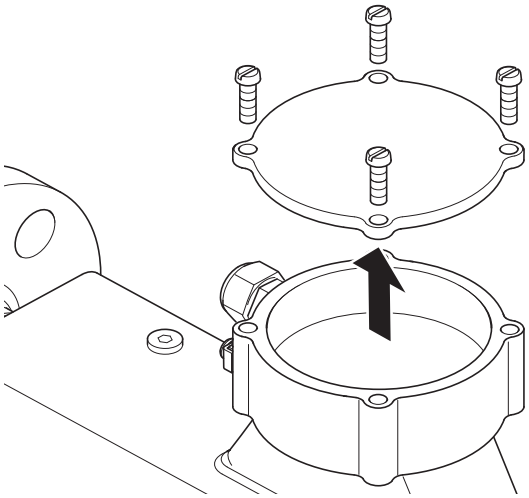
[2)] Present only at transmitter side

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.

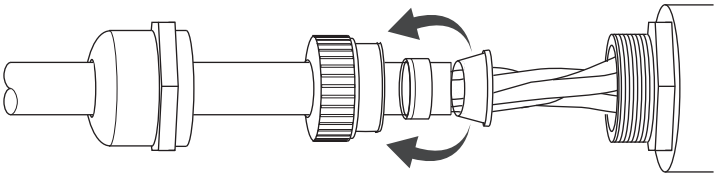
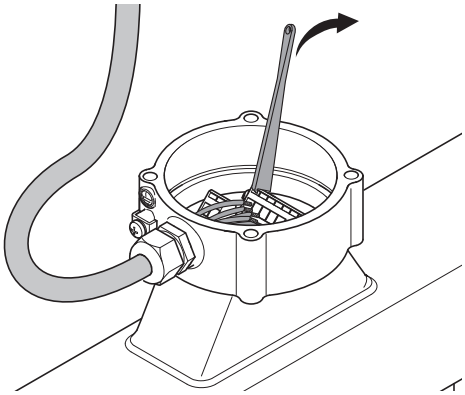


Fig. 36: Cable gland parts mounting

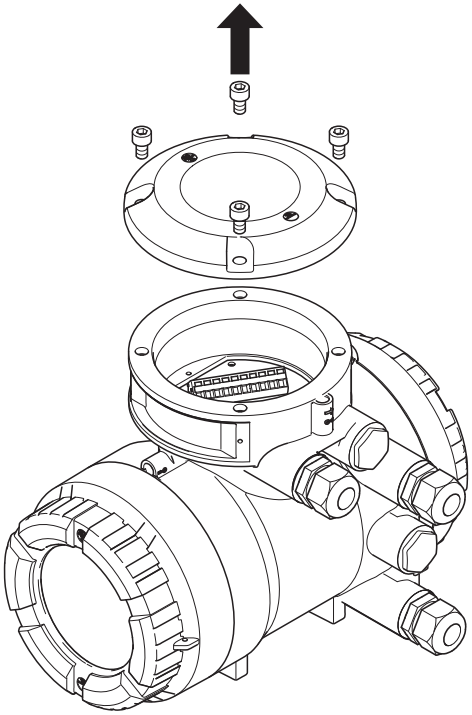
6. Feed cable through cable entry into sensor.
7. Use the operating tool to connect wires to connection terminals in accordance with terminal diagram, see *Connection terminals [▷ 49]*.



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

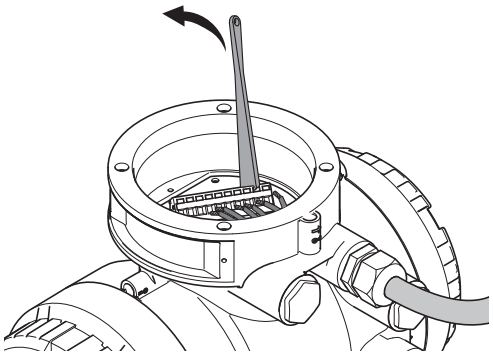
7.3.3 Connecting the connecting cable to transmitter

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 as shown in *Connecting the connecting cable to sensor [52]*, figure 36.
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 [49]*.



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

7.4 Transmitter interfaces

⚠ 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.

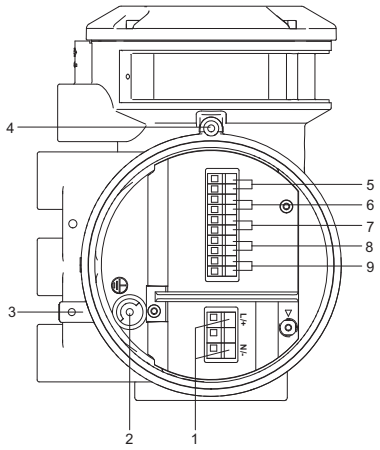
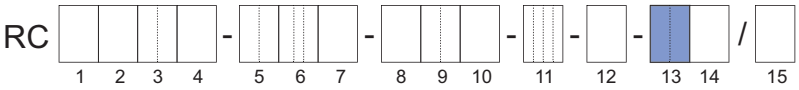


Fig. 37: Terminal for I/O outputs and power supply in transmitter

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 transmitter housing	8	Connection terminals for I/O4 +/-
4	Locking screw	9	WP: Write-protection terminal
5	Connection terminals for I/O1 +/-		

Depending on the selected interface protocol up to 4 in and/or outputs (I/O) are available, partially configurable.



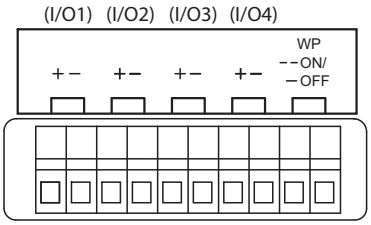


Fig. 38: I/O connection terminal layout

Tab. 5: I/O connection terminal configuration

Model code position 13	**Interface protocol**	**IO1 +/-**	**IO2 +/-**	**IO3 +/-**	**IO4 +/-**
J␣	HART	Active or Passive Analog Output + HART	Passive Pulse or Status Output	*Configurable*	*Configurable*
M␣	Modbus	*Configurable*		Modbus	
G␣ [1)]	PROFIBUS PA	PROFIBUS PA	Passive Pulse Output	–	–
F␣ [1)]	FOUNDATION Fieldbus	FOUNDATION Fieldbus		–	–

[1)]Only with Ultimate Transmitter

Details about in and outputs and communication interfaces are specified in the following chapters.

Galvanic isolation

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

Inputs and outputs wiring gauge

For all in- and outputs wire gauge of 0.5 mm² to 2.5 mm² (AWG 20 to AWG 14) is applicable.

7.4.1 Analog inputs and outputs

7.4.1.1 Analog outputs

Active current output *Iout*

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 for example.

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

NOTICE Please see Software Instruction Manual IM 01U10S0␣-00␣␣-R for further details.

For HART communication devices, it is supplied on the current output *Iout1*. The current output may be operated in compliance with the NAMUR NE43 standard.

	Value
Nominal output current range	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

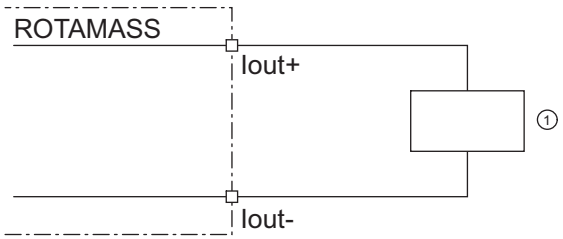


Fig. 39: Active current output connection *Iout* HART

① Receiver

Passive current output *Iout*

	Value
Nominal output current range	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

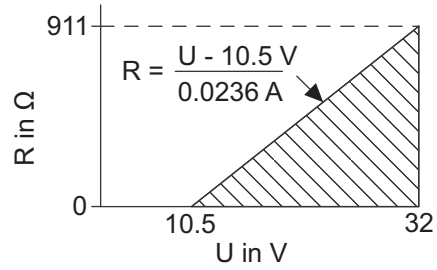


Fig. 40: Maximum load resistance as a function of an external power supply voltage

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.

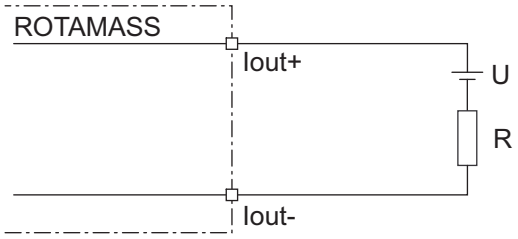


Fig. 41: Passive current output connection *Iout*

7.4.1.2 Analog inputs

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 range	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

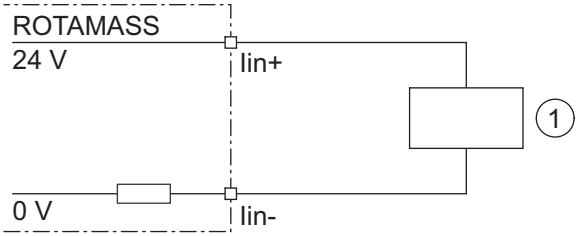


Fig. 42: Connection of external device with passive current output

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 range	4 – 20 mA
Maximum input current range	2.4 – 21.6 mA
Internal load resistance Rotamass	≤ 160 Ω

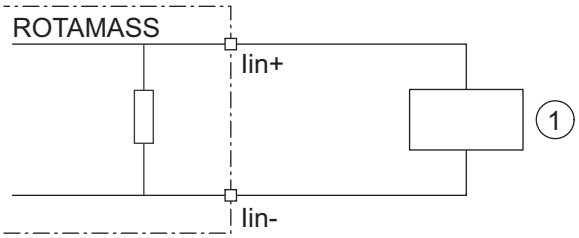


Fig. 43: Connection of external device with active current output

① External active current output device

7.4.2 Digital inputs and outputs

7.4.2.1 Digital outputs

Active pulse output *P/Sout*

Connection of an electronic counter

Maximum voltage and correct polarity must be observed for wiring.

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

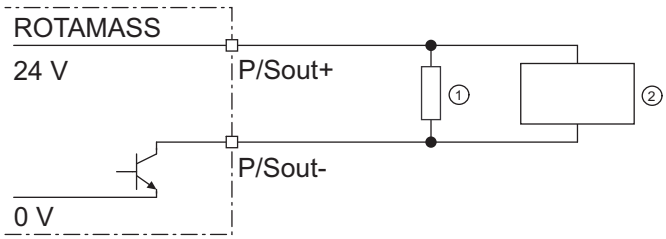


Fig. 44: Active pulse output connection *P/Sout*

① Load resistance
② Electronic counter

Connection of an electromechanical counter

Terms	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

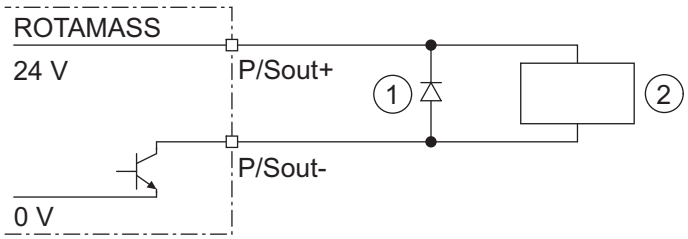


Fig. 45: Active pulse output *P/Sout* connection with electromechanical counter

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

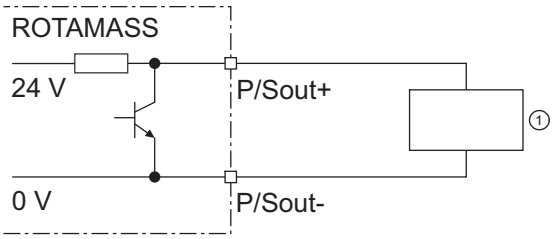


Fig. 46: Active pulse output *P/Sout* with internal pull-up resistor

① Electronic counter

Passive pulse output *P/Sout*

Maximum voltage and correct polarity must be observed for wiring.

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

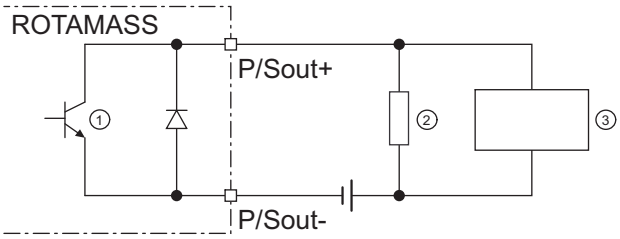


Fig. 47: Passive pulse output connection *P/Sout* with electronic counter

① Passive pulse or status output
② Load resistance
③ Electronic counter

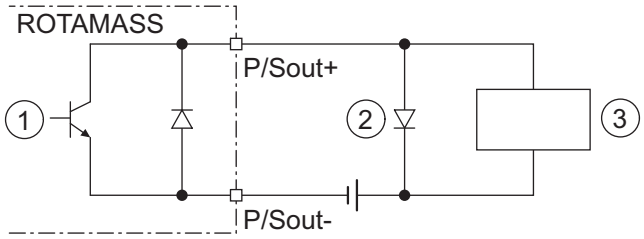


Fig. 48: Passive pulse output *P/Sout* connection with electromechanical counter

① Passive pulse or status output
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 %

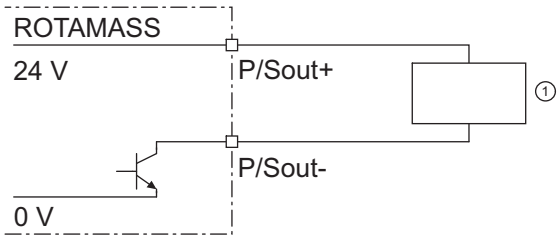


Fig. 49: Active status output connection *P/Sout*

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 %

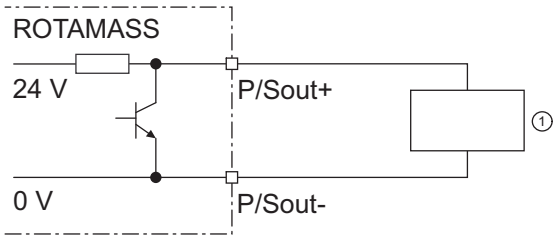


Fig. 50: Active status output *P/Sout* with internal pull-up resistor

① External device

Passive status output *P/Sout* or *Sout*

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

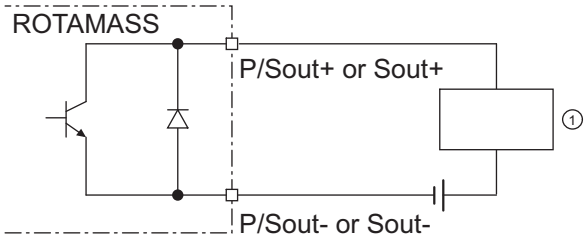


Fig. 51: Passive status output connection *P/Sout* or *Sout*

① External device

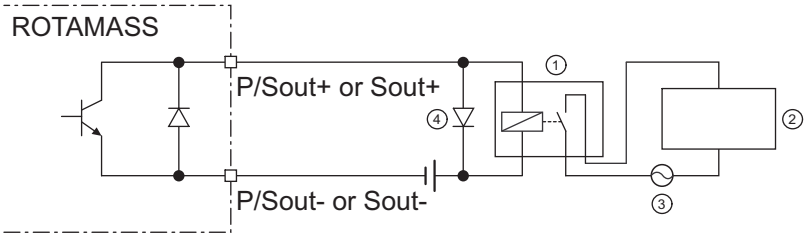


Fig. 52: Passive status output connection *P/Sout* or *Sout* for solenoid valve circuit

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):

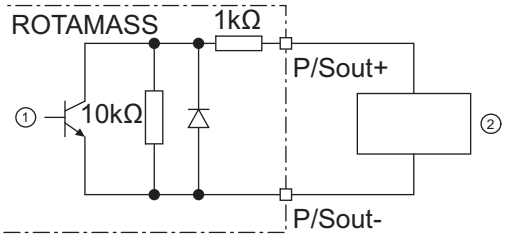


Fig. 53: Passive pulse or status output with switching amplifier connected in series

① Passive pulse or status output
② Switching amplifier

7.4.2.2 Digital inputs

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

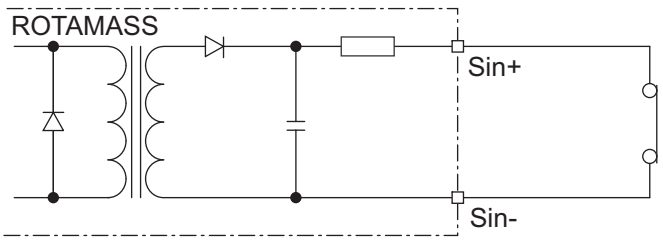


Fig. 54: Status input connection

7.4.3 HART communication interface

For HART communication devices, it is supplied on the current output Iout1. The current output may be operated in compliance with the NAMUR NE43 standard. HART is available with non-intrinsically and intrinsically safety outputs.

HART I/O

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

Iout1	Analog current output with HART communication
Iout2	Analog current output
Iin	Analog current input
P/Sout1	Pulse or status output
P/Sout2	Pulse or status output
Sin	Status input
Sout	Status output

HART I/O intrinsically safe

Model code position 13	Connection terminal assignment				
	I/O1 +/-	**I/O2 +/-**	**I/O3 +/-**	**I/O4 +/-**	**WP**
JP	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	–	Write-protect
JQ	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	P/Sout2 Passive	Write-protect
JR	Iout1 Passive	P/Sout1 Passive NAMUR	Iout2 Passive	–	Write-protect
JS	Iout1 Passive	P/Sout1 Passive NAMUR	Iout2 Passive	P/Sout2 Passive NAMUR	Write-protect

Iout1	Analog current output with HART communication
Iout2	Analog current output
P/Sout1	Pulse or status output
P/Sout2	Pulse or status output

Intrinsically safe outputs are only available in combination with selecting Ex approval of the device (see applicable General Specifications GS01U01B␣␣-00␣␣-R, chapter "8.1 Model code description").

HART communication

A load resistance of 230 – 600 Ω at Iout1 is recommended.

7.4.4 Modbus communication interface

Modbus interface is available with configurable I/O option.

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	Iin 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	Iout1 Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M7	Iin Passive	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect

Iout	Analog current output, no HART
Iin	Analog current input
P/Sout1	Pulse or status output
P/Sout2	Pulse or status output

Modbus connection

Tab. 6: Connection terminal assignment for Modbus

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

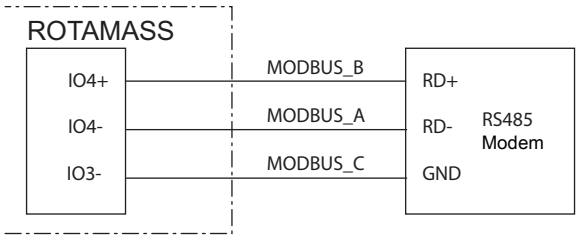


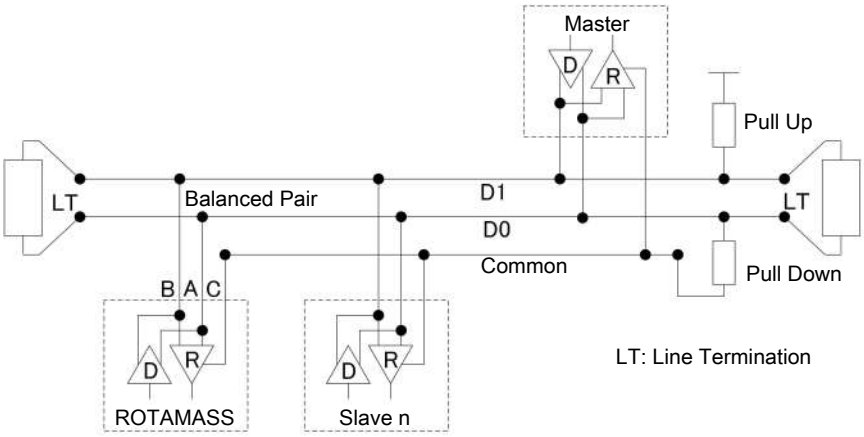
Fig. 55: MODBUS communication

Modbus cable

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

Output Signal

Digital communication signal according to EIA485 standard (RS485).



7.4.5 PROFIBUS PA

PROFIBUS PA interface is available with and without intrinsically safety.

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 applicable General Specifications GS01U01B␣␣-00␣␣-R, chapter "8.1 Model code description").

Output Signal

Digital communication signal according to IEC 61158/61784.

Maximum voltage and correct polarity must be observed for wiring.

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

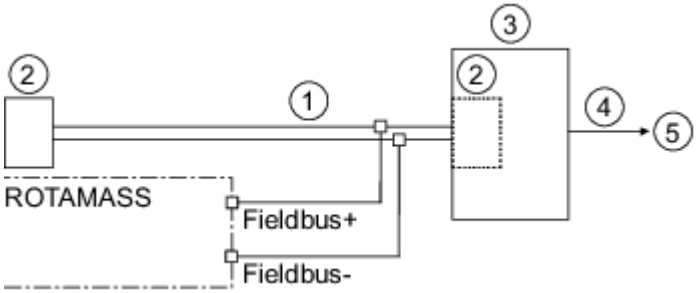


Fig. 56: PROFIBUS PA connection

① PROFIBUS PA
② Termination
③ DP/PA-Coupler
④ PROFIBUS DP
⑤ HOST

Cable type and length

Tab. 7: Fieldbus cable and transmissible length

Type of cable	Cable specifications	Max. length of cable (reference value)
Type A: Individually-shielded twisted pair cable	#18 AWG (0.82 mm²)	1,900 m

7.4.6 FOUNDATION Fieldbus

FOUNDATION Fieldbus interface is available with and without intrinsically safety.

Functions overview

Model code position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
F0	FOUNDATION Fieldbus	Pulse Passive	–	–	Write-protect
F1	FOUNDATION Fieldbus (IS)	Pulse Passive (IS)	–	–	Write-protect

Intrinsically safe (IS) outputs are only available in combination with selecting Ex approval of the device (see applicable General Specifications GS01U01B␣␣-00␣␣-R, chapter "8.1 Model code description").

Output Signal

Digital communication signal according to IEC 61158/61784.

Maximum voltage and correct polarity must be observed for wiring.

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

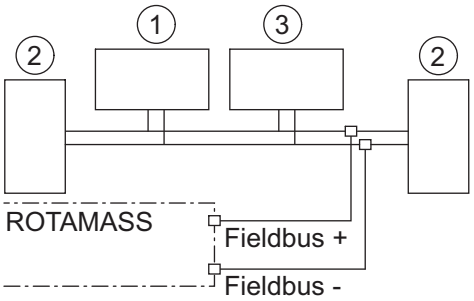


Fig. 57: FOUNDATION Fieldbus connection

① Fieldbus power supply and condition
② Termination
③ HOST

Cable type and length

Tab. 8: Fieldbus cable and transmissible length

Type of cable	Cable specifications	Max. length of cable (reference value)
Type A: Individually-shielded twisted pair cable	#18 AWG (0.82 mm²)	1,900 m

7.5 Transmitter power supply

Power supply

Alternating-current voltage (rms):

- Power supply[1)]: 24 V_{AC} +20 % -15 % or 100 – 240 V_{AC} +10 % -20 %
- Power frequency: 47 – 63 Hz

Direct-current voltage:

- Power supply[1)]: 24 V_{DC} +20 % -15 % or 100 – 120 V_{DC} +8.3 % -10 %

[1)] for option MC⎵ (Marine 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.

Wiring gauge

Recommended wire gauge is 0.5 to 2.5 mm² (AWG 20 to 14).

Power supply terminal layout

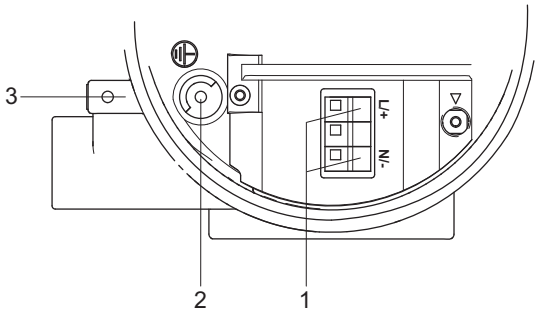


Fig. 58: Power supply terminal layout in transmitter

1 L/+: Phase / DC+
N/-: Neutral/ 0 V
2 Grounding screw in terminal box
3 Grounding transmitter housing

7.6 Connect power supply and I/O or communication wires

⚠ 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. Recommended wire gauge is 0.5 to 2.5 mm² (AWG 20 to 14).

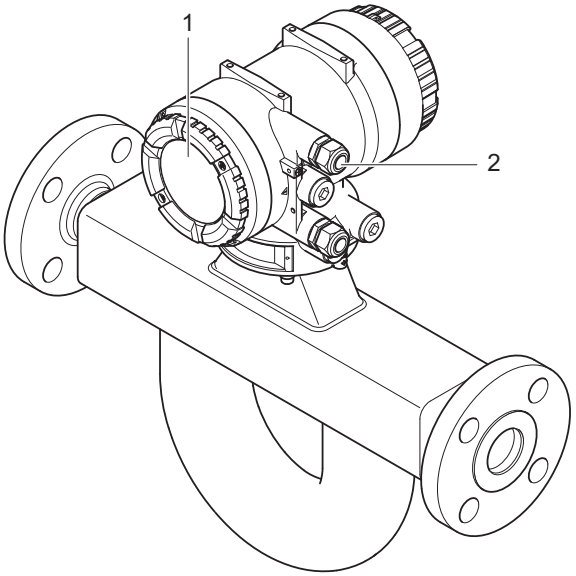


Fig. 59: Illustration for connecting the power supply and I/O or communication cables

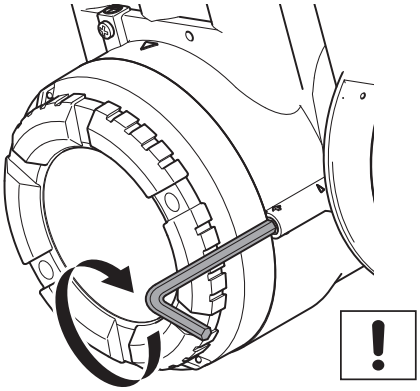
1	Transmitter back cover
2	Power supply cable gland

⚠ WARNING

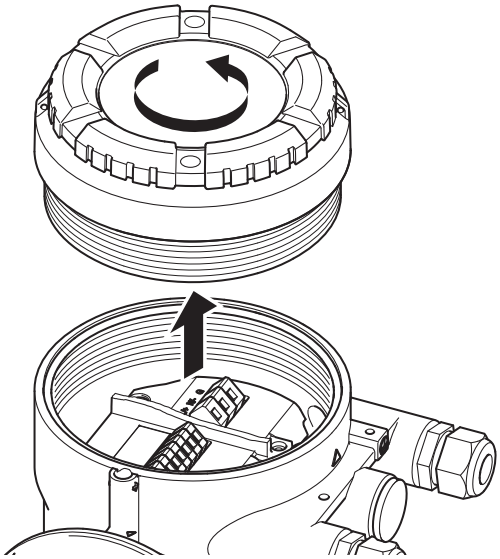
Risk of injury due to electrical shock

- 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 of 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.

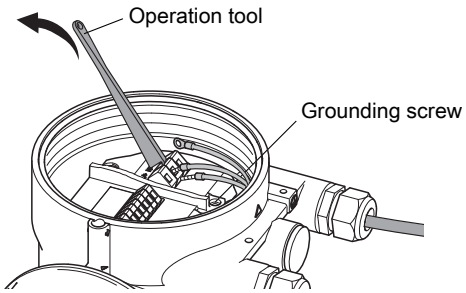


4. Attach cable glands.
5. Connect wires to connection terminals with the operating tool.

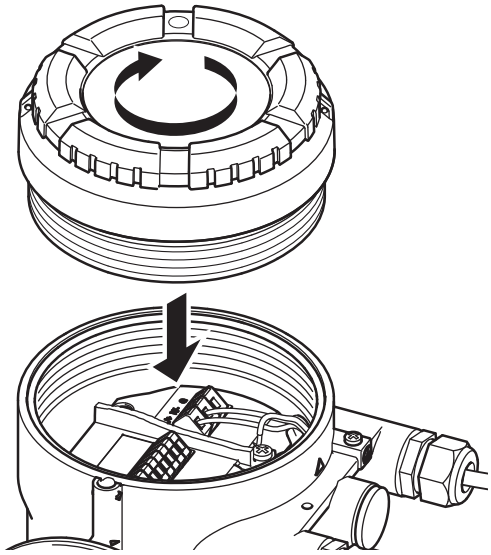
NOTICE	Connect the grounding conductor to the grounding screw (see chapter *Connection terminals [49]*, fig. 30/ point 2).

NOTICE	For the graphic representation of phase and neutral conductor connection, please see chapter *Power supply terminal layout in transmitter [68]*

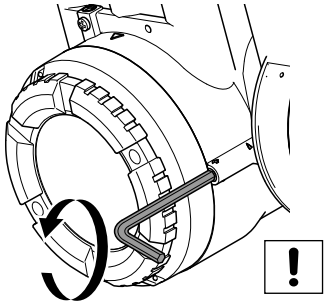
NOTICE	For details about I/O or communication wiring configuration refer to Fig 38 I/O connection terminal layout and in chapter 7.4 Table *Transmitter interfaces [54]*



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.



7.7 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 System configuration and operation

8.1 Startup

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 *Transmitter basic settings by display menu [▶ 78]*.

⇨ Flow meter is ready for operation.

8.2 Operating options

The Rotamass Total Insight can be operated in different ways:

- IR (Infra-Red) buttons on the display
- Communication interface, e.g. with FDT frame application like FieldMate

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

For more information on how to operate the transmitter, its functions and communication interface, see applicable Software Instruction Manual IM 01U10S0␣-00␣␣-R.

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.

NOTICE	Avoid writing setting parameters cyclically. The number of writes to the EEPROM is limited. If this limit is exceeded, it may cause data loss and memory failure.

8.3 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.

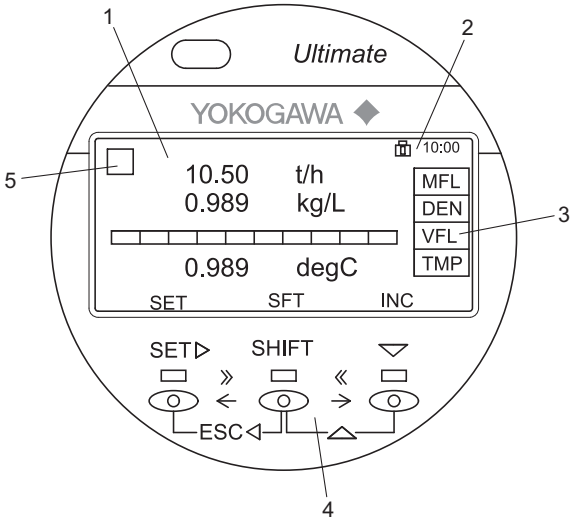


Fig. 60: Display layout

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

The controls on the display are IR buttons. 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 [33]*

Observe the following instructions to ensure that the IR buttons 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.

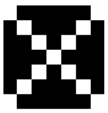
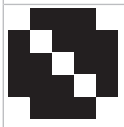
IR button functions

IR button	Display	Function
SET ▶	SET	▪ Apply setting ▪ Enter data ▪ Apply parameter
SHIFT	SFT	▪ Move cursor right or to the next position ▪ Change function and display of SET and ▼
▼	INC	▪ Increment parameter or value. Hold to scroll faster. ▪ Change position of the decimal point ▪ Select next menu item

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

Key combinations	Display	Function
SHIFT + SET ▶	ESC	▪ Cancel and switch to parent menu
SHIFT + ▼	DEC	▪ 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
	Upload parameter enabled		Download parameter enabled

Status icons HART

	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 [▶ 74]*, No. 1, 2 or 5.

Measured quantities and identifications

List of measured quantity abbreviations and identification on the display

Tab. 9: 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

Abbreviation	Measured quantity or identification
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
VSC	Viscosity

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. 10: Trend display

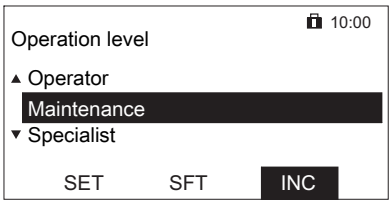
Abbreviation	Measured quantity or identification
MFL	Mass flow
DNS	Density
TMP	Temperature
VFL	Volume flow
PRS	Pressure
CNC	Concentration
NM1	Net mass flow rate 1
NV1	Net volume flow rate 1
PHS	Phase shift
FRQ	Resonance frequency
DRG	Drive gain
DRC	Driving current
MBT	Transmitter temperature
VSC	Viscosity

8.4 Transmitter basic settings by display menu

To limit access to device setup and parameters for configuring the operation of the device, 3 operation levels can be defined. One of them has to be selected and set when a user enters the operation menu to configure the device:

Tab. 11: Operation levels and related user rights

Operation level	User rights	Description
Operator	All parameters can be displayed. The following parameter can be used: Language	No password is required.
Maintenance	All parameters can be displayed. The following parameters can be used: ▪ Language ▪ Autozero ▪ Basic setup for PROFINET ▪ Basic setup for HART/Modbus	▪ Password is required. Default value is 0000. ▪ Password can be changed, see Root menu.
Specialist	All parameters can be displayed and all parameters can be used.	▪ Password is required. Default value is 0000. ▪ Password can be changed, see Root menu.



The following instruction refer to display values. Buttons to press described in table IR buttons, see *Display [▷ 75]*.

8.4.1 Select operation level

1. Press and hold [SET] for 2 seconds.
2. Press [SFT] + [INC] switches to enter [Setting Mode].
   ⇨ Menu [No] is preselected.
3. Press [INC] switch and select [Yes], then press [SET].
4. [Yes] is blinking, then press [SET] switch to enter the menu [Operation level].
5. Press [INC] to select the desired operation level.
6. Press [SET] to confirm.
   ⇨ If the operation level [Operator] has been selected, the following steps are not necessary. Access to the operation menu will be granted.
   ⇨ If the operation levels [Maintenance] or [Specialist] have been selected, a numeric password must be entered, see steps 7 – 11.
7. Press [INC] to choose the first number of the numeric password.
8. Press [SFT] to switch to the remaining numbers of the numeric password.
9. Press [INC] to choose the remaining numbers of the numeric password.
10. Press [SET] to confirm the entered numeric password.
    ⇨ The entered password flashes.
11. Press [SET] to confirm.

⇨ If the password is correct, access to the operation menu will be granted.

⇨ If the password is incorrect, access to the operation menu will be denied and the menu [Operation level] opens again.

8.4.2 Setting display language

1. Access operation level [Operator].
2. Browse to [Lang], Press **[INC]** to browse and [SET] to enter desired menus/parameters.
3. Press **[INC]** repeatedly until the desired language appears.
4. Press [SET] to select the desired language.
5. Press [SET] to confirm the language selected.
   ⇨ Display returns to higher menu level after few seconds.

8.4.3 Setting date

1. Access operation level [Maintenance].
2. Browse to [Detailed setup]► **[Set date]**. Press **[INC]** to browse and **[SET]** to enter desired menus/parameters. menu is selected.
   ⇨ Date on display is flashing.
3. To set date press **[INC]** to increment date digits and **[SFT]** to shift between year, month and day.
4. Press **[SET]** to apply the date set.
5. Press **[SET]** to confirm the date set.
   ⇨ Display returns to higher menu level after few seconds.

8.4.4 Setting time

1. Access operation level [Maintenance].
2. Browse to [Detailed setup] ► [Date/Time] ► [Set time]. Press **[INC]** to browse and **[SET]** to enter desired menus/parameters.
   ⇨ Time on display is flashing.
3. To set time press **[INC]** to increment time digits and press **[SFT]** to shift between hour, minutes and seconds.
4. Press **[SFT]** button to set the minutes.
5. Repeat the two previous steps for minutes and seconds.
6. Press **[SET]** to apply the time set.
7. Press **[SET]** to confirm the time set.
   ⇨ Display returns to higher menu level after few seconds.

8.4.5 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 multiphase 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.

8.4.6 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. Access operation level [Maintenance].
2. Browse to [Diag/Service] ► [AZ] ► [Exe]. Press **[INC]** to browse and **[SET]** to enter desired menus/parameters.
   ⇨ Parameter [Not exe] appears.
3. Press **[INC]** until [Exe] is selected.
4. Press **[SET]**.
   ⇨ Parameter [Exe] flashes.
5. Press **[SET]** to start autozero.
   ⇨ Progress bar appears to indicate status of autozero, after completion display returns to higher menu level after few seconds.

8.4.7 Change operation level passwords

Default passcode for [Maintenance] and [Specialist] operation level should be changed.

1. Access operation level [Maintenance] or [Specialist].
2. Browse to [Detailed setup] ► [Access cfg] ► [Chg Mainte] or [Chg Special]. Press **[INC]** to browse and **[SET]** to enter desired menus/parameters.
3. To change passcode press **[INC]** to increment digits and **[SFT]** to shift to next digits.
4. Press **[SET]** to apply the passcode.
   ⇨ Passcode flashes.
5. Press **[SET]** to confirm the passcode.
   ⇨ Passcode stops flashing, display return to higher menu level after few seconds.

8.5 Transmitter hardware setting

The transmitter is equipped with DIP switches which can be used for specific settings. Some settings can be changed in the transmitter software as well.

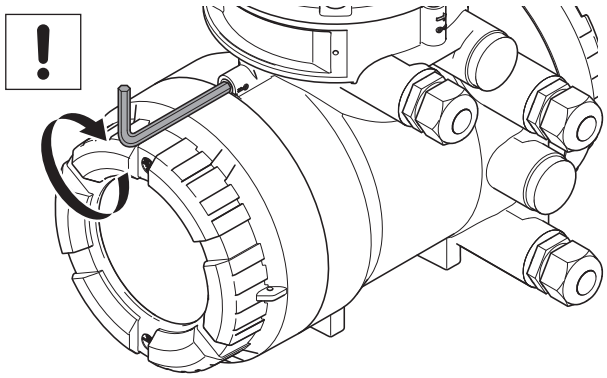
To access the switches follow instructions as below.

DANGER

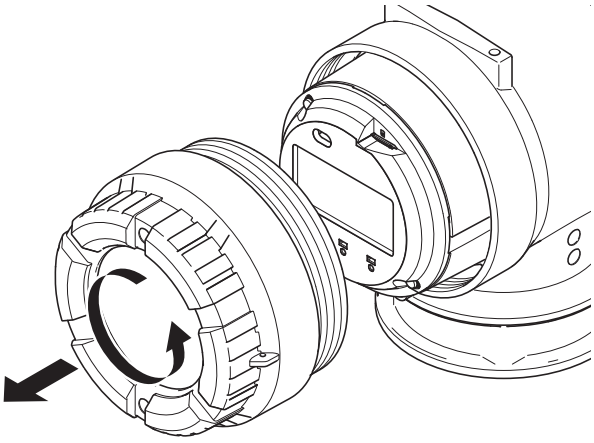
Explosion hazard

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

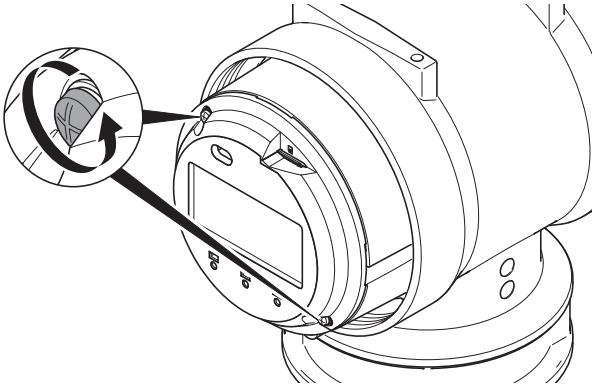
1. Switch off power supply.
2. Loosen the locking screw by turning it clockwise with an Allen wrench (size: 3.0).



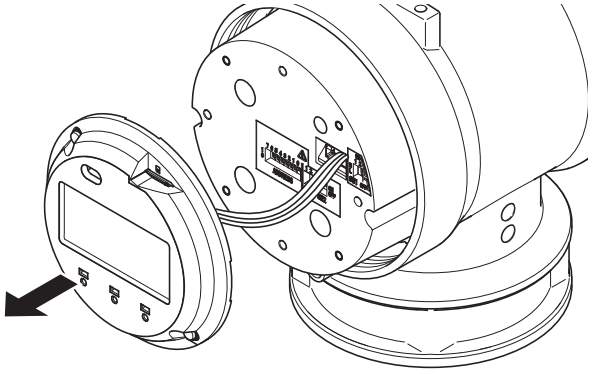
3. Unscrew display cover from transmitter housing.



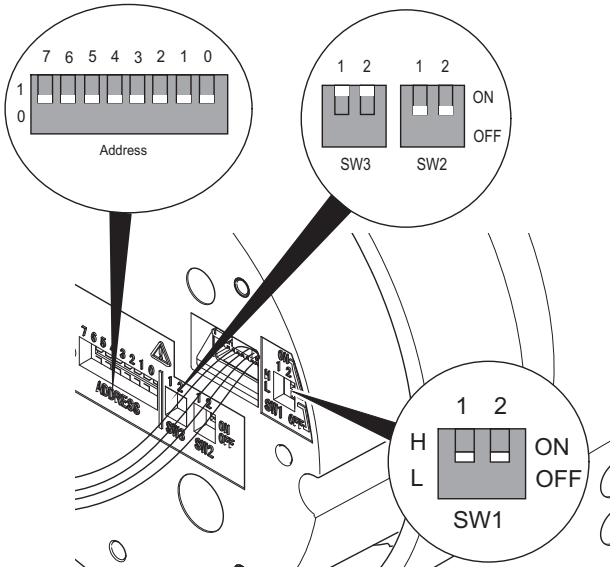
4. Remove 2 screws from the display.



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



6. Access desired switches.



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).

DIP switch functions

SW No.		Function
1	1	Burnout/ Simulation mode
	2	Write protection
2		Bus termination
3		Pull-up /-down resistor for Modbus
Address		Bus address

8.5.1 Setting hardware write-protection and burnout-/ simulation-mode

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 *Transmitter interfaces [▶ 54]*).

> ⓘ It is not possible to release the hardware write-protection via transmitter software nor with via communication interface (e.g. with configuration software).

Write protection

SW1-2	Function
H	Write protection on
L (default)	Write protection off

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

Burnout mode HART / Simulation (FOUNDATION Fieldbus)

Depending on interface setting DIP SW1-1 can activate Burnout or simulation mode. Switch is located behind the display.

SW1-1	Function (FOUNDATION Fieldbus)	Function (HART)	Analog output burnout value (HART)
H	Simulation on	Burnout mode High	21.6 mA
L (default)	Simulation off	Burnout mode Low	2.4 mA

8.5.2 Bus address switch

Bus address can be set using DIP switch ADDRESS for Modbus RTU, PROFIBUS PA. To enable hardware address ADDRESS switch bit no. 7 has to be set to pos. 1. Bit no. 0 to 6 will then define the binary coded address.

SW Address Pos.		Function
7	**0 - 6**	
1	7-bit no.	Bus address defined by HW
0 (default)	No function	Bus address defined by SW

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

Pos. no. 0-6 show the square of each number.

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

($\mathbf{1} * 2^6 + \mathbf{0} * 2^5 + \mathbf{0} * 2^4 + \mathbf{0} * 2^3 + \mathbf{0} * 2^2 + \mathbf{0} * 2^1 + \mathbf{0} * 2^0$)

Address range

Protocol	Address range	Remarks
Modbus	1-127	If address switch is set to 0, address is automatically converted to 1.
PROFIBUS	0-126	If address switch is set to 127, address is automatically converted to 126.

8.5.3 Bus termination and pull-up resistor

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 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.

9.1 Malfunction of operation

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

Malfunction	Possible causes	Remedy
Display on transmitter not functioning	Power supply disconnected	▪ Ensure that the unit is connected to the power supply, see *[69]*
	Settings cannot be made via IR buttons	▪ Check cable connections between display and main board and connect properly, if necessary.
Settings cannot be made via IR buttons	Incorrect settings in write-protect menu item	▪ Switch off write-protect menu item via digital communication or hardware switch.
Field communicator is not detected	HART DD not installed on field communicator	▪ Install HART DD file on field communicator.
	Field communicator not connected	▪ 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	▪ Install PROFIBUS PA EDD[1)] on the Host
	PROFIBUS PA GSD file is not installed on the Host	▪ Install PROFIBUS PA GSD[2)] file on the Host
	PROFIBUS DP/PA coupler is not connected to the Host	▪ Connect PROFIBUS DP/PA coupler with Host
	PROFIBUS PA modem is not connected to the DP/PA coupler	▪ Connect PROFIBUS PA modem with DP/PA coupler
	Rotamass Total Insight is not connected to the PROFIBUS PA modem	▪ Connect PROFIBUS PA modem with Rotamass Total Insight
FOUNDATION Fieldbus Host does not detect Rotamass Total Insight	FOUNDATION Fieldbus EDD[1)] not installed on the Host	▪ Install FOUNDATION Fieldbus EDD[1)] on the Host
	FOUNDATION Fieldbus CFF[3)] file is not installed on the Host	▪ Install FOUNDATION Fieldbus CFF file on the Host
	FOUNDATION Fieldbus terminator is not connected to the Host	▪ Connect FOUNDATION Fieldbus terminator with host
	FOUNDATION Fieldbus modem is not connected to the terminator	▪ Connect FOUNDATION Fieldbus modem with terminator
	Rotamass Total Insight is not connected to the FOUNDATION Fieldbus modem	▪ Connect FOUNDATION Fieldbus 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.

[3] meaning of "CFF": The CFF file is necessary for FOUNDATION Fieldbus communication with host system. Before starting communication, the device must be specified by the CFF file in the host system and the Device type of the device.

9.2 Zero point unstable

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

Malfunction	Possible causes	Remedy
Zero point unstable	Measuring tube not completely filled with fluid	– Check that the measuring tube in the sensor is completely filled with fluid. Correct installation, see *[▷ 22]*.
	Bubbles or solids in the fluid	– Check pipe and sensor installation, see *[▷ 26]*. – Correct installation, see *[▷ 22]*.
	No electrical grounding	– Ground transmitter and sensor, see *[▷ 47]*, and *[▷ 69]*. – Check correct connection of connecting cable shield on transmitter.
	Flow meter installed in proximity to facilities with strong electro-magnetic field	– Ground transmitter and sensor, see *[▷ 47]*, and *[▷ 69]*. – Install flow meter as far away as possible from these electric devices.
	Mechanical strain from traction or pressure	– Eliminate cause for mechanical tension.
	Terminal board or connection terminals of transmitter or sensor soiled or damp	– 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	– Install mechanical dampers. – Increase parameter [mass flow damping], see applicable Software Instruction Manual IM01U10S0␣-00␣␣-R.

9.3 Display deviating

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

Malfunction	Possible causes	Remedy
Flow rate displayed deviates from actual flow rate	Zero point set incorrectly	– Set zero point, see *[▷ 79]*
	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 *[▷ 26]*
	Bubbles in fluid	– Check pipe and installation, see *[▷ 26]*. – Correct installation, see *[▷ 26]*
	Connecting cable incorrectly connected for remote type	– Check cable connections and correct, if necessary, see *[▷ 49]*.
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 Val sel parameter is set correctly. If a fixed value is selected, ensure that the parameter Fix val is set correctly, see Software Instruction Manual. – Set parameter Val sel to Meas val, 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 *[▷ 47]*. – Check correct connection of connecting cable shield on transmitter.
	Bubbles in fluid	– Check pipe and installation, see *[▷ 26]*.
	Connecting cable incorrectly connected for remote type	– Check cable connections and correct, if necessary, see *[▷ 49]*.
	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	– Match settings of flow meter and reading system. – Check LRV and URV process parameters, see Software Instruction Manual.
	Non-adjustable temperature	– Check whether the Func sel parameter is set correctly. If a fixed value is selected, ensure that the Fix val is set correctly, see Software Instruction Manual. – Set parameter Func sel to Inter val.
	Analog output trim was performed incorrectly	– Correctly perform trimming (see applicable Software Instruction Manual).
	Connecting cable incorrectly connected for remote type	– Check cable connections and correct, if necessary, see *[▷ 49]*.
	Incorrect temperature measurement with remote type	– 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	– Check parameter LRV and URV of the corresponding output signal, and correct, if necessary.
	Incorrect measured quantity	– Check measured quantity output and, if necessary, correct; check parameter Sel, see Software Instruction Manual.

10 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 [▷ 20]*; 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.

10.1 Exterior cleaning

⚠ WARNING

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.

10.2 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.

10.3 Dry Verification

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

10.4 Impairment of the display

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

10.5 List of replacement parts

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

11 Device replacement

Please consider chapter *General safety instructions [10]*

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

For spare transmitter or spare sensor installation please refer to *Installation [22]*

11.1 Disconnect the device

WARNING

Life-threatening injuries from electric shock

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

In the following procedure power, grounding, communication and/or I/O cables will be disconnected.
Below Fig. 60 shows open transmitter without back cover for inputs/outputs and power supply.

After power down / breaking circuits from L/+ N/- and grounding for the power supply (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!) with the operating tool.
3. Remove the cable gland and cable.
4. Disconnect the power cables from L/+ and N/- “Power supply connection terminals”.

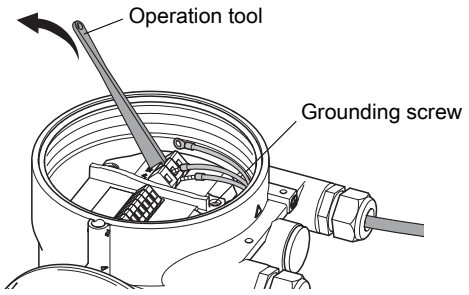


Fig. 61: Open transmitter terminal box power and I/O connection

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

11.2 Disconnect transmitter from sensor

The defective device has to be dismantled. It depends on integral or remote design.

For details, please refer to chapter 4.3 *Flow meter components [▶ 19]*.

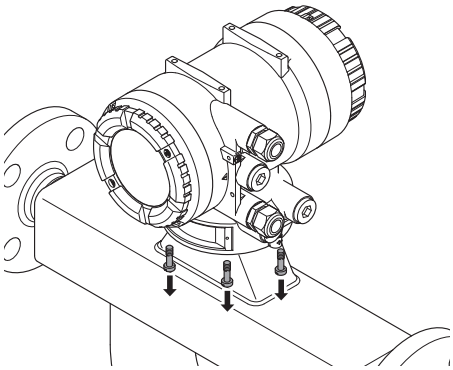
11.2.1 Integral type

⚠ WARNING

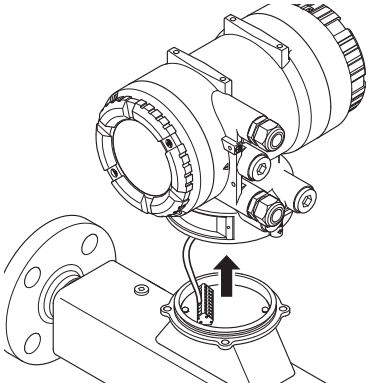
Life-threatening injuries from electric shock

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

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.

11.2.2 Remote type

WARNING

Life-threatening injuries from electric shock

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

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:

Remove connecting from transmitter

1. Open the terminal box sensor connection.

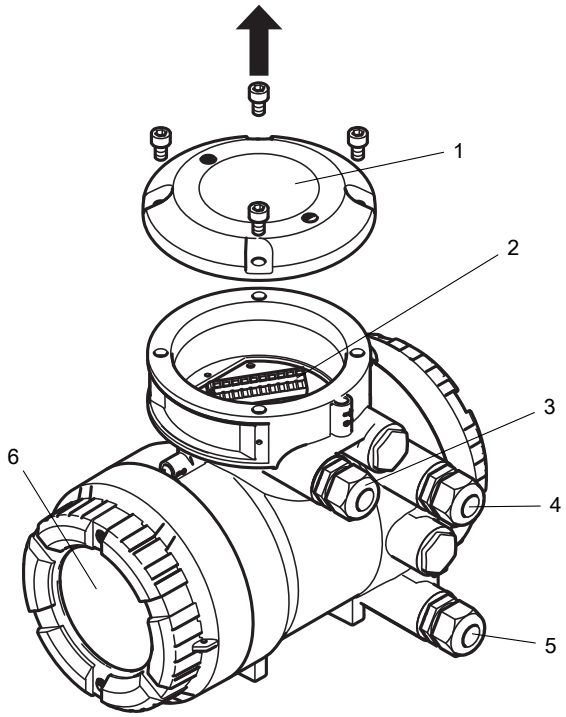
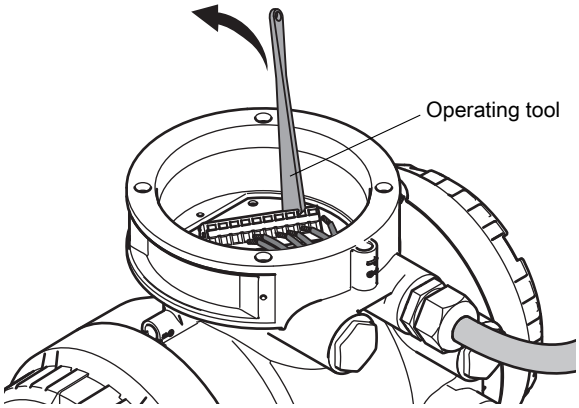


Fig. 62: Connecting interfaces on transmitter

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

2. Disconnect all cables with the operating tool.

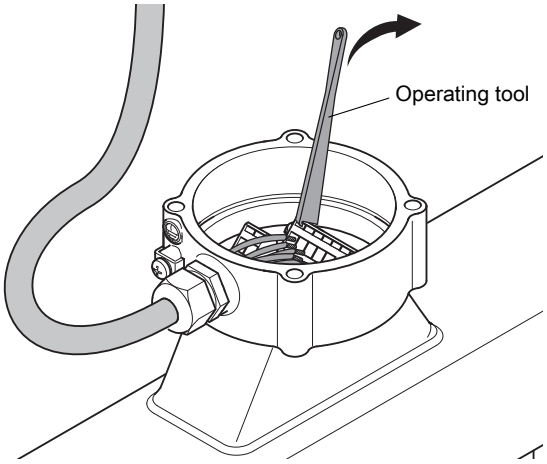


3. Remove the cable gland and cable.

Remove connecting cable from sensor

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.

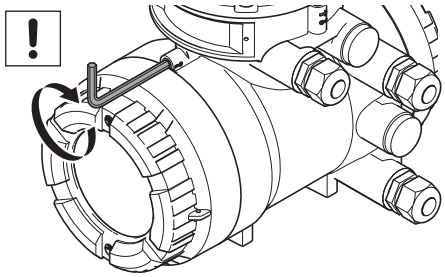
11.3 Dismount the defective device

11.3.1 Transmitter

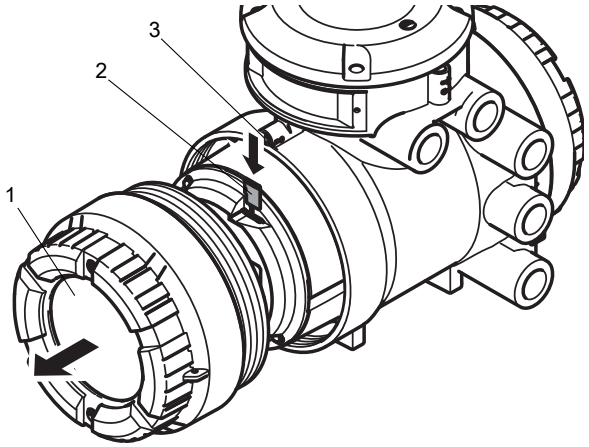
Remove microSD card

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

Remove defective transmitter (in case of remote type)

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

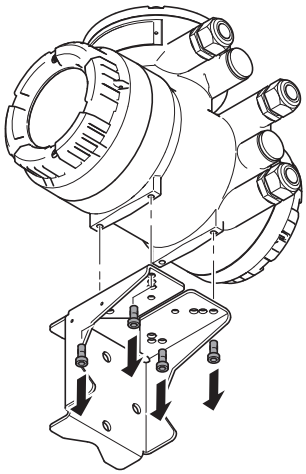


Fig. 63: Removal of defective transmitter from the mounting bracket

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

11.3.2 Sensor

⚠ 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.

⚠ 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.

For sensor diasmounting consider:

1. *Installation in pipe [▷ 27]*
2. *Installation Rotamass Nano (Option PD) [▷ 30]*

11.4 Installation and hardware setting of spare device

Installation, wiring and hardware setup of spare device is equal to standard device (except integral type). Please refer to chapters:

1. *Installation [▷ 22]*
2. *Wiring [▷ 45]*
3. *System configuration and operation [▷ 73]*

For integral spare sensor installation please refer to *Integral type [▷ 92]* and proceed in opposite order.

11.5 Parameter setting

For sensor and transmitter coupling depending on replaced device related parameters have to be configured properly. Parameter setting is possible by IR buttons on the display or communication interface. Spare transmitter is always equipped with display.

Communication interface

For more information on how to operate the transmitter, its functions and communication interface, see *Operating options [▶ 73]*

Consider table 15 communication interface conditions for setting method.

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 by setup with backup file Value	
	By display	By FDT framework tool like FieldMate
J␣(HART)	*Possible*[1)]	*Recommended from FW Rev.3*
M␣(Modbus)	*Possible*	*Recommended*
G␣(PROFIBUS PA)	*Possible*	*Recommended*
F␣(FOUNDATION Fieldbus)	*Possible*	*Recommended*

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

11.5.1 Relevant parameters and storage

The Rotamass Total Insight transmitter has four kinds of relevant parameters which must be adjusted to ensure a proper operation of the flowmeter:

- **System relevant parameters** - a device can be identified in one of the following ways:
  - *Device identifier (Device ID)* – fixed value by manufacturer
  - *Device tag* (HART, FOUNDATION Fieldbus, PROFIBUS PA)
  - *Bus address* (HART, FOUNDATION Fieldbus, PROFIBUS PA)
- **Sensor related parameters** (liquid or gas select, mass flow or volume flow, temperature unit...)
- **Sensor specific parameters** (SK20, KD, fl20)
- **Customer specific parameters** (lowcut and URV)

Relevant parameters are stored on microSD card in the file “Factory.PAR” or in case of gas devices use "Fact_gas.PAR"[1)].

Customer specific parameters are stored on microSD card in the file “Customer_Settings_YourDeviceSerialNumber.csv”. (make sure complete cell content is visible!).

[1)]in case of gas devices ordered after 04.05.2020 use "Fact_gas.PAR".

Sensor specific parameter contain:

- Sensor coefficient SK20
- Density coefficient KD
- Frequency FL20

They can be found additionaly on:

- sensor calibration certificate
- additional sensor nameplate

11.5.2 Parameter setting procedure

There are multiple ways to setup parameters properly for device replacement. Within this chapter the most applicable method is described. This method focuses on minimal setting by using sensor constant download function. For that, display is required.

Step	Task	Sensor replacement	Transmitter replacement
1	Copy and rename the backup file, see chapter *[▷ 97]*	From spare sensor onto existing transmitter microSD	From replaced transmitter onto new transmitter microSD
2	Set process variable units	From customer to default values[1)]	From default to customer values
3	Execute sensor constant download function		
4	Set process variable units, see *[▷ 98]*	From default to customer values	n.A.
5	Set customer specific values, see *[▷ 99]*	n.A.	From default to specific values
6	Set system related parameters, see *[▷ 99]*	n.A.	From default to customer values

[1)]Please take notes of customer unit settings before changing in order to restore properly.

11.5.3 Set up process variable units

For usage of sensor constant download function the following process variables have to be adjusted.

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

Process variable	Default unit
Mass flow	*kg/h*
Density	*kg/l*
Pressure	*bar*
Temperature	*°C*

Below procedure describes how to change process variable units based on mass flow example.

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

1. Access operation level [Specialist].
2. Browse to [Easy setup wizard] ▶ **`[Std dev var]`** ▶ [Mass]. Press **`[INC]`** to browse and [SET] to enter desired menus/parameters.
3. Press **`[INC]`** until desired unit appears.
4. Press [SET] to confirm.

Execute this procedure for all other relevant process parameter units in your device correspondingly described in interface related Software Instruction Manual *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.**

11.5.4 Set up sensor relevant and sensor specific parameters

To use the download function please execute the following sequence:

1. Access operation level [Specialist].
2. Browse to [Diag/Service] ► [Param bkup/restore] ► [Bkup name]. Press **[INC]** to browse and [SET] to enter desired menus/parameters.
3. Enter the name of the renamed configuration file, e.g. “UsrCfg” when filename is “UsrCfg.PAR”. Press **[INC]** to increment characters and [SFT] to shift to next letters.
4. Press [SET] to apply the name.
   ⇨ Name in display flashes.
5. Press [SET] to confirm the name.
   ⇨ Display returns to higher menu level after few seconds.
6. Browse to [Diag/Service] ► [Param bkup/restore] ► [Restore]. Press **[INC]** to browse and [SET] to enter desired menus/parameters.
7. Press **[INC]** repeatedly until value [DL snsr cnst SD] appears.
8. Press [SET] to apply.
   ⇨ [DL snsr cnst SD] flashes.
9. Press [SET] to confirm.
   ⇨ Progress bar appears to indicate status of download progress, after completion display returns to higher level after few seconds.

11.5.5 Set up customer specific parameters

The default setting for customer specific parameters is as follows:

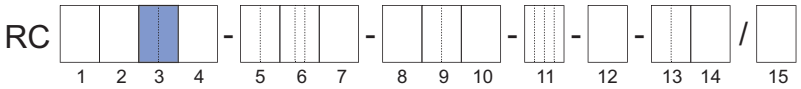
Tab. 17: Assignment: default setting for customer specific parameters

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 following model codes of the defective transmitter related parameters should be adjusted.

Meter size (model code pos.3)



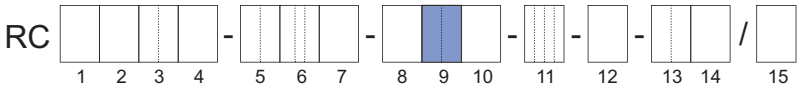
The following parameter values are recommended to set, if needed:

Tab. 18: Overview: setting values for parameters [… lowcut] and [… URV]

	Recommend RMTI parameter setting values:			
Parameter name:	**[… lowcut][1)]**		**[… URV][1)]**	
Meter size:	**Setting value:**		**Setting value:**	
(model code pos.3)	***Value***	***Unit***	***Value***	***Unit***
06	0.0105		21.0	
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	*kg/h*	10000.0	*kg/h*
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	
2F	450.0000		900000.0	

[1)] "…" Mass flow low cut and URV values compared to parameter values in *table 17*, see *Set up customer specific parameters [▷ 99]*.

Mass flow and density accuracy (model code pos.9)



The parameter [Liquid gas select] has to be set to "Gas" if the mass flow and density accuracy value is 30, 50 or 70.

11.5.6 Set up system related parameters

It is necessary for usage in the plant that the system related parameters like tag names and communication interface (bus) address fit to the superior system settings. For details please refer to applicable Software Instruction Manual IM 01U10S0_-00_ _-R.

11.6 Startup

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 *System configuration and operation [▷ 73]*.

⇨ Flow meter is ready for operation.

12 Dismantling and disposal

12.1 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.

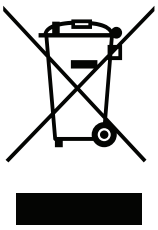
Note the following items before returning the shipment:

- 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.

12.2 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.



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE). Devices can be returned to the manufacturer or supplier within the EU and UK, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

ROTA YOKOGAWA GmbH & Co. KG
Service & Repair Department
Rheinstraße 8; D - 79664 Wehr
Phone no.: +49 (0)7761-567-190
Fax no.: +49 (0)7761-567-285
e-Mail: services.flow@de.yokogawa.com

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:	[ ] toxic [ ] corrosive [ ] explosive [ ] biological hazardous [ ] unknown if dangerous [ ] 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

13 Operating Conditions

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

13.1 Ambient conditions

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

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

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

[1] Check derating for high fluid temperature, see Process fluid temperature range, Process conditions and Allowed ambient temperature for sensor.

[2] Lower temperature specification valid for fixed installation only

Ambient temperature range for NTEP custody approval

Maximum ambient temperature range		
integral type:		-40 – 50 °C(-40 – 122 °F)
remote type		
with standard cable (option L_ _ _):	Sensor[1]:	-50 – 80 °C (-58 – 176 °F)
	Transmitter:	-40 – 50 °C (-40 – 122 °F)
with fire retardant cable[2] (option Y_ _ _):	Sensor[1, 2]:	-35 – 80 °C (-31 – 176 °F)
	Transmitter:	-35 – 50 °C (-31 – 122 °F)

[1] Check derating for high fluid temperature, see Process fluid temperature range, Process conditions and Allowed ambient temperature for sensor.

[2] 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)
Resistance to vibration acc.: IEC 60068-2-6 (not with option T_ _)	Transmitter: 10 – 500 Hz, 1g Sensor: 25– 100 Hz, 4g
Electromagnetic compatibility (EMC) ▪ IEC/EN 61326-1, Table 2 ▪ IEC/EN 61326-2-3 ▪ NAMUR NE 21 recommendation ▪ DNVGL-CG-0339, chapter 14 This includes ▪ Surge immunity acc.: – EN 61000-4-5 for lightning protection ▪ Emission acc.: – 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 ±1% of the output span.
Maximum altitude	2000 m (6600 ft) above mean sea level (MSL)
Overvoltage category acc. IEC/EN 61010-1	II

13.2 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

HART:	registered trademark of FieldComm Group, Inc., US
Modbus:	registered trademark of SCHNEIDER ELECTRIC USA, INC.
PROFIBUS:	registered trademark of PROFIBUS Nutzerorganisation e.V., Karlsruhe, DE
TRI-CLAMP:	registered trademark of ALFA LAVAL CORPORATE AB, SE
FOUNDATION Fieldbus:	registered trademark of FieldComm Group, Inc., US
ROTAMASS:	registered trademark of Rota Yokogawa GmbH & Co. KG, DE
FieldMate:	registered trademark of YOKOGAWA ELECTRIC CORPORATION
SD:	registered trademark of SD-3C LLC.
QR code:	registered trademark of DENSO WAVE INCORPORATED

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Manufacturer:

Rota Yokogawa GmbH & Co. KG
Rheinstr. 8
D-79664 Wehr
Germany

For the actual manufacturing location of your device refer to the model code and/or serial number.

QUALITY SYSTEM CERTIFICATION
DNV
ISO 14001
ISO 45001
ISO 9001
ISO/IEC 27001