# User's Manual

# ROTA**MASS** Total Insight Coriolis Mass Flow and Density Meter Quick Reference Instruction Manual



IM01U10A00-00EN-R



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Introduction Scope of application

#### 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

#### 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
- Dismantling and disposal

#### 1.3 Applicable documents

The following documents supplement this manual:

- Explosion Proof Type Manual (Ex-IM) IM01U10X\_\_-00\_\_-R
- Software Instruction Manual (SW-IM) IM01U10S....-00....-R
- General Specifications (GS) GS01U10B\_\_-00\_\_-R
- Dry Verification procedure MP 208-008-2019

#### 1.4 Contact information

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

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



#### 1.5 Explanation of safety instructions and symbols

#### Signal words

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

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

# Explanation of symbols

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

| Symbols on the nameplates | Meaning   |
|---------------------------|---|
| <u></u>                   | Warning that requires reading the documentation |
|                           | RCM marking                                     |
| C€                        | CE marking                                      |
| (Ex)                      | ATEX explosion protection marking               |
| EHC, EHC Ex               | EAC and EAC Ex marking                          |
| [C] [Cs                   | Korean (KC and KCs) marking                     |
| E FM IS APPROVED          | FM/CSA marking                                  |
| NEPSI NEPSI               | NEPSI marking                                   |
| INMETRO                   | INMETRO marking                                 |
| DNV-GL                    | DNV GL type approval marking                    |
| 28–05                     | 3-A Sanitary approval marking                   |
| 10                        | China RoHS marking                              |

| Symbols on the nameplates | Meaning                          |
|---------------------------|----------------------------------|
|                           | Taiwan Safety (TS) marking       |
| <b>©</b>                  | Russia Pattern approval marking  |
|                           | Belarus Pattern approval marking |

Intended use Safety

### 2 Safety

#### 2.1 Intended use

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

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

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

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

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

#### 2.2 Technical conditions

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

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

For this reason, the following must be observed:

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



#### 2.3 General safety instructions

# **⚠** DANGER

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

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

### **⚠** DANGER

# Use of 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.





#### Risk of injury from electrical shock at the transmitter

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

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

- Carefully read the User's Manual prior to operating the flow meter.
- Only qualified specialist personnel must be charged with the tasks described in this User's Manual.
- Ensure that personnel complies with locally applicable regulations and rules for working safely.
- ▶ Do not remove or cover safety markings and nameplates from flow meter.
- Replace soiled or damaged safety markings on the flow meter. For replacing please contact the Yokogawa Service Center.
- ▶ If Rotamass Total Insight is used to measure safety-related quantities, ensure that the transmitter does not display any error messages and, if applicable, the Total Health Check function is performed at regular intervals (see applicable General Specifications GS01U01B\_\_-00\_\_-R, chapter "Options").
- Avoid erosion and corrosion as they reduce accuracy and resistance to temperature and pressure. Over time, calibration constants change as a result of erosion and corrosion, therefore requiring recalibration. Rota Yokogawa does not assume any guaranty or liability with respect to corrosion resistance of wetted parts in any specific process. The user is responsible for selecting the appropriate materials. Rota Yokogawa provides support in clearing up the question of corrosion resistance of the materials used (special fluids but also cleaning agents). Minor changes in temperature, concentration or pollution degree in the process may result in differences in terms of corrosion resistance. In case of corrosion or erosion, the pipes must be checked periodically to ensure necessary wall thickness. This can be accomplished by using, for example, the Tube Health Check function (see applicable General Specifications GS01U01B\_\_-00\_\_-R, chapter "Options").
- When performing welding tasks on the pipe, it is important not to ground the welding equipment by way of the flow meter. Soldering and welding work on parts of the flow meter is prohibited.
- Continuous temperature fluctuations in excess of 100 °C may result in tube failure due to material fatigue and therefore must be avoided.
- ► The operator is responsible for ensuring that design limits (pressure, temperature) are not exceeded in the event unstable fluids decay.
- External influences may result in failure of threaded connections. The operator is responsible for providing suitable protective measures.
- ► Compression and shock waves in pipes can cause damage to the sensor. For this reason it is important to avoid exceeding the design limits (pressure, temperature).
- Fires may result in increased process pressure (caused by temperature-related volume changes) and failure of gaskets. The operator is responsible for taking suitable measures to prevent fire-related damage.
- Manufacturing methods and technologies have been successfully field-tested for decades. Erosion and/or corrosion are not taken into account.
- Removal of material from the flow meter with power tools such as drills or saws is not permitted.
- Any repair, modification, replacement or installation of replacement parts is permitted only if it's complying with this User's Manual. Other work must be first authorized by Rota Yokogawa. Rota Yokogawa does not assume liability for damage caused by unauthorized work on the flow meter or by improper use.

### 3 Warranty



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

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

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

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

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

The warranty does not apply in the following cases:

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



# 4 Product specification

#### 4.1 Scope of delivery

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

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

|  | Integral<br>type | Remote type                     |
|--|------------------|---------------------------------|
| Sensor   | 1 unit           | 1 unit                          |
| Transmitter  | i uiiit          | 1 unit                          |
| Connecting cable   | _                | Length acc.<br>to model<br>code |
| Operating tool for terminals   | 2 units          | 2 units                         |
| <ul> <li>2-inch pipe mounting bracket set</li> <li>Sheet metal console (bracket)</li> <li>Mounting bracket (U-bracket)</li> <li>Fixing materials (2 nuts, 2 washers, 4 Allen screws)</li> </ul>                                | -                | 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                           |
| 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.                                       | 2 units          | 2 units                         |
| <ul> <li>For a device with Ex approval the inclusion of cable glands<br/>may vary. Please refer to the applicable Explosion Proof<br/>Type Manual.</li> </ul>  |                  |                                 |
| 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:  Product CD/DVD (includes the complete product documentation)  Quick Reference Instruction Manual  Safety Regulations Manual  Further documents like certificates (depending on model code) | 1 folder         | 1 folder                        |

### 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).

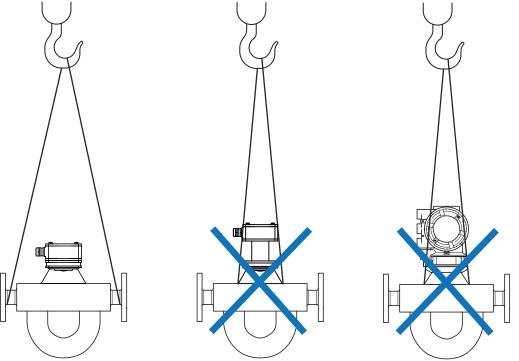


Fig. 1: Attachment of the transport ropes to the sensor independent of the design (impermissible attachment types are crossed out)

#### 5.2 Storage

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

#### NOTICE

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

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

#### NOTICE

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

- ▶ Store flow meter in a location that is secured against mechanical influences.
- Ensure compliance with the allowed storage temperature according to specification.
- 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 heating connections (if applicable), and thoroughly clean the flow meter, please see *General Instruction Manual IM01U10B\_\_-00\_\_-R*.



Installation Installation

#### 6 Installation

#### 6.1 Installation instructions

# **MARNING**

#### 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.

#### 6.1.1 Installation dimensions

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

#### 6.1.2 Installation site

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

# **⚠** CAUTION

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

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

#### NOTICE

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

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



Installation instructions Installation

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.

#### 6.1.3 Instructions

Observe the following general installation instructions during installation:

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

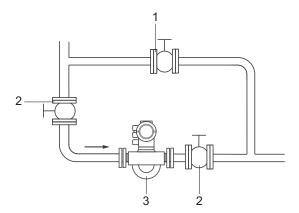


Fig. 2: Closing valves and bypass line

- 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.

Installation Installation

#### 6.1.4 Installation position

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

Sideways position

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

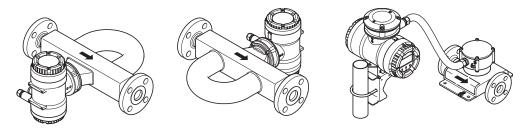


Fig. 3: Installation positions to be avoided: Flow meter in sideways position

# 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.

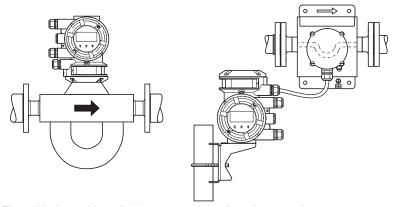


Fig. 4: Horizontal installation, measuring tubes downward

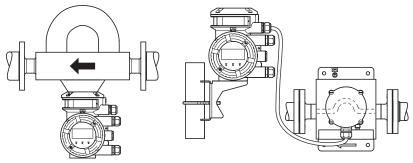


Fig. 5: Horizontal installation, measuring tubes upward

Installation instructions Installation

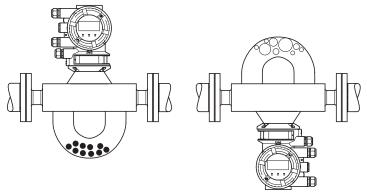


Fig. 6: Risk of solid matter and/or gas accumulation

# Vertical installation (recommended)

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

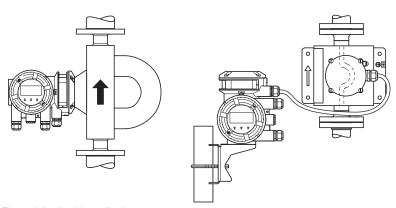


Fig. 7: Vertical Installation

#### 6.1.5 Sanitary installation

#### **EHEDG** compliant installation

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

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

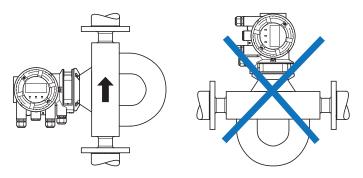


Fig. 8: EHEDG compliant installation position

Installation Installation

#### 3-A compliant installation

Remote transmitter installation

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

#### **NOTICE**

#### Fixation of the transmitter

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

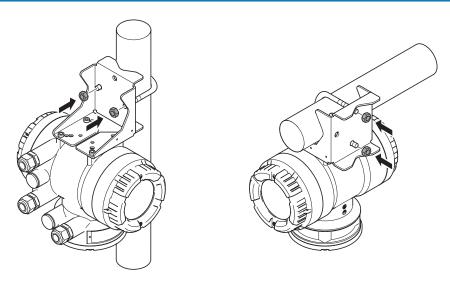


Fig. 9: Hanging installation for remote transmitter

Sensor installation (remote or integral version)

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

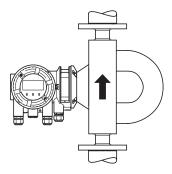


Fig. 10: Vertical (self-draining) installation

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

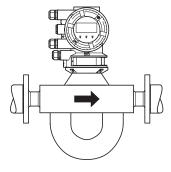


Fig. 11: Horizontal installation with tubes down

Unpacking Installation

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

# Notes on fittings and gasket

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

#### 6.2 Unpacking

Note the following rules prior to installation:

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

#### 6.3 Sensor installation

#### 6.3.1 General installation rules



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

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

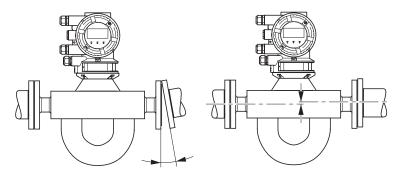


Fig. 12: Avoid: Slope and mismatch

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

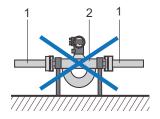


Fig. 13: Installation to be avoided: Fixing the sensor

Installation Sensor installation

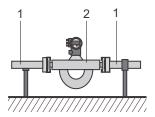


Fig. 14: Recommended installation: use the piping to support the sensor

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

#### Avoiding creation of noise

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

Countermeasures to help avoid noise creation:

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

Sensor installation Installation

#### 6.3.2 Installation in pipe

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

## **⚠** DANGER

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

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

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

#### Clamp connection

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

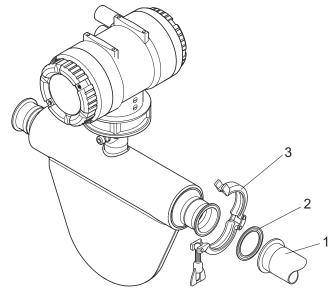


Fig. 15: Clamp connection

- 1 Terminal
- 2 Gasket
- 3 Terminal connector

#### Fixing the flange

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

Installation Sensor installation

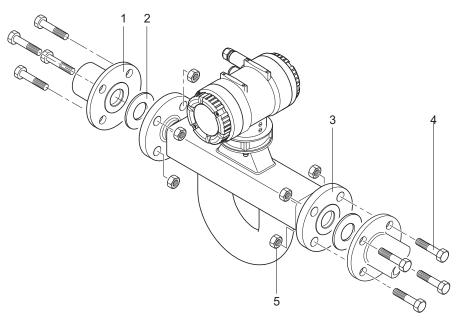


Fig. 16: Fixing the flange

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

# Internal thread connection

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

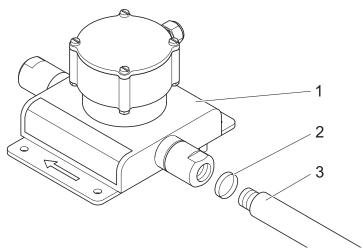


Fig. 17: Internal thread connection

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

Sensor installation Installation

#### **NOTICE**

#### Use of seal tape for installation

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

#### 6.3.3 Installation Rotamass Nano (Option PD)

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

#### NOTICE

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

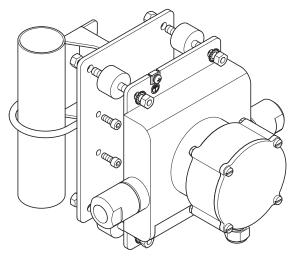


Fig. 18: 2" fixing device option /PD for Nano

#### 6.3.4 Installation recommendation for viscosity function

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

#### NOTICE

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

Installation Sensor installation

#### **HART**

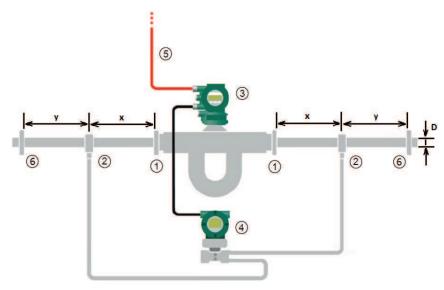


Fig. 19: Positioning of pressure taps / HART communication line

Mounting flanges

 Differential pressure transmitter with HART

② Pressure taps

- ⑤ HART communication
- ③ Rotamass Total Insight with HART
- 6 Other flow elements

#### **PROFIBUS PA**

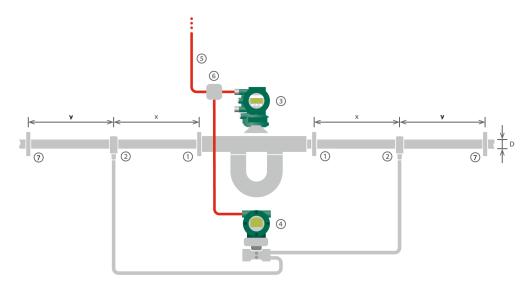


Fig. 20: Positioning of pressure taps / PROFIBUS PA communication line

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

#### x, y = minimum 4 to 5 <math>x D

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

Insulation and heat tracing Installation

#### 6.4 Insulation and heat tracing

#### 6.4.1 Heat tracing

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

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

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



#### Risk of overheating the transmitter due to increased ambient temperature

Failure of measuring electronics

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

#### 6.4.2 Customer-supplied insulation

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

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

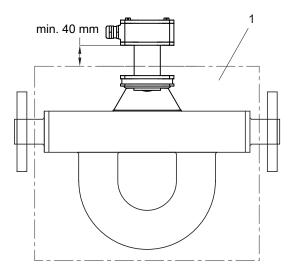


Fig. 21: Customer-supplied insulation

#### 1 Insulation box



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

Installation Transmitter installation

#### 6.5 Transmitter installation

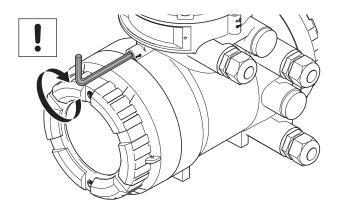
#### 6.5.1 Rotating and replacing the display

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

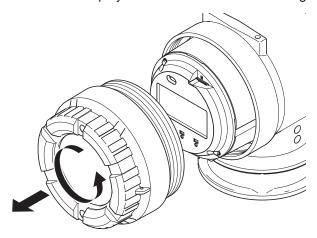
#### **NOTICE**

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

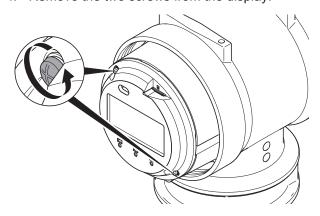
- at temperatures up to 31 °C: relative humidity maximum 80 %
- ► at temperatures between 31 °C and 40 °C: from 80 % linearly decreasing to 50 % of maximum relative humidity
- 1. Switch off power supply.
- 2. Using an Allen wrench (size: 3.0), turn the locking screw on display screw plug clockwise to remove.



3. Unscrew display cover from transmitter housing.

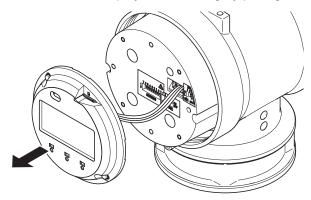


4. Remove the two screws from the display.

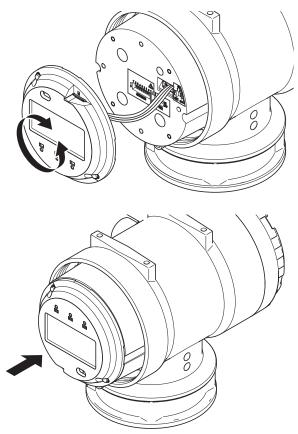


Installation

5. Remove the display from housing by pulling forward.



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

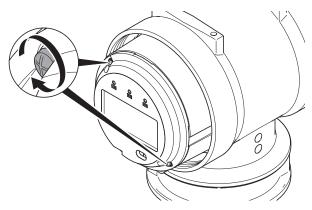


**NOTICE** 

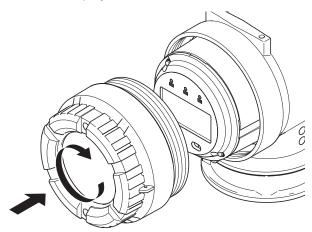
The display can be removed and replaced by loosening the connector.

Installation Transmitter installation

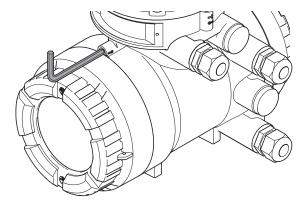
7. Tighten screws.



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.



Transmitter installation Installation

#### 6.5.2 Rotating transmitter housing (integral type)

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

### **M** 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

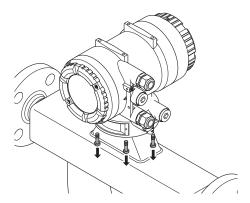
Use a minimum torque of 4.3 Nm when tightening the screws.

#### NOTICE

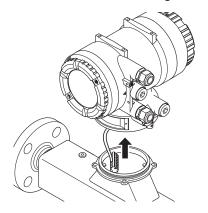
#### Damage to flow meter

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.

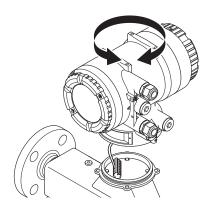


2. Lift transmitter housing.

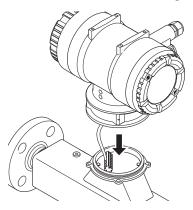


Installation Transmitter installation

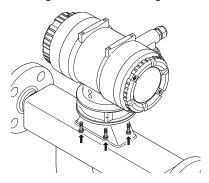
3. Rotate transmitter housing at angles of  $90^{\circ}$ ,  $180^{\circ}$  or  $270^{\circ}$ .



4. Place transmitter housing.



5. Tighten the four fixing screws.

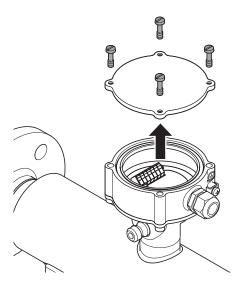


Transmitter installation Installation

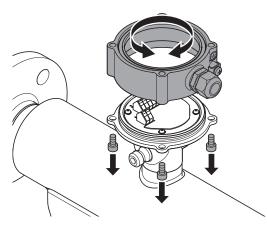
#### 6.5.3 Rotating the terminal box (remote type)

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

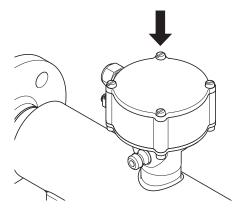
1. Loosen the four fixing screws and remove the cover.



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



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



Installation Transmitter installation

#### 6.5.4 Installing transmitter on pipe (remote type)

# **M** 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.

# **MARNING**

#### 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.

# **A** CAUTION

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

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

#### NOTICE

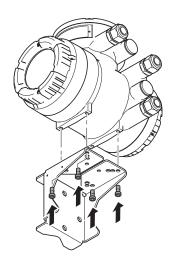
#### Installation at high vibration levels

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

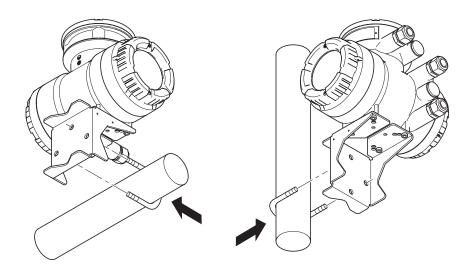
If it is a remote type transmitter, it can be mounted to a pipe size DN50 (2") using the angle bracket and retaining clip included in the delivery.

Transmitter installation Installation

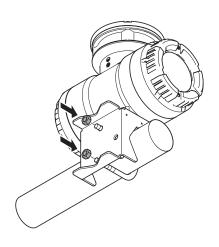
1. Screw angle bracket to bottom of transmitter.

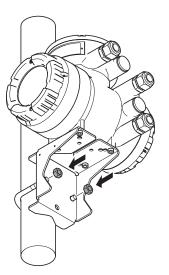


2. Place retaining clip around pipe and slide through drill holes on angle bracket.



3. Fasten retaining clip to bracket using the nuts.





Installation Installation

#### 6.6 Installation check list

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

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

General wiring rules Wiring

### 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.

# **A** DANGER

#### Life-threatening injuries from electric shock

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

# **⚠** DANGER

#### Life-threatening injuries from ignition of explosive atmospheres

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

# 

# 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 [▶ 39].

Wiring General wiring rules

### **M** WARNING

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

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

# **⚠** CAUTION

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

#### NOTICE

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

#### NOTICE

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

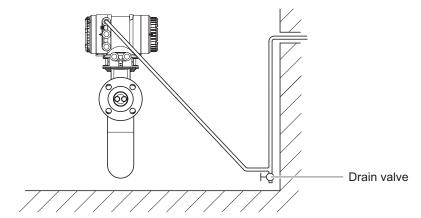
#### NOTICE

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

#### NOTICE

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

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



- Unused cable entries must be closed using blind plugs.
- ► Install cables hanging down to prevent water from flowing along the cable into the flow meter.
- ► The electrical connection between potential equalization system and grounding connection must be safe, see *Grounding connections* [ 37].
- ► Ensure that housing gaskets are positioned in the lining grooves and not damaged.



Grounding connections Wiring

# 7.2 Grounding connections



# 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".

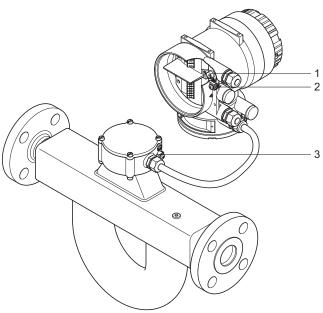


Fig. 22: Grounding connections on transmitter and sensor

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

# 7.3 Connecting cable installation

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

# **A** CAUTION

## Risk of damage to the flow meter due to incorrect sealing

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

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

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

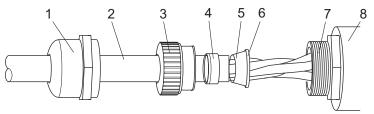


Fig. 23: Cable gland parts mounting

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

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

#### 7.3.1 Connection terminals

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

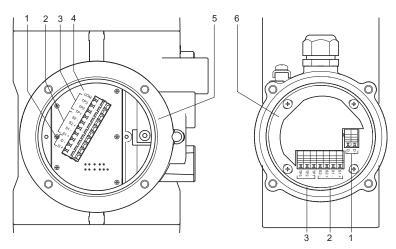


Fig. 24: Connection terminal circuits (transmitter on the left side, sensor on the right side)

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

Installation of standard connecting cable option L\_\_\_

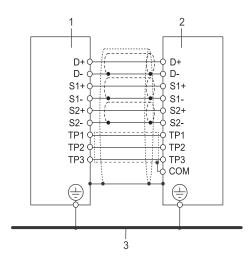


Fig. 25: Transmitter and sensor interconnection diagram

- 1 Sensor
- 2 Transmitter
- 3 Potential equalization system

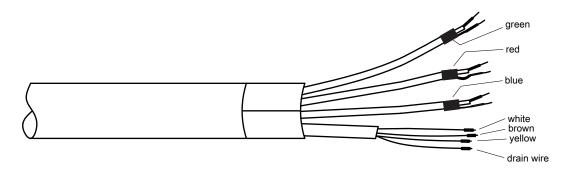


Fig. 26: Terminated standard connecting cable L\_\_\_, transmitter side

Connection scheme of standard connecting cable option  $L_{\_\_}$ 

Tab. 2: Version coaxial wire

| Standard connecting cable option L |                          |           |             |  |  |  |
|------------------------------------|--------------------------|-----------|-------------|--|--|--|
| Signal                             | Coaxial wire             |           |             |  |  |  |
|                                    | Coaxial wire pair colour | Wire type | Wire colour |  |  |  |
| D+                                 | groop                    | Core wire | transparent |  |  |  |
| D-                                 | green                    | Shield    | black       |  |  |  |
| S1+                                | rod                      | Core wire | transparent |  |  |  |
| S1-                                | red                      | Shield    | black       |  |  |  |
| S2+                                | blue                     | Core wire | transparent |  |  |  |
| S2-                                | blue                     | Shield    | black       |  |  |  |

Tab. 3: Version single wire

| Standard connecting cable option L |                          |             |  |  |
|------------------------------------|--------------------------|-------------|--|--|
| Signal                             |                          | Single wire |  |  |
|                                    | Wire type                | Wire colour |  |  |
| TP1                                |                          | white       |  |  |
| TP2                                | Conductor                | brown       |  |  |
| TP3                                |                          | yellow      |  |  |
| COM <sup>1)</sup>                  | Drain wire <sup>1)</sup> | _           |  |  |

<sup>1)</sup> Present only at transmitter side

Installation of fire retardant connecting cable option Y\_\_\_

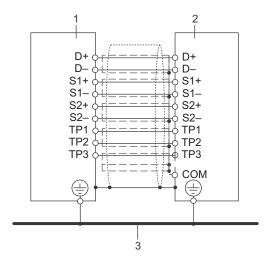
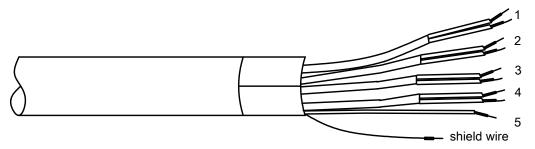


Fig. 27: Transmitter and sensor interconnection diagram

- 1 Sensor
- 2 Transmitter
- 3 Potential equalization system



 $\textit{Fig. 28:} \ \text{Terminated fire retardant connecting cable Y} \ \_\_\_, \ \text{transmitter side}$ 

Connection scheme of fire retardant connecting cable option Y\_\_\_

Tab. 4: Version Y\_\_\_

| Ycable            |                                     |                  |  |  |  |
|-------------------|-------------------------------------|------------------|--|--|--|
| Signal            | Conductor pair number <sup>1)</sup> | Conductor colour |  |  |  |
| D+                | 1                                   | white            |  |  |  |
| D-                | I                                   | blue             |  |  |  |
| S1+               | 2                                   | white            |  |  |  |
| S1-               | 2                                   | blue             |  |  |  |
| S2+               | 3                                   | white            |  |  |  |
| S2-               | 3                                   | blue             |  |  |  |
| TP1               | 4                                   | white            |  |  |  |
| TP2               | 4                                   | blue             |  |  |  |
| TP3               | 5                                   | white            |  |  |  |
| COM <sup>2)</sup> | Shield wire <sup>2)</sup>           | _                |  |  |  |

<sup>1)</sup> Conductor pair number refers to the numbers printed on the single conductors

<sup>&</sup>lt;sup>2)</sup> Present only at transmitter side

#### 7.4 Transmitter

### 7.4.1 Connection terminals

# **MARNING**

# 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.

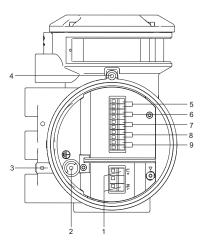


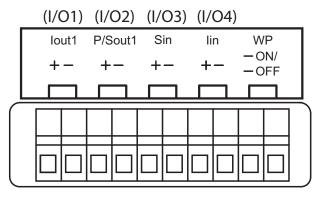
Fig. 29: Terminal for I/O outputs and power supply in transmitter

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

#### 7.4.2 HART and Modbus connection terminals

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

**HART** 



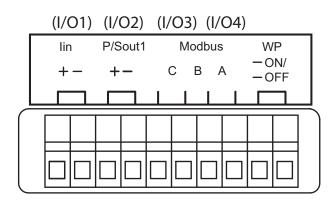
I/O1: lout1 Current output (active/passive)I/O2: P/Sout1 Pulse or status output (passive)

I/O3: Sin Status input

I/O4: lin Current input (active/passive)

WP: Write-protect bridge

#### Modbus



I/O1: Iin Current input (passive)

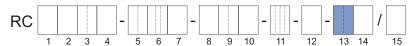
I/O2: P/Sout1 Pulse or status output (passive)

I/O3-I/O4: Modbus RS485 input/output WP: Write-protect bridge

## 7.4.3 Assignment of HART and Modbus

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

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



## Configuration of input/output terminals for HART communication

### HART I/O

Tab. 5: Connection terminal assignment for HART

| Model code  |          | Connecti | Connection terminal assignment |                |                |  |  |
|-------------|----------|----------|--------------------------------|----------------|----------------|--|--|
| Position 13 | I/O1 +/- | I/O2 +/- | I/O3 +/-                       | I/O4 +/-       | WP             |  |  |
| JA          | lout1    | P/Sout1  |                                |                | Write-protect  |  |  |
| JA          | Active   | Passive  |                                |                | vvrite-protect |  |  |
| JB          | lout1    | P/Sout1  | P/Sout2                        | lout2          | Write-protect  |  |  |
| JD          | Active   | Passive  | Passive                        | Active         | vviite-protect |  |  |
| JC          | lout1    | P/Sout1  | Sin                            | lout2          | Write-protect  |  |  |
| 30          | Active   | Passive  | Siii                           | Active         | vviite-protect |  |  |
| JD          | lout1    | P/Sout1  | Sout                           | P/Sout2        | Write-protect  |  |  |
| 30          | Active   | Passive  | Passive                        | Passive        | vviite-protect |  |  |
| JE          | lout1    | P/Sout1  | Sin                            | P/Sout2        | Write-protect  |  |  |
| JE          | Active   | Passive  | SIII                           | Passive        | vviite-protect |  |  |
|             |          |          |                                | P/Sout2        |                |  |  |
| JF          | lout1    | P/Sout1  | Sin                            | Active         | Write-protect  |  |  |
| 01          | Active   | Passive  | Oll 1                          | Internal pull- | Wille proteot  |  |  |
|             |          |          |                                | up resistor    |                |  |  |
| JG          | lout1    | P/Sout1  | Sin                            | P/Sout2        | Write-protect  |  |  |
|             | Active   | Passive  |                                | Active         | p. co.         |  |  |
| JH          | lout1    | P/Sout1  | lout2                          | lin            | Write-protect  |  |  |
| <b></b>     | Active   | Passive  | Passive                        | Active         | Time protect   |  |  |
| JJ          | lout1    | P/Sout1  | P/Sout2                        | lin            | Write-protect  |  |  |
|             | Active   | Passive  | Passive                        | Active         | Willo protoot  |  |  |
| JK          | lout1    | P/Sout1  | Sin                            | lin            | Write-protect  |  |  |
| OIX.        | Active   | Passive  | OIII                           | Active         | Wille-protect  |  |  |
| JL          | lout1    | P/Sout1  | lout2                          | lin            | Write-protect  |  |  |
| OL.         | Active   | Passive  | Passive                        | Passive        | Wille-protect  |  |  |
| JM          | lout1    | P/Sout1  | P/Sout2                        | lin            | Write-protect  |  |  |
| JIVI        | Active   | Passive  | Passive                        | Passive        | vviite-protect |  |  |
| JN          | lout1    | P/Sout1  | Sin                            | lin            | Write-protect  |  |  |
| JIN         | Active   | Passive  | Siii                           | Passive        | vviite-protect |  |  |
| JP          | lout1    | P/Sout1  | lout2                          | _              | Write_protect  |  |  |
| JΓ          | Passive  | Passive  | Passive                        | _              | Write-protect  |  |  |
| JQ          | lout1    | P/Sout1  | lout2                          | P/Sout2        | Write protect  |  |  |
| JŲ          | Passive  | Passive  | Passive                        | Passive        | Write-protect  |  |  |

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

lout1 Analog current output with HART communication

lout2Analog current outputlinAnalog current inputP/Sout1Pulse or status outputP/Sout2Pulse or status output

Sin Status input Sout Status output

# Configuration of input/output terminals for Modbus communication

#### Modbus I/O

Tab. 6: Connection terminal assignment for Modbus

| Model code  | Connection terminal assignment                       |                    |        |             |             |             |                   |
|-------------|--|--------------------|--------|-------------|-------------|-------------|-------------------|
| position 13 | I/O1 +/-   | I/O2 +/-           | I/O3 + | I/O3 -      | I/O4 +      | I/O4 -      | WP                |
| MO          | _  | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M2          | lin<br>Active  | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M3          | P/Sout2<br>Passive                                   | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M4          | P/Sout2<br>Active                                    | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M5          | P/Sout2<br>Active<br>Internal<br>pull-up<br>resistor | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M6          | Iout1<br>Active                                      | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |
| M7          | lin<br>Passive                                       | P/Sout1<br>Passive | _      | Modbus<br>C | Modbus<br>B | Modbus<br>A | Write-<br>protect |

lout Analog current output, no HART

Iin Analog current inputP/Sout1 Pulse or status outputP/Sout2 Pulse or status output

#### 7.4.4 HART and Modbus communication

#### **HART** communication

#### **HART** interface

For devices with HART communication, the HART interface, along with the analog signal, is available at the output *lout1*. A load resistance of 230 – 600  $\Omega$  at *lout1* is recommended.

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

### **Modbus communication**

# Modbus interface

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

# Modbus connections

Tab. 7: Connection terminal assignment for Modbus

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

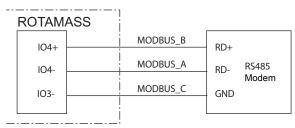


Fig. 30: MODBUS communication

#### Modbus cable

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

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

# Default Modbus setting

Modbus baud rate: 19200 bpsModbus transfer mode: RTU

Modbus parity: EvenModbus stop bit: 1 stop bit

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

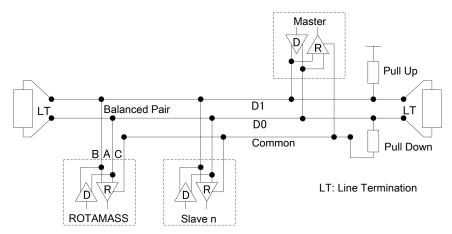


Fig. 31: Modbus connection

## **Output signals**

**Galvanic** isolation

Active current output lout

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

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

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

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

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

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

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

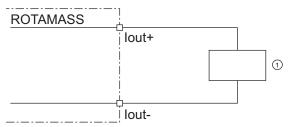


Fig. 32: Active current output connection lout HART

Receiver

Passive current output *lout* 

|   | Value                     |
|---|---------------------------|
| Nominal output current                        | 4 – 20 mA                 |
| Maximum output current range                  | 2.4 – 21.6 mA             |
| External power supply                         | 10.5 – 32 V <sub>DC</sub> |
| Load resistance for secure HART communication | 230 – 600 Ω               |
| Load resistance at current output             | ≤ 911 Ω                   |

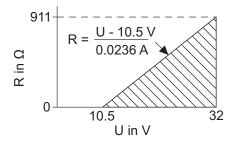


Fig. 33: Maximum load resistance as a function of an external power supply voltage

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.

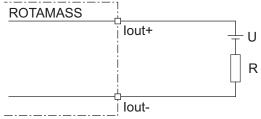


Fig. 34: Passive current output connection lout

# Active pulse output P/Sout

## Connection of an electronic counter

Maximum voltage and correct polarity must be observed for wiring.

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

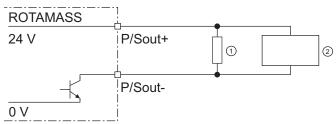


Fig. 35: Active pulse output connection P/Sout

- Load resistance
- ② Electronic counter

#### Connection of an electromechanical counter

|                       | Value                    |
|-----------------------|--------------------------|
| Maximum current       | 150 mA                   |
| Average current       | ≤ 30 mA                  |
| Internal power supply | 24 V <sub>DC</sub> ±20 % |
| Maximum pulse rate    | 2 pulses/s               |
| Pulse width           | 20, 33, 50, 100 ms       |

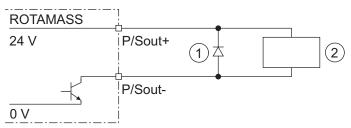


Fig. 36: Active pulse output P/Sout connection with electromechanical counter

- ① Protective diode
- ② Electromechanical counter

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

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

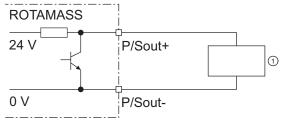


Fig. 37: Active pulse output P/Sout with internal pull-up resistor

Electronic counter

# Passive pulse output

|                      | Value                |
|----------------------|----------------------|
| Maximum load current | ≤ 200 mA             |
| Power supply         | ≤ 30 V <sub>DC</sub> |
| Maximum pulse rate   | 10000 pulses/s       |
| Frequency range      | 0 – 12.5 kHz         |

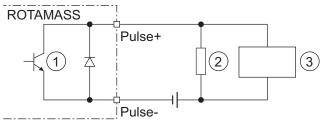


Fig. 38: Passive pulse output connection with electronic counter

- Passive pulse
- ② Load resistance
- 3 Electronic counter

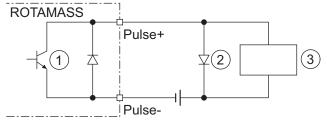


Fig. 39: Passive pulse output connection with electromechanical counter

- Passive pulse
- ② Protective diode
- ③ Electromechanical counter

Active status output P/Sout

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

|                       | Value                    |
|-----------------------|--------------------------|
| Load resistance       | > 1 kΩ                   |
| Internal power supply | 24 V <sub>DC</sub> ±20 % |

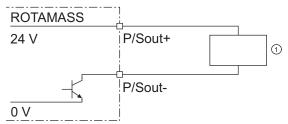


Fig. 40: Active status output connection P/Sout

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 <sub>DC</sub> ±20 % |

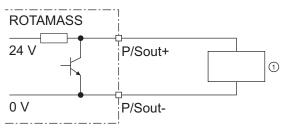


Fig. 41: Active status output P/Sout with internal pull-up resistor

External device

Passive status output P/Sout or Sout

|                | Value                |
|----------------|----------------------|
| Output current | ≤ 200 mA             |
| Power supply   | ≤ 30 V <sub>DC</sub> |

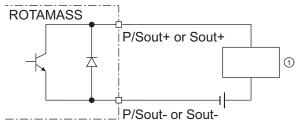


Fig. 42: Passive status output connection P/Sout or Sout

#### External device

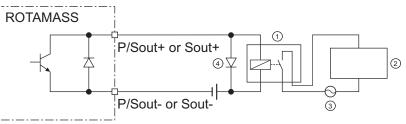


Fig. 43: Passive status output connection P/Sout or Sout for solenoid valve circuit

- 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):

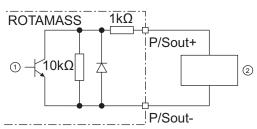


Fig. 44: Passive pulse or status output with switching amplifier connected in series

- Passive pulse or status output
- ② Switching amplifier

# Input signals

# Active current input *lin*

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

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

|                                   | Value                    |
|-----------------------------------|--------------------------|
| Nominal input current             | 4 – 20 mA                |
| Maximum input current range       | 2.4 – 21.6 mA            |
| Internal power supply             | 24 V <sub>DC</sub> ±20 % |
| Internal load resistance Rotamass | ≤ 160 Ω                  |

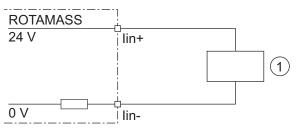


Fig. 45: Connection of external device with passive current output

① External passive current output device

# Passive current input *lin*

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

|                                   | Value                |
|-----------------------------------|----------------------|
| Nominal input current             | 4 – 20 mA            |
| Maximum input current range       | 2.4 – 21.6 mA        |
| Maximum input voltage             | ≤ 32 V <sub>DC</sub> |
| Internal load resistance Rotamass | ≤ 160 Ω              |

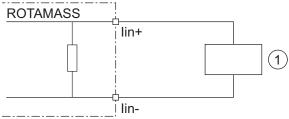


Fig. 46: Connection of external device with active current output

① External active current output device

#### Status input Sin



Do not connect a signal source with electric voltage.

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

| Switching status | Resistance |
|------------------|------------|
| Closed           | < 200 Ω    |
| Open             | > 100 kΩ   |

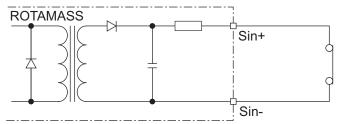
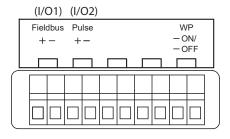


Fig. 47: Status input connection

#### 7.4.5 PROFIBUS PA connection terminals

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

#### **PROFIBUS PA**

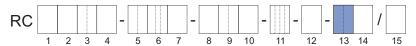


I/O1: Fieldbus PROFIBUS PA communicationI/O2: Pulse Pulse / Frequency outputWP: Write-protect bridge

## 7.4.6 Assignment of PROFIBUS PA

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

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



Tab. 8: Connection terminal assignment for PROFIBUS PA

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

PROFIBUS PA: PA communication
Pulse Passive: Pulse / Frequency output

Intrinsically safe (IS) outputs are only available in combination with selecting Ex approval of the device, see *General Specifications (GS) GS01U10B\_\_-00\_\_-R, chapter Ex approval.* 

#### 7.4.7 PROFIBUS PA communication

# PROFIBUS PA interface

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

### **Output signals PROFIBUS PA**

Digital communication signal based on PROFIBUS PA protocol.

# PROFIBUS PA output signals

Maximum voltage and correct polarity must be observed for wiring.

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

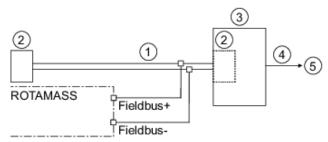


Fig. 48: PROFIBUS PA connection

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



# PROFIBUS PA cable

Tab. 9: PROFIBUS PA cable and transmissible length

| Type of cable                                    | Cable specifications | Max. length of cable (reference value) |
|--|----------------------|--|
| Type A: Individually-shielded twisted pair cable | #18AWG<br>(0.82 mm²) | 1.900 m                                |

Default PROFIBUS PA setting

Passive pulse output (only for calibration)

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

|                      | Value                |
|----------------------|----------------------|
| Maximum load current | ≤ 200 mA             |
| Power supply         | ≤ 30 V <sub>DC</sub> |
| Maximum pulse rate   | 10000 pulses/s       |
| Frequency range      | 0 – 12.5 kHz         |

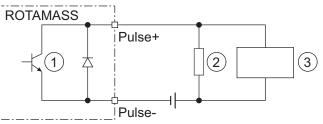


Fig. 49: Passive pulse output connection with electronic counter

- Passive pulse
- 2 Load resistance
- ③ Electronic counter

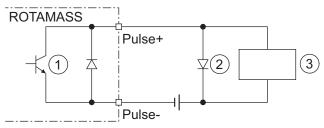


Fig. 50: Passive pulse output connection with electromechanical counter

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

## 7.4.8 Power supply

#### Power supply

Alternating-current voltage (rms):

• Power supply<sup>1)</sup>: 24  $V_{AC}$  +20 % -15 % or 100 – 240  $V_{AC}$  +10 % -20 %

■ Power frequency: 47 – 63 Hz

Direct-current voltage:

• Power supply<sup>1)</sup>: 24  $V_{DC}$  +20 % -15 % or 100 – 120  $V_{DC}$  +8,3 % -10 %

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

#### **Power consumption**

P ≤ 10 W (including sensor)

#### Power supply failure

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

### 7.4.9 Connecting power supply and external devices

# **⚠** WARNING

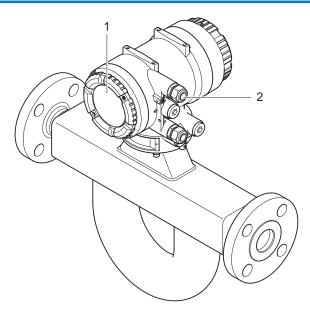
## Risk of sparking and damage to the flow meter due to incorrect sealing

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

#### NOTICE

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

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

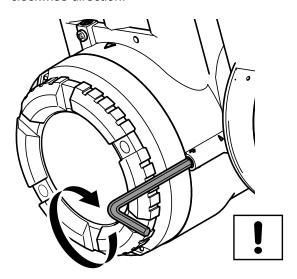


- 1 Transmitter back cover
- 2 Power supply cable gland

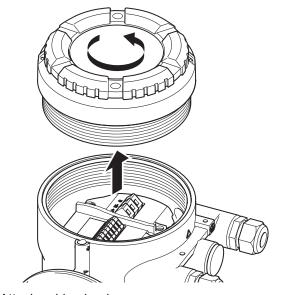


## Risk of injury due to electrical shock

- ► 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.

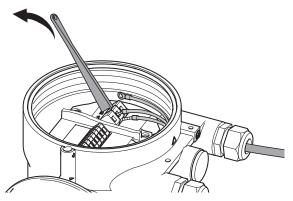


4. Attach cable glands.

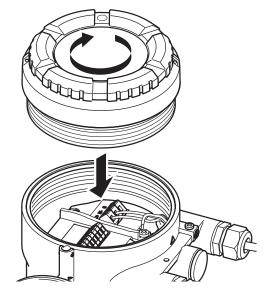
5. Connect wires to connection terminals.

### **NOTICE**

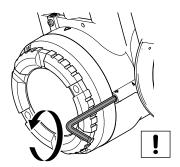
Connect the grounding conductor to the grounding screw (see chapter *Connection terminals* [> 42], figure 29, point 2).



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



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



Wiring check list

# 7.5 Wiring check list

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

# **MARNING**

## 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.

# **MARNING**

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

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

#### **NOTICE**

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

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

#### NOTICE

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

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

# 8 Commissioning

- 1. Activate external power switch.
- 2. Perform check of piping installation.
- 3. Check flow meter for device errors, warnings or alarms, see chapter on *Troubleshooting* [> 63].
- 4. Configure the transmitter, and perform autozero, see chapter on *System configuration and operation* [▶ 62].
- ⇒ Flow meter is ready for operation.



# 9 System configuration and operation

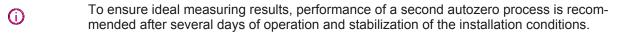
# 9.1 Default settings

#### 9.1.1 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.

# 9.1.2 Performing autozero



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



Malfunction of operation Troubleshooting

# 10 Troubleshooting

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

## 10.1 Malfunction of operation

Tab. 10: Different kinds of malfunction of operation: causes ans remedies

| Malfunction  | Possible causes  | Remedy  |
|--|--|---|
| Display on trans-<br>mitter not function-<br>ing                 | Power supply disconnected  | <ul> <li>Ensure that the unit is connected to the<br/>power supply, see Connecting power<br/>supply and external devices</li> </ul> |
|  | Settings cannot be made via IR switches                          | <ul> <li>Check cable connections between dis-<br/>play and main board and connect prop-<br/>erly, if necessary.</li> </ul>          |
| Settings cannot be made via IR switches                          | Incorrect settings in write-protect menu item                    | <ul> <li>Switch off write-protect menu item via<br/>digital communication or hardware<br/>switch.</li> </ul>                        |
| Field communica-<br>tor is not detected                          | HART DD not installed on field communicator                      | <ul> <li>Install HART DD file on field communicator.</li> </ul>   |
|  | Field communicator not connected                                 | <ul> <li>Connect field communicator with<br/>Rotamass Total Insight, see software<br/>instruction manual.</li> </ul>                |
| PROFIBUS PA<br>Host does not<br>detect Rotamass<br>Total Insight | PROFIBUS PA EDD not installed on the Host                        | <ul> <li>Install PROFIBUS PA EDD<sup>1)</sup> on the<br/>Host</li> </ul>  |
|  | PROFIBUS PA GSD file is not installed on the Host                | <ul> <li>Install PROFIBUS PA GSD<sup>2)</sup> file on the<br/>Host</li> </ul>   |
|  | PROFIBUS DP/PA coupler is not connected to the Host              | <ul> <li>Connect PROFIBUS DP/PA<br/>coupler with Host</li> </ul>  |
|  | PROFIBUS PA modem is not connected to the DP/PA coupler          | <ul> <li>Connect PROFIBUS PA modem with<br/>DP/PA coupler</li> </ul>  |
|  | Rotamass Total Insight is not connected to the PROFIBUS PA modem | <ul> <li>Connect PROFIBUS PA modem with<br/>Rotamass Total Insight</li> </ul>   |

<sup>&</sup>lt;sup>1)</sup> 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).

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

<sup>&</sup>lt;sup>2)</sup> 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.

Troubleshooting Zero point unstable

# 10.2 Zero point unstable

| Malfunction         | Possible causes  | Remedy   |
|---------------------|--|--|
| Zero point unstable | Measuring tube not completely filled with fluid                                    | <ul> <li>Check that the measuring tube in the sensor<br/>is completely filled with fluid.</li> </ul>   |
|                     | Bubbles or solids in the fluid   | <ul> <li>Check pipe and sensor installation, see Sensor installation.</li> </ul>   |
|                     |  | <ul> <li>Correct installation, see Installation.</li> </ul>  |
|                     | No electrical grounding  | <ul> <li>Ground transmitter and sensor, see ground<br/>connections and sensor circuits [&gt; 37], and<br/>connect power supply and external devices<br/>Connecting power supply and external devices.</li> </ul> |
|                     |  | <ul> <li>Check correct connection of connecting cable shield on transmitter.</li> </ul>  |
|                     | Flow meter installed in proximity to facilities with strong electro-magnetic field | <ul> <li>Ground transmitter and sensor, see ground<br/>connections and sensor circuits [&gt; 37], and<br/>connect power supply and external devices<br/>Connecting power supply and external devices.</li> </ul> |
|                     |  | <ul> <li>Install flow meter as far away as possible<br/>from these electric devices.</li> </ul>  |
|                     | Mechanical strain from traction or pressure  | Eliminate cause for mechanical tension.  |
|                     | Terminal board or connection terminals of transmitter or sensor soiled or damp     | <ul> <li>Clean terminal board and connection terminals.</li> </ul>   |
|                     |  | <ul> <li>Clean transmitter and/or sensor.</li> </ul>   |
|                     |  | <ul> <li>Dry transmitter and/or sensor.</li> </ul>   |
|                     |  | <ul> <li>Seal transmitter and/or sensor tightly.</li> </ul>  |
|                     | Influence of external vibration  | <ul> <li>Install mechanical dampers</li> </ul>   |
|                     |  | <ul> <li>Increase parameter mass flow damping (see applicable software instruction manual)</li> </ul>  |

Display deviating Troubleshooting

# 10.3 Display deviating

| Malfunction  | Possible causes  | Remedy   |
|--|--|--|
| Flow rate displayed deviates from actual flow rate | Zero point set incorrectly   | <ul> <li>Set zero point.</li> </ul>  |
|  | Highest and lowest value for mass flow set incorrectly                       | <ul> <li>Match settings of flow meter and reading system.</li> <li>Check LRV and URV process parameters, see software instruction manual.</li> </ul>   |
|  | Measuring tubes not completely filled with fluid                             | - Correct installation, see [▶ 19]   |
|  | Bubbles in fluid   | <ul> <li>Check pipe and installation, see [▶ 19].</li> <li>Correct installation, see [▶ 19]</li> </ul>   |
|  | Connecting cable incorrectly connected for remote type                       | <ul> <li>Check cable connections and correct, if necessary, see [&gt; 39].</li> </ul>  |
|  | Density unit, highest and low-<br>est value for density set incor-<br>rectly | <ul> <li>Match settings of flow meter and reading system.</li> </ul>   |
|  |  | <ul> <li>Check LRV and URV process parameters,<br/>see software instruction manual.</li> </ul>   |
|  | Fixed density  | <ul> <li>Check whether the Val sel parameter is set<br/>correctly. If a fixed value is selected, ensure<br/>that the parameter Fix val is set correctly, see<br/>software instruction manual.</li> </ul> |
|  |  | <ul> <li>Set parameter Val sel to Meas val, see soft-<br/>ware instruction manual.</li> </ul>  |
|  | Analog output trim was per-<br>formed incorrectly                            | <ul> <li>Correctly perform trimming, see applicable software instruction manual.</li> </ul>  |
| Density displayed devi-                            | No electrical grounding  | <ul> <li>Ground transmitter and sensor, see [▶ 37].</li> </ul>   |
| ating from actual density                          |  | <ul> <li>Check correct connection of connecting cable shield on transmitter.</li> </ul>  |
|  | Bubbles in fluid   | <ul> <li>Check pipe and installation, see [▶ 19].</li> </ul>   |
|  | Connecting cable incorrectly connected for remote type                       | <ul> <li>Check cable connections and correct, if<br/>necessary, see [&gt; 39].</li> </ul>  |
|  | Faulty temperature measurement   | <ul> <li>Check temperature measurement circuits</li> <li>TP1 – TP3 of connecting cable.</li> </ul>   |
|  | Corrosion and erosion  | <ul> <li>If corrosion or erosion due to corrosive fluids<br/>is suspected, contact Yokogawa and have<br/>density and mass flow recalibrated, if neces-<br/>sary.</li> </ul>                              |
|  | Contaminated measuring tubes   | Clean measuring tubes.   |



Troubleshooting Display deviating

| Malfunction   | Possible causes  | Remedy  |
|---|--|---|
|   | Temperature unit, highest and lowest value for temperature set incorrectly | <ul> <li>Match settings of flow meter and reading system.</li> </ul>  |
|   |  | <ul> <li>Check LRV and URV process parameters,<br/>see applicable software instruction manual.</li> </ul>   |
|   | Non-adjustable temperature   | <ul> <li>Check whether the Func sel parameter is set<br/>correctly. If a fixed value is selected, ensure<br/>that the Fix val is set correctly, see software<br/>instruction manual.</li> </ul> |
|   |  | <ul> <li>Set parameter Func sel to Inter val.</li> </ul>  |
| Temperature displayed deviating from actual temperature | Analog output trim was per-<br>formed incorrectly                          | <ul> <li>Correctly perform trimming, see applicable software instruction manual.</li> </ul>   |
|   | Connecting cable incorrectly connected for remote type                     | <ul> <li>Check cable connections and correct, if necessary, see [&gt; 39].</li> </ul>   |
|   | Incorrect temperature measurement with remote type                         | <ul> <li>Check temperature measurement circuit by<br/>measuring resistance between TP1/TP2 and<br/>TP1/TP3. Each value must be between 50 –<br/>200 Ω.</li> </ul>                               |
|   |  | - Check temperature measurement circuit TP2/ TP3 and make sure that resistance is < 10 $\Omega$ .   |
|   |  |   |
| Output signal deviating from measured quantity          | Incorrect parameter  | <ul> <li>Check parameter LRV and URV of the corresponding output signal, and correct, if necessary.</li> </ul>  |
|   | Incorrect measured quantity  | <ul> <li>Check measured quantity output and, if necessary, correct; check parameter Sel, see applicable software instruction manual.</li> </ul>   |



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