General Specifications

ROTA*MASS* Total Insight
Coriolis Mass Flow and Density Meter
Giga

GS 01U10B03-00EN-R

Scope of application

- Precise flow rate measurement of fluids and gases, multi-phase fluids and fluids with specific gas content using the Coriolis principle.
- Direct measurement of mass flow and density independent of the fluid's physical properties, such as density, viscosity and homogeneity
- Concentration measurement of solutions, suspensions and emulsions
- Fluid temperatures of -70 – 350 °C (-94 – 662 °F)
- Process pressures up to 100 bar
- EN, ASME or JIS standard flange process connections up to three nominal diameters per meter size
- Connection to common process control systems, such as via HART 7 or Modbus
- Hazardous area approvals: IECEx, ATEX, FM (USA/Canada), NEPSI, INMETRO, PESO, Taiwan Safety Label
- Safety-related applications: PED per AD 2000 Code, SIL 2, secondary containment up to 65 bar
- Marine type approval for Giga 1F: DNV GL

Advantages and benefits

- Inline measurement of several process variables, such as mass, density and temperature
- Advanced functions like Net Oil Computing, Batching function and Viscosity function to avoid external dedicated flow computer.
- Adapterless installation due to multi-size flange concept
- No straight pipe runs at inlet or outlet required
- Fast and uncomplicated commissioning and operation of the flow meter
- Maintenance-free operation
- Functions that can be activated subsequently (Features on Demand)
- Total health check (diagnostic function): Self-monitoring of the entire flow meter, including accuracy
- Maximum accuracy due to calibration facility accredited according to ISO/IEC 17025 (for option K5)
- Self-draining installation
- Vibration-resistant due to counterbalanced double-tube measurement system

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1 Introduction

1.1 Applicable documents

For Ex approval specification, refer to the following documents:

- Explosion Proof Type Manual ATEX IM 01U10X01-00␣␣-R[1)]
- Explosion Proof Type Manual IECEx IM 01U10X02-00␣␣-R[1)]
- Explosion Proof Type Manual FM IM 01U10X03-00␣␣-R[1)]
- Explosion Proof Type Manual INMETRO IM 01U10X04-00␣␣-R[1)]
- Explosion Proof Type Manual PESO IM 01U10X05-00␣␣-R[1)]
- Explosion Proof Type Manual NEPSI IM 01U10X06-00␣␣-R[1)]
- Explosion Proof Type Manual KOREA Ex IM 01U10X07-00␣␣-R[1)]
- Explosion Proof Type Manual EAC Ex IM 01U10X08-00␣␣-R[1)]

Other applicable User´s manuals:

- Protection of Environment (Use in China only) IM 01A01B01-00ZH-R

[1)] The "␣" symbols are placeholders. Here for example, for the corresponding language version (DE, EN, etc.).

1.2 Product overview

Rotamass Total Insight Coriolis mass flow and density meters are available in various product families distinguished by their applications. Each product family includes several product alternatives and additional device options that can be selected.

The following overview serves as a guide for selecting products.

Overview of Rotamass Total Insight product families

Rotamass Nano		**For low flow rate applications** Meter sizes: Nano 06, Nano 08, Nano 10, Nano 15, Nano 20 Connection sizes: ▪ DN15, DN25, DN40 ▪ ¼", ⅜", ½", ¾", 1", 1½" Maximum mass flow: 1.5 t/h (55 lb/min)
Rotamass Prime		**Versatility with low costs for the operator** Meter sizes: Prime 25, Prime 40, Prime 50, Prime 80 Connection sizes: ▪ DN15, DN25, DN40, DN50, DN80 ▪ ⅜", ½", ¾", 1", 1½", 2", 2½", 3" Maximum mass flow: 76 t/h (2800 lb/min)
Rotamass Supreme		**Excellent performance under demanding conditions** Meter sizes: Supreme 34, Supreme 36, Supreme 38, Supreme 39 Connection sizes: ▪ DN15, DN25, DN40, DN50, DN65, DN80, DN100, DN125 ▪ ⅜", ½", ¾", 1", 1½", 2", 2½", 3", 4", 5" Maximum mass flow: 170 t/h (6200 lb/min)
Rotamass Intense		**For high process pressure applications** Meter sizes: Intense 34, Intense 36, Intense 38 Connection sizes: ▪ ⅜", ½", ¾", 1", 2" Maximum mass flow: 50 t/h (1800 lb/min)
Rotamass Hygienic		**For food, beverage and pharmaceutical applications** Meter sizes: Hygienic 25, Hygienic 40, Hygienic 50, Hygienic 80 Connection sizes: ▪ DN25, DN40, DN50, DN65, DN80 ▪ 1", 1½", 2", 2½", 3" Maximum mass flow: 76 t/h (2800 lb/min)
Rotamass Giga		**For high flow rate applications** Meter sizes: Giga 1F, Giga 2H Connection sizes: ▪ DN100, DN125, DN150, DN200 ▪ 4", 5", 6", 8" Maximum mass flow: 600 t/h (22000 lb/min)

2 Measuring principle and flow meter design

2.1 Measuring principle

The measuring principle is based on the generation of Coriolis forces. For this purpose, a driver system (E) excites the two measuring tubes (M1, M2) in their first resonance frequency. Both pipes vibrate inversely phased, similar to a resonating tuning fork.

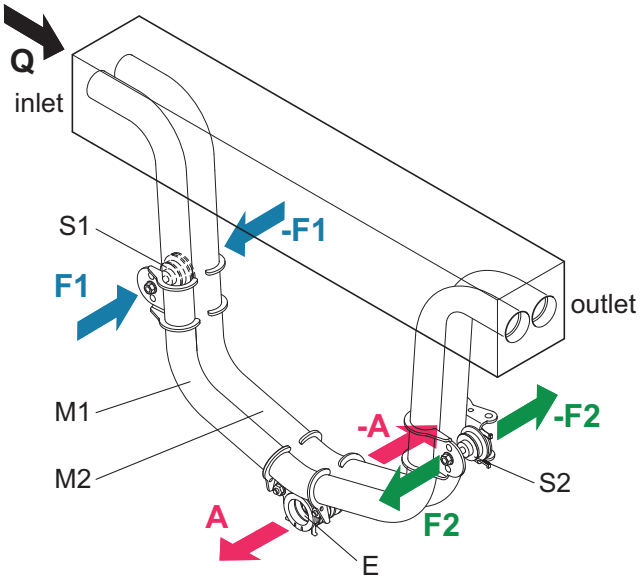


Fig. 1: Coriolis principle

M1,M2	Measuring tubes	E	Driver system
S1, S2	Pick-offs	A	Direction of measuring tube vibration
F1, F2	Coriolis forces	Q	Direction of fluid flow

Mass flow

The fluid flow through the vibrating measuring tubes generates Coriolis forces (F1, -F1 and F2, -F2) that produce positive or negative values for the tubes on the inflow or outflow side. These forces are directly proportional to the mass flow and result in deformation (torsion) of the measuring tubes.

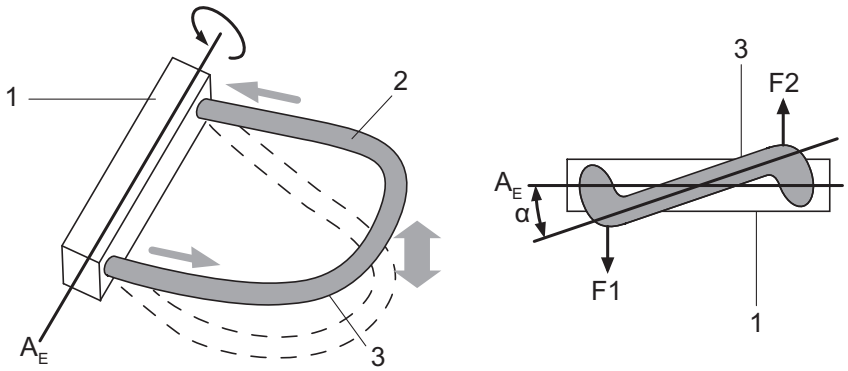


Fig. 2: Coriolis forces and measuring tube deformation

1	Measuring tube mount	A_E	Rotational axis
2	Fluid	F1, F2	Coriolis forces
3	Measuring tube	α	Torsion angle

The small deformation overlying the fundamental vibration is recorded by means of pick-offs (S1, S2) attached at suitable measuring tube locations. The resulting phase shift $\Delta\varphi$ between the output signals of pick-offs S1 and S2 is proportional to the mass flow. The output signals generated are further processed in a transmitter.

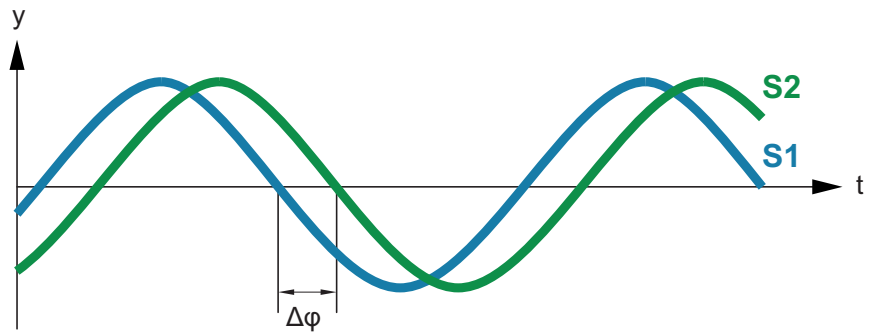


Fig. 3: Phase shift between output signals of S1 and S2 pick-offs

$$\Delta\varphi \sim F_c \sim \frac{dm}{dt}$$

$\Delta\varphi$	Phase shift
m	Dynamic mass
t	Time
dm/dt	Mass flow
F_c	Coriolis force

Density measurement

Using a driver and an electronic regulator, the measuring tubes are operated in their resonance frequency f. This resonance frequency is a function of measuring tube geometry, material properties and the mass of the fluid covibrating in the measuring tubes. Altering the density and the attendant mass will alter the resonance frequency. The transmitter measures the resonance frequency and calculates density from it according to the formula below. Device-dependent constants are determined individually during calibration.

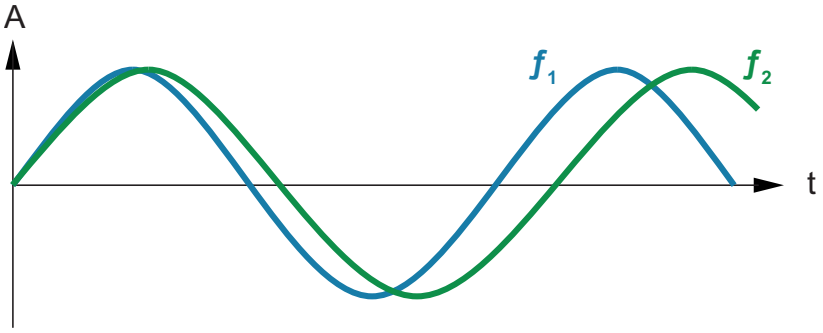


Fig. 4: Resonance frequency of measuring tubes

A	Measuring tube displacement
f_1	Resonance frequency with fluid 1
f_2	Resonance frequency with fluid 2

$$\rho = \frac{\alpha}{f^2} + ß$$

ρ	Fluid density
f	Resonance frequency of measuring tubes
α, β	Device-dependent constants

Temperature measurement

The measuring tube temperature is measured in order to compensate for the effects of temperature on the flow meter. This temperature approximately equals the fluid temperature and is made available as a measured quantity at the transmitter as well.

2.2 Flow meter

The Rotamass Coriolis flow meter consists of:

- Sensor
- Transmitter

When the integral type is used, sensor and transmitter are firmly connected.

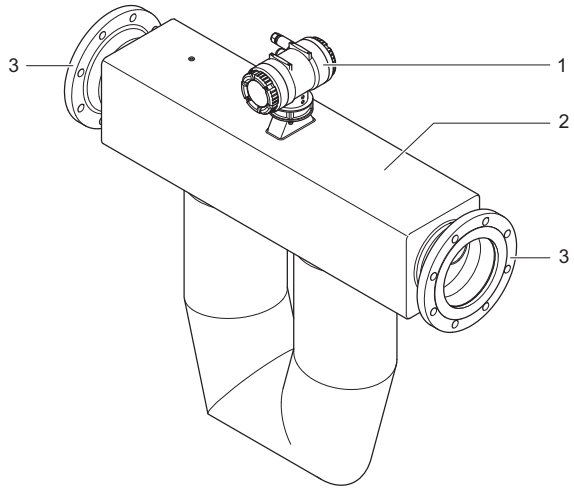


Fig. 5: Configuration of the Rotamass integral type

1	Transmitter
2	Sensor
3	Process connections

When the remote type is used, sensor and transmitter are linked via connecting cable. As a result, sensor and transmitter can be installed in different locations.

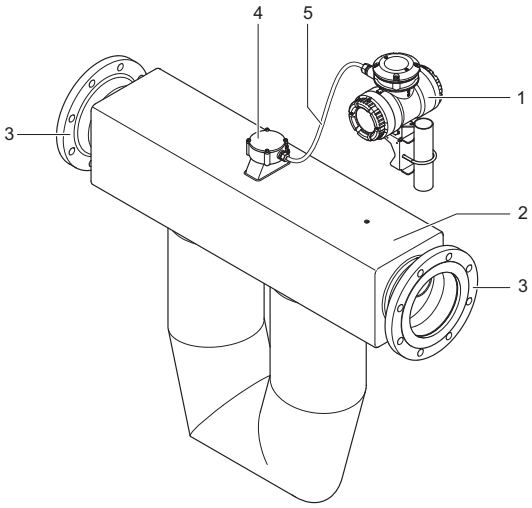


Fig. 6: Configuration of the Rotamass remote type

1	Transmitter	4	Sensor terminal box
2	Sensor	5	Connecting cable
3	Process connections		

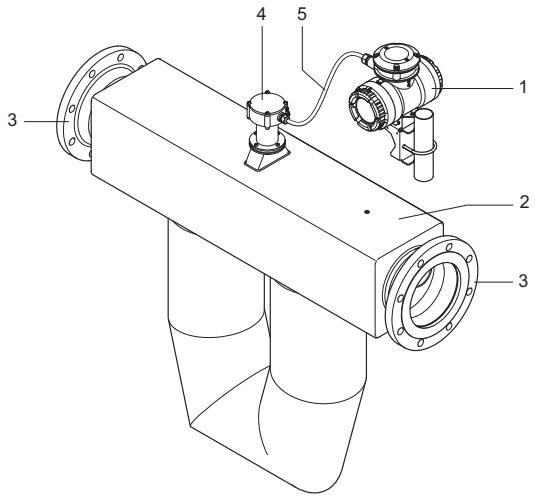


Fig. 7: Configuration of the Rotamass remote type - long neck

1	Transmitter	4	Sensor terminal box
2	Sensor	5	Connecting cable
3	Process connections		

General specifications

All available properties of the Rotamass Coriolis flow meter are specified by means of a model code.

One model code position may include several characters depicted by means of dashed lines.

The positions of the model code relevant for the respective properties are depicted and highlighted in blue. Any values that might occupy these model code positions are subsequently explained.

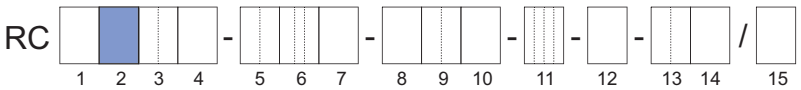


Fig. 8: Highlighted model code positions

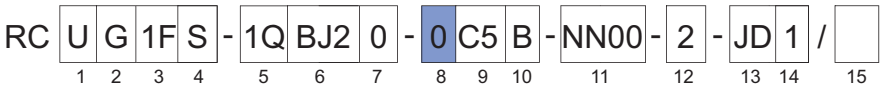
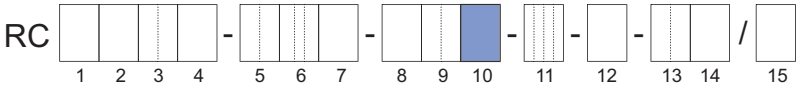


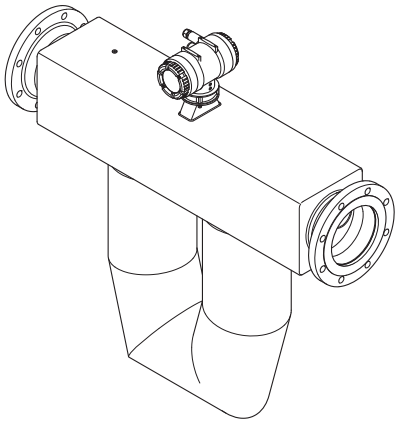
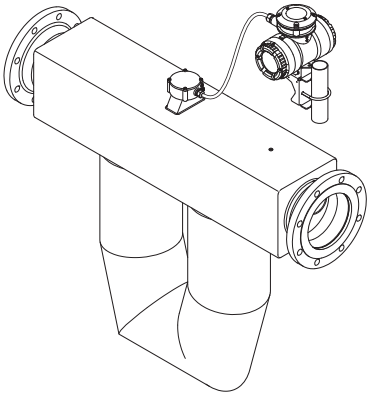
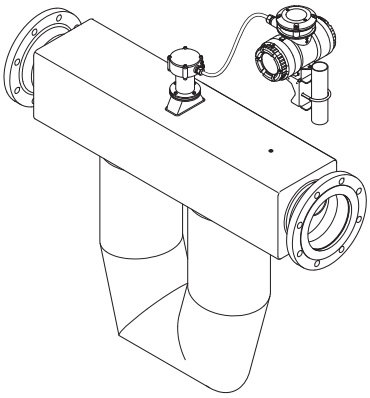
Fig. 9: Example of a completed model code

A complete description of the model code is included in the chapter entitled *Ordering information [▷ 74]*.

Type of design

Position 10 of the model code defines whether the integral type or the remote type is used. It specifies further flow meter properties, such as the transmitter coating, see *Design and housing [▶ 88]*.



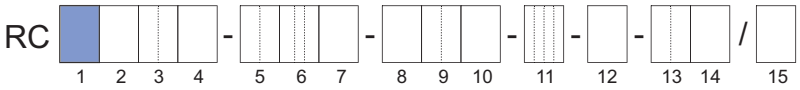
Flow meter	Model code position 10
Integral type 	0, 2
Remote type - standard neck 	A, E, J
Remote type - long neck 	B, F, K

Transmitter overview

Two different transmitters can be combined with the sensor: Essential and Ultimate.

Essential transmitter is suitable for general purposes applications and it delivers accurate and precise measurements of flow rate and density.

Ultimate transmitter, thanks to the advanced functions and "Features on Demand", offers dedicated application solutions with a superior accuracy and performances in measuring flow rate, density and concentration.



Transmitter	Properties	Model code position 1
Essential 	▪ Down to 0.2 % mass flow accuracy for liquids ▪ Down to 0.75 % mass flow accuracy for gases ▪ Down to 4 g/l (0.25 lb/ft³) accuracy for density ▪ Total health check (diagnostic function) ▪ Advanced functions: - Tube health check (diagnostic function) ▪ HART communication ▪ Modbus communication ▪ Data backup on microSD card	E
Ultimate 	▪ Down to 0.1 % mass flow accuracy for liquids ▪ Down to 0.5 % mass flow accuracy for gases ▪ Down to 2 g/l (0.13 lb/ft³) accuracy for density ▪ Total health check (diagnostic function) ▪ Advanced functions: - Standard concentration measurement - Advanced concentration measurement - Net Oil Computing following API standard - Viscosity function - Batching function - Measurement of heat quantity - Tube health check (diagnostic function) ▪ Features on Demand ▪ HART communication ▪ Modbus communication ▪ Data backup on microSD card	U

3 Application and measuring ranges

3.1 Measured quantities

The Rotamass Coriolis flow meter can be used to measure the following fluids:

- Liquids
- Gases
- Mixtures, such as emulsions, suspensions, slurries

Possible limitations applying to measurement of mixtures must be checked with the responsible Yokogawa sales organization.

The following variables can be measured using the Rotamass:

- Mass flow
- Density
- Temperature

Based on these measured quantities, the transmitter also calculates:

- Volume flow
- Partial component concentration of a two-component mixture
- Partial component flow rate of a mixture consisting of two components (net flow)

In this process, the net flow is calculated based on the known partial component concentration and the overall flow.

3.2 Measuring range overview

	Giga 1F	Giga 2H	
Mass flow range			
Typical connection size	DN100, 4"	DN150, 6"	
Q_{nom}	250 t/h (9200 lb/min)	500 t/h (18000 lb/min)	*[▷ 14]*
Q_{max}	300 t/h (11000 lb/min)	600 t/h (22000 lb/min)	
Maximum volume flow			
(Water)	300 m^3/h (2500 barrel/h)	600 m^3/h (5000 barrel/h)	*[▷ 14]*
Range of fluid density			
	0 – 2 kg/l (0 – 120 lb/ft^3)		*[▷ 14]*
Process fluid temperature range			
Standard[1)]	-70 – 150 °C (-94 – 302 °F)		*[▷ 25]*
Mid-range	-70 – 230 °C (-94 – 446 °F)		
High	0 – 350 °C (32 – 662 °F)		

[1)] May be further restricted depending on the design.

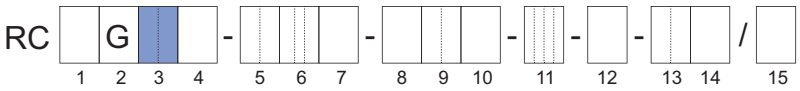
Q_{nom} - Nominal mass flow

Q_{max} - Maximum mass flow

The nominal mass flow Q_{nom} is defined as the mass flow of water (temperature: 20 °C) at 1 bar pressure loss along the flow meter.

3.3 Mass flow

For Rotamass Giga the following meter sizes to be determined using the *Model code [▷ 85]* are available.



Mass flow of liquids

Meter size	Typical connection size	Q_{nom} in t/h (lb/min)	Q_{max} in t/h (lb/min)	Model code position 3
Giga 1F	DN100, 4"	250 (9200)	300 (11000)	1F
Giga 2H	DN150, 6"	500 (18000)	600 (22000)	2H

Mass flow of gases

When using the Rotamass for measuring the flow of gases, the mass flow is usually limited by the pressure loss generated and the maximum flow velocity. Since these depend heavily on the application, please contact the local Yokogawa sales organization.

3.4 Volume flow

Volume flow of liquids (water at 20 °C)

Meter size	Volume flow (at 1 bar pressure loss) in m^3/h (barrel/h)	Maximum volume flow in m^3/h (barrel/h)
Giga 1F	250 (2100)	300 (2500)
Giga 2H	500 (4200)	600 (5000)

Volume flow of gases

When using the Rotamass for measuring the flow of gases, the flow rate is usually limited by the pressure loss generated and the maximum flow velocity. Since these depend heavily on the application, please contact the local Yokogawa sales organization.

3.5 Pressure loss

The pressure loss along the flow meter is heavily dependent on the application. The pressure loss of 1 bar at nominal mass flow Q_{nom} also applies to water and is considered the reference value.

3.6 Density

Meter size	Measuring range of density
Giga 1F	0 – 2 kg/l (0 – 120 lb/ft³)
Giga 2H	

Rather than being measured directly, density of gas is usually calculated using its reference density, process fluid temperature and process pressure.

3.7 Temperature

The process fluid temperature measuring range is limited by:

- Design type (integral or remote)
- Process connection size and type
- Ex approvals

Maximum measuring range: -70 – 350 °C (-94 – 662 °F)

4 Accuracy

In this chapter, maximum deviations are indicated as absolute values.

All accuracy data are given in ± values.

4.1 Overview

Achievable accuracies for liquids

Maximum deviation *D* is made up of zero point stability *Z* and accuracy D_0, see *Mass flow accuracy [▷ 16]*. The accuracy achieved at calibration conditions as delivered is specified below; see *Calibration conditions [▷ 21]*.

Measured quantity		Accuracy for transmitters	
		Essential	Ultimate
Mass flow[1]	Accuracy[2] D_0	0.2 % of measured value	0.1 % of measured value
	Repeatability	0.1 % of measured value	0.05 % of measured value
Volume flow (water)[1]	Accuracy[2] D_V	0.45 % of measured value	0.12 % of measured value
	Repeatability	0.23 % of measured value	0.06 % of measured value
Density	Accuracy[2]	4 g/l (0.25 lb/ft³)	2 g/l (0.13 lb/ft³)
	Repeatability	2 g/l (0.13 lb/ft³)	1 g/l (0.06 lb/ft³)
Temperature	Accuracy[2]	0.5 °C (0.9 °F)	0.5 °C (0.9 °F)

[1] Based on the measured values of the pulse output. This means that the flow accuracy and repeatability considers the combined measurement uncertainties including sensor, electronic and pulse output interface.
[2] Best accuracy per transmitter type.

The connecting cable may influence the accuracy. The values specified are valid for connecting cables ≤ 30 m (98.4 ft) long.

Achievable accuracies for gases

Measured quantity		Accuracy for transmitters	
		Essential	Ultimate
Mass flow / standard volume flow[1]	Accuracy[2] D_0	0.75 % of measured value	0.5 % of measured value
	Repeatability	0.6 % of measured value	0.4 % of measured value
Temperature	Accuracy[2]	0.5 °C (0.9 °F)	0.5 °C (0.9 °F)

[1] Based on the measured values of the pulse output. This means that the flow accuracy and repeatability considers the combined measurement uncertainties including sensor, electronic and pulse output interface.
[2] Best mass flow accuracy per transmitter type.

In the event of fluid temperature jumps, a delay is to be expected in the temperature being displayed due to low heat capacity and heat conductivity of gases.

The connecting cable may influence the accuracy. The values specified are valid for connecting cables ≤ 30 m (98.4 ft) long.

4.2 Zero point stability of the mass flow

In case of no flow, the maximum measured flow rate is called *Zero point stability*. Zero point values are shown in the table below.

Meter size	Zero point stability *Z* in kg/h (lb/h)
Giga 1F	13 (29)
Giga 2H	25 (55)

4.3 Mass flow accuracy

Maximum deviation D is made up of zero point stability Z and accuracy D_0, resulting in the following formula:

$$D = \frac{Z}{Q} \times 100\ \% + D_0$$

D	Maximum deviation in %	*Q*	Mass flow in kg/h
D_0	Accuracy	*Z*	Zero point stability

Basic accuracy depends on the product version selected and can be found in the tables in chapter *Accuracy of mass flow and density according to the model code [▷ 18]*.

4.3.1 Sample calculation for liquids

Example

RC	U	G	1F	S	-	1Q	BJ2	0	-	0	C5	B	-	NN00	-	2	-	JD	1	/	
	1	2	3	4		5	6	7		8	9	10		11		12		13	14		15

Fluid:	Liquid
Zero point stability *Z*:	13 kg/h
Accuracy D_0:	0.1 %
Value of mass flow *Q*:	6250 kg/h

Calculation of accuracy:

D = 13 kg/h / 6250 kg/h× 100 % + 0.1 %

D = 0.31 %

4.3.2 Sample calculation for gases

The maximum deviation in the case of gases depends on the product version selected, see also *Mass flow and density accuracy [▷ 88]*.

Example

RC	U	G	1F	S	-	1Q	BJ2	0	-	0	50	B	-	NN00	-	2	-	JD	1	/	
	1	2	3	4		5	6	7		8	9	10		11		12		13	14		15

Fluid:	Gas
Zero point stability *Z*:	13 kg/h
Accuracy D_0:	0.5 %
Value of mass flow *Q*:	2500 kg/h

Calculation of accuracy:

D = 13 kg/h / 2500 kg/h× 100 % + 0.5 %

D = 1.02 %

4.4 Accuracy of density

4.4.1 For liquids

Meter size	Transmitter	Maximum deviation of density[1)] in g/l (lb/ft³)
Giga 1F	Essential	Down to 4 (0.25)
Giga 2H		
Giga 1F	Ultimate	Down to 2 (0.13)
Giga 2H		

[1)] Deviations possible depending on product version (meter size, type of calibration)

The maximum deviation depends on the product version selected, see also *Accuracy of mass flow and density according to the model code [▷ 18]*.

4.4.2 For gases

In most applications, density at standard conditions is fed into the transmitter and used to calculate the standard volume flow based on mass flow.

If gas pressure is a known value, after entering a reference density, the transmitter is able to calculate gas density from temperature and pressure as well (while assuming an ideal gas).

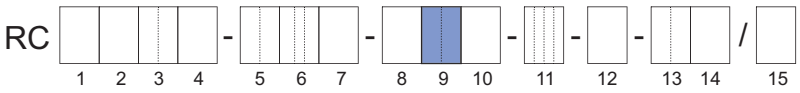
Alternatively, there is an option for measuring gas density. In order to do so, it is necessary to adapt the lower density limit value in the transmitter.

For most applications the direct measurement of the gas density will have insufficient accuracy.

4.5 Accuracy of mass flow and density according to the model code

Accuracy for flow rate as well as density is selected via model code position 9. Here a distinction is made between devices for measuring liquids and devices for measuring gases. No accuracy for density measurement is specified for gas measurement devices.

4.5.1 For liquids



Essential

Model code position 9	Maximum deviation of density[1] in g/l	Applicable measuring range of accuracy in kg/l	Maximum deviation D_0 for mass flow in %	
			Giga 1F	Giga 2H
E7	4	0.3 – 2	0.2	0.2

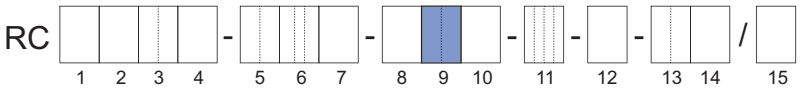
[1] Specified maximum deviation is achieved within the applicable measuring range for density.

Ultimate

Model code position 9	Maximum deviation of density[1] in g/l	Applicable measuring range of accuracy in kg/l	Maximum deviation D_0 for mass flow in %	
			Giga 1F	Giga 2H
C5	2	0.3 – 2	0.1	0.1
E7	4	0.3 – 2	0.2	0.2

[1] Specified maximum deviation is achieved within the applicable measuring range for density.

4.5.2 For gases



Essential

Maximum accuracy D_0 for mass flow in %	Model code position 9
0.75	70

Ultimate

Maximum accuracy D_0 for mass flow in %	Model code position 9
0.5	50

4.6 Volume flow accuracy

4.6.1 For liquids

The following formula can be used to calculate the accuracy of liquid volume flow:

$$D_V = \sqrt{D^2 + \left(\frac{\Delta\rho}{\rho} \times 100\%\right)^2}$$

D_V Maximum deviation of volume flow in %
$\Delta\rho$ Maximum deviation of density in kg/l
D Maximum deviation of mass flow in %
ρ Density in kg/l

4.6.2 For gases

Accuracy of standard volume flow for gas with a fixed composition equals the maximum deviation *D* of the mass flow.

$$D_V = D$$

In order to determine the standard volume flow for gas, it is necessary to input a reference density in the transmitter. The accuracy specified is achieved only for fixed gas composites. Major deviations may appear if the gas composition changes.

4.7 Accuracy of temperature

Various process fluid temperature ranges are specified for Rotamass Giga:

- *Standard*:
  - Integral type: -50 – 150 °C (-58 – 302 °F)
  - Remote type: -70 – 150 °C (-94 – 302 °F)
- *Mid-range*:
  - Remote type: -70 – 230 °C (-94 – 446 °F)
- *High*:
  - Remote type: 0 – 350 °C (32 – 662 °F)

Accuracy of temperature depends on the sensor temperature range selected (see *Process fluid temperature range [▷ 25]*) and can be calculated as follows:

Formula for temperature specifications *Standard* and *Mid-range*

$$\Delta T = 0.5\ °C + 0.005 \times \left| T_{pro} - 20\ °C \right|$$

ΔT Maximum deviation of temperature
T_{pro} Process fluid temperature in °C

Formula for temperature specification *High*

$$\Delta T = 1.0\ °C + 0.008 \times \left| T_{pro} - 20\ °C \right|$$

ΔT Maximum deviation of temperature
T_{pro} Process fluid temperature in °C

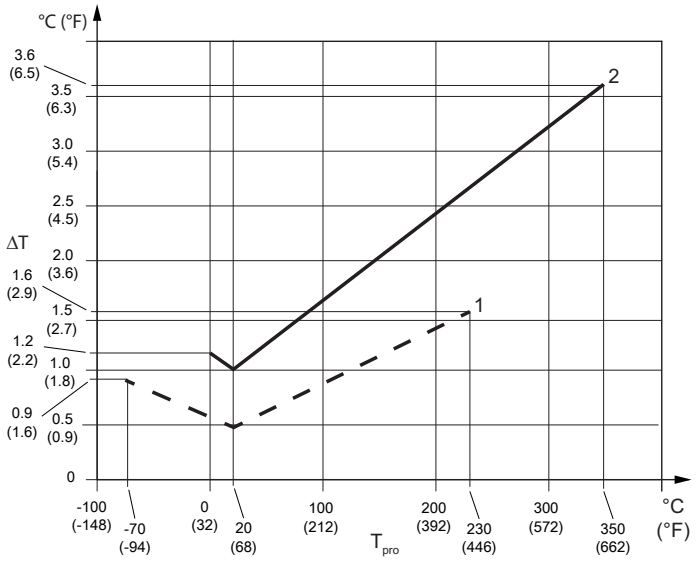


Fig. 10: Presentation of temperature accuracy

1 Temperature specification High
2 Temperature specifications Standard and Mid-range

Example

RC	U	G	1F	S	-	1Q	BJ2	0	-	0	C5	B	-	NN00	-	2	-	JD	1	/	
	1	2	3	4		5	6	7		8	9	10		11		12		13	14		15

The sample model code specifies the Standard temperature range.

Process fluid temperature T_{pro}: 50 °C

Calculation of accuracy:

$\Delta T = 0.5\ °C + 0.005 \times |50\ °C - 20\ °C|$

$\Delta T = 0.65\ °C$

4.8 Repeatability

For liquids

When using default damping times, the specified repeatability of mass flow, density and temperature measurements equals half of the respective maximum deviation.

$$R = \frac{D}{2}$$

R Repeatability
D Maximum deviation

For gases

In deviation hereto, the following applies to mass and standard volume flow of gases:

$$R = \frac{D}{1.25}$$

4.9 Calibration conditions

4.9.1 Mass flow calibration and density adjustment

All Rotamass are calibrated in accordance with the state of the art at Rota Yokogawa. Optionally, the calibration can be performed according to a method accredited by DAkkS in accordance with DIN EN ISO/IEC 17025 (Option K5, see *Certificates [▷ 96]*).

Each Rotamass device comes with a standard calibration certificate.

Calibration takes place at reference conditions. Specific values are listed in the standard calibration certificate.

	Reference conditions
Fluid	Water
Density	0.9 – 1.1 kg/l (56 − 69 lb/ft³)
Fluid temperature	10 – 35 °C (50 – 95 °F) Average temperature: 22.5 °C (72.5 °F)
Ambient temperature	10 – 35 °C (50 – 95 °F)
Process pressure (absolute)	1 – 2 bar (15 – 29 psi)

The accuracy specified is achieved at as-delivered calibration conditions stated.

4.10 Process pressure effect

Process pressure effect is defined as the change in sensor flow and density deviation due to process pressure change away from the calibration pressure. This effect can be corrected by dynamic pressure input or a fixed process pressure.

Tab. 1: Process pressure effect, wetted parts stainless steel 1.4404/ 316L and Ni alloy C-22/ 2.4602

Meter size	Material	Deviation of Flow		Deviation of Density	
		in % of rate per bar	in % of rate per psi	in g/l per bar	in g/l per psi
Giga 1F	1.4404/316L	-0.0289	-0.00199	-0.140	-0.0097
	C-22/2.4602	-0.0313	-0.00216	-0.191	-0.0132
Giga 2H	1.4404/316L	-0.0484	-0.00334	-0.179	-0.0123

4.11 Process fluid temperature effect

For mass flow and density measurement, process fluid temperature effect is defined as the change in sensor flow and density accuracy due to process fluid temperature change away from the calibration temperature. For temperature ranges, see *Process fluid temperature range [▷ 25]*.

Temperature effect on Zero

Temperature effect on Zero of mass flow can be corrected by zeroing at the process fluid temperature.

Temperature effect on mass flow

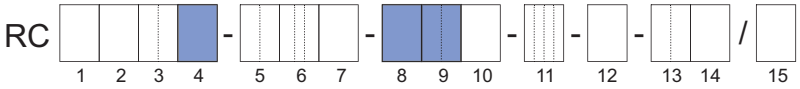
The process fluid temperature is measured and the temperature effect compensated. However due to uncertainties in the compensation coefficients and in the temperature measurement an uncertainty of this compensation is left. The typical rest error of Rotamass Total Insight temperature effect on mass flow is:

Tab. 2: All models

Temperature range	Uncertainty of flow
Standard, Mid-range	±0.001 % of rate / °C (±0.0005 % of rate / °F)
High	±0.0011 % of rate / °C (±0.0006 % of rate / °F)

The temperature used for calculation of the uncertainty is the difference between process fluid temperature and the temperature at calibration condition. For temperature ranges, see *Process fluid temperature range [▷ 25]*.

Temperature effect on density measurement (liquids)



Process fluid temperature influence:

Formula for metric values

$$D'_\rho = \pm k \times \text{abs}\,(T_{pro} - 20\ °C)$$

Formula for imperial values

$$D'_\rho = \pm k \times \text{abs}\,(T_{pro} - 68\ °F)$$

D'_ρ Additional density deviation due to the effect of fluid temperature in g/l (lb/ft³)

T_{pro} Process fluid temperature in °C (°F)

k Constant for temperature effect on density measurement in g/l × 1/°C (lb/ft³ × 1/°F)

Tab. 3: Constants for particular meter size and model code position (see also *Process fluid temperature range [▷ 25]* and *Mass flow and density accuracy [▷ 88]*)

Meter size	Model code position 4	Model code position 8	Model code position 9	*k* in g/l × 1/°C (lb/ft³ × 1/°F)
Giga 1F	S	0, 2	C5, E7	0.110 (0.0038)
		3		0.290 (0.0101)
	H	0, 2	C5, E7	0.090 (0.0031)
		3		0.210 (0.0073)
Giga 2H	S	0, 2	C5, E7	0.070 (0.0024)
		3		0.180 (0.0062)

5 Operating conditions

5.1 Location and position of installation

Rotamass Coriolis flow meters can be mounted horizontally, vertically and at an incline. The measuring tubes should be completely filled with the fluid during flow measurement 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 usually not required.

Avoid the following installation locations and positions:

- Measuring tubes as highest point in piping when measuring liquids
- Measuring tubes as lowest point in piping when measuring gases
- Immediately in front of a free pipe outlet in a downpipe
- Lateral positions

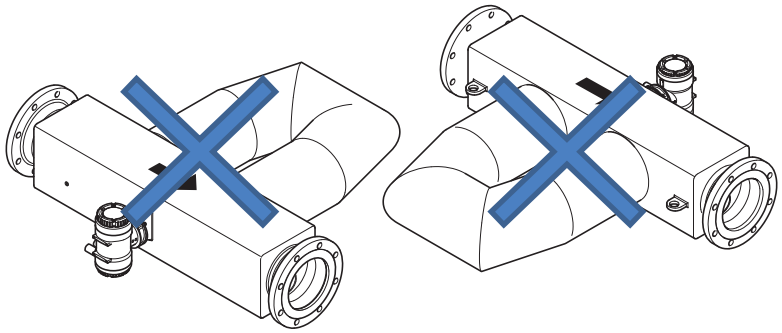
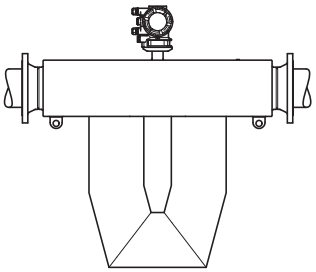
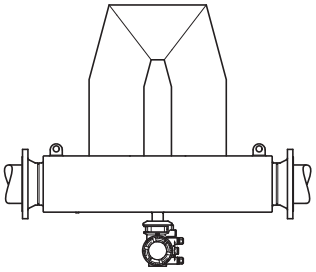
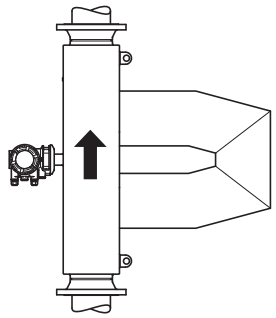


Fig. 11: Installation position to be avoided: Flow meter in sideways position

5.1.1 Sensor installation position

Sensor installation position as a function of the fluid

Installation position	Fluid	Description
Horizontal, measuring tubes at bottom 	Liquid	The measuring tubes are oriented toward the bottom. Accumulation of gas bubbles is avoided.
Horizontal, measuring tubes at top 	Gas	The measuring tubes are oriented toward the top. Accumulation of liquid, such as condensate is avoided.

Installation position	Fluid	Description
Vertical, direction of flow towards the top (recommended) 	Liquid/gas	The sensor is installed on a pipe with the direction of flow towards the top. Accumulation of gas bubbles or solids is avoided. This position allows for complete self-draining of the measuring tubes.

5.2 Installation instructions

The following instructions for installation must be observed:

1. Protect the flow meter from direct sun irradiation in order to avoid exceeding the maximum allowed temperature of the transmitter.
2. In case of installing two sensors of the same kind back-to-back redundantly, use a customized design and contact the responsible Yokogawa sales organization.
3. Avoid installation locations susceptible to cavitation, such as immediately behind a control valve.
4. In case that the fluid temperatures deviate approx. 80 °C from the ambient temperature, insulating the sensor is recommended in order to avoid injuries as well as to maintain utmost accuracy, see *Insulation and heat tracing [▷ 29]*.
5. Avoid installation directly behind rotary and gear pumps to prevent fluctuations in pressure from interfering with the resonance frequency of the Rotamass measuring tubes.
6. In case of remote installation: When installing the connecting cable between sensor and transmitter, keep the cable temperature above -10 °C (14 °F) to prevent cable damage from the installation stresses.

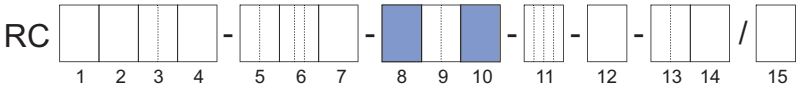
5.3 Process conditions

The pressure and temperature ratings presented in this section represent the design values for the devices. For individual applications (e.g. marine applications with option MC␣) further limitations may apply according to the respective applicable regulations. For details see chapter *Marine Approval [▷ 100]*.

5.3.1 Process fluid temperature range

Allowed process fluid and ambient temperature ranges in hazardous areas depend on classifications defined by applications, refer to *Temperature specification in hazardous areas [▷ 34]*.

For Rotamass Giga the following process fluid temperature ranges are available:



Temperature range	Model code position 8	Process fluid temperature in °C (°F)	Design type	Model code position 10
Standard	0	-50 – 150 (-58 – 302)	Integral type	0, 2
		-70 – 150 (-94 – 302)	Remote type	A, B, E, F, J, K
Mid-range	2	-70 – 230 (-94 – 446)		B, F, K
High	3	0 – 350 (32 – 662)		B, F, K

5.3.2 Density

Meter size	Measuring range of density
Giga 1F	0 – 2 kg/l (0 – 120 lb/ft³)
Giga 2H	

Rather than being measured directly, density of gas is usually calculated using its reference density, process fluid temperature and process pressure.

5.3.3 Pressure

The maximum allowed process pressure depends on the selected process connection and its surface temperature.

The given process connection temperature and process pressure ranges are calculated and approved without corrosion or erosion effects.

The following diagrams shows the process pressure as a function of process connection temperature as well as the process connection used (type and size of process connection).

ASME class 150
EN PN16

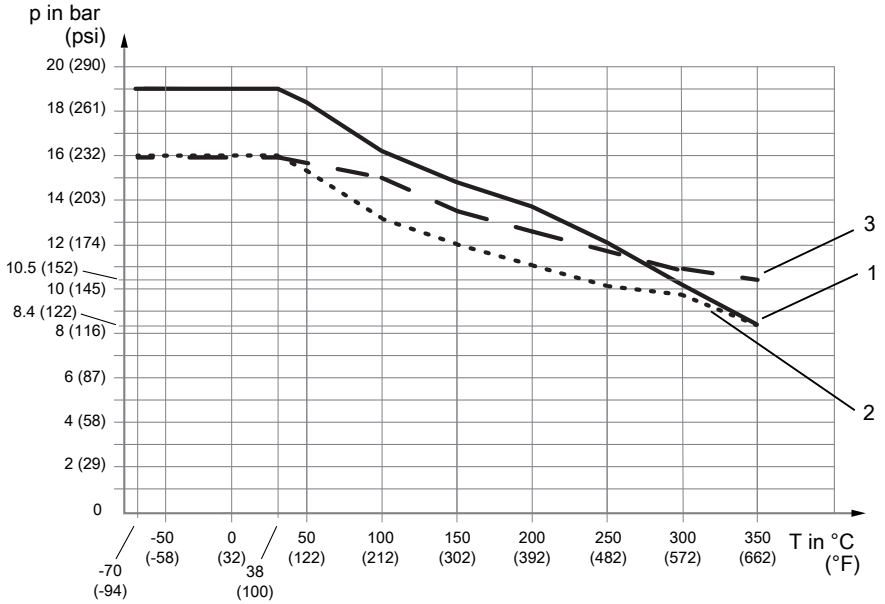


Fig. 12: Allowed process pressure as a function of process connection temperature

1 Process connection suitable for ASME B16.5 class 150
2 Heat tracing connection suitable for ASME B16.5 class 150
3 Process connection suitable for EN 1092-1 PN16

ASME class 300
EN PN40

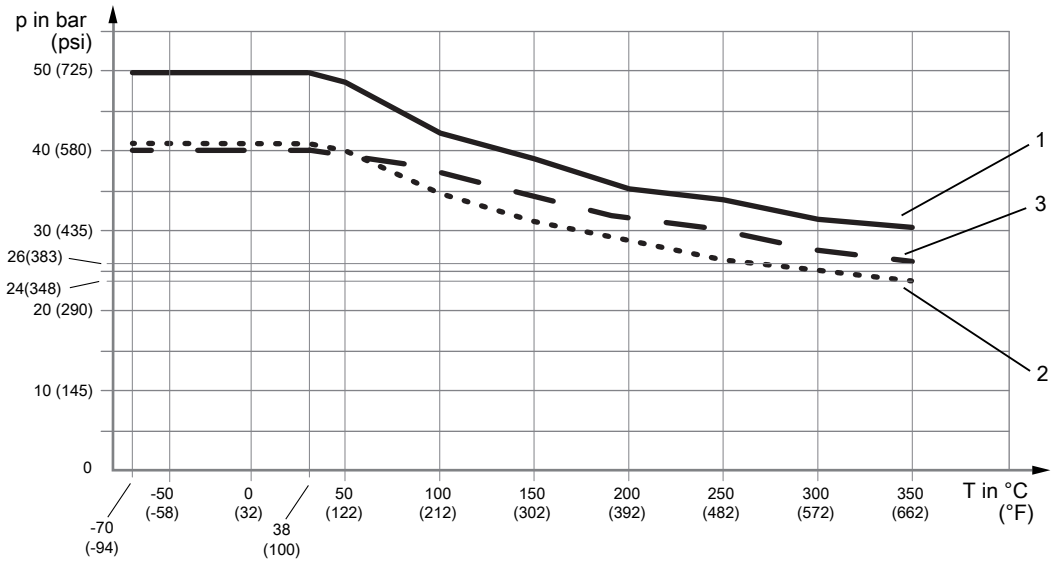


Fig. 13: Allowed process pressure as a function of process connection temperature

1 Process connection suitable for ASME B16.5 class 300
2 Heat tracing connection for ASME B16.5 class 300
3 Process and heat tracing connection suitable for EN 1092-1 PN40

ASME class 600
EN PN63

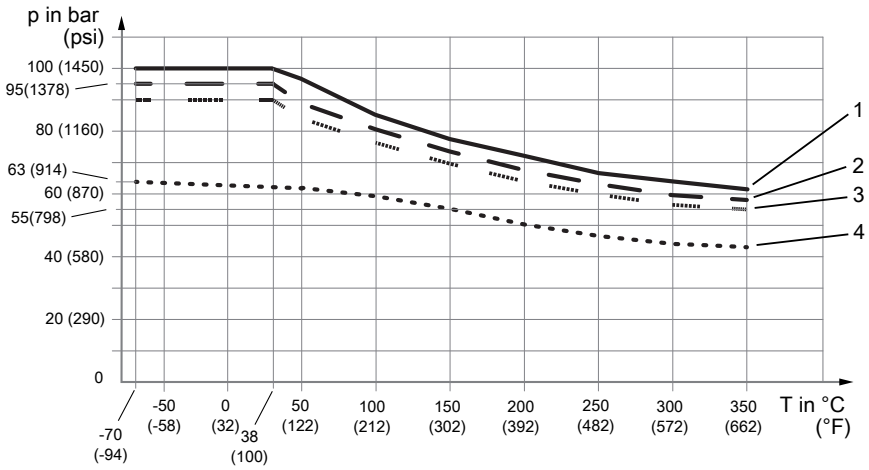


Fig. 14: Allowed process pressure as a function of process connection temperature

1 Process connection suitable for ASME B16.5 class 600:
Giga with meter size 1F, material wetted parts S or H (without ASME compliance);
Giga with meter size 1F, material wetted parts H and ASME compliance (option P15)

2 Process connection suitable for ASME B16.5 class 600:
Giga with meter size 1F, material wetted parts S and ASME compliance (option P15)

3 Process connection suitable for ASME B16.5 class 600:
Giga with meter size 2H

4 Process connection suitable for EN 1092-1 PN63

EN PN100

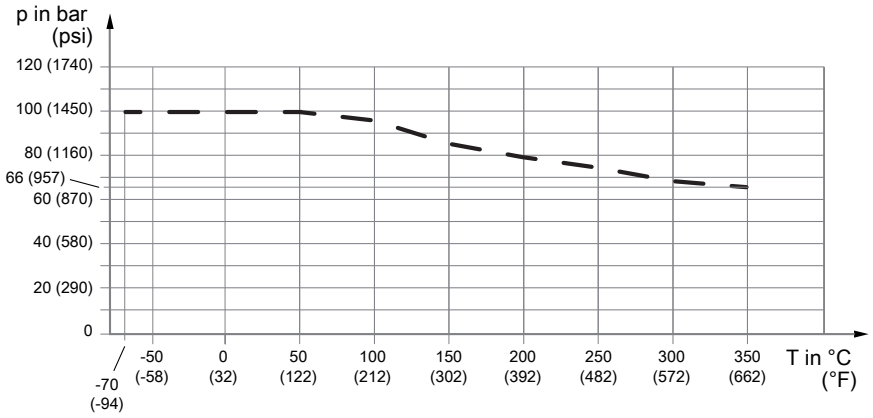


Fig. 15: Allowed process pressure as a function of process connection temperature, suitable for flange EN 1092-1 PN100

JIS 10K
JIS 20K

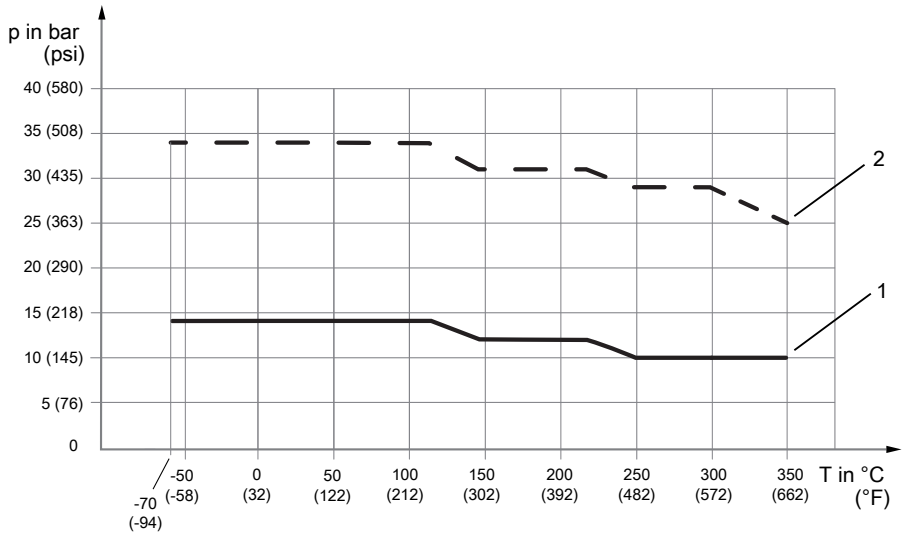


Fig. 16: Allowed process pressure as a function of process connection temperature

1 Process connection suitable for JIS B 2220 10K
2 Process connection suitable for JIS B 2220 20K

Rupture disc

The rupture disc is located on the sensor housing. It is available as an option, see *rupture disc [▷ 98]*. The rupture disc's bursting pressure is 20 bar. In the case of big nominal diameters and high pressures, it is not possible to ensure that the entire process pressure is released across the rupture disc. In the event this is necessary, it is possible to request a customized design from the responsible Yokogawa sales organization. In the event of a burst pipe, the rupture disc provides an acoustic signal in applications with gases.

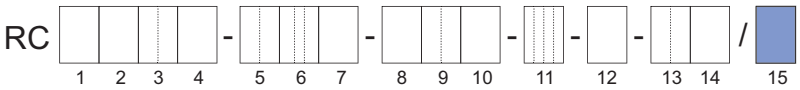
5.3.4 Mass flow

For **liquids** the preferred measuring range is 10 % - 80 % of Q_{nom}, see *Mass flow [▷ 14]*.

For **gases**, as a result of low gas density, the maximum mass flow Q_{max} is usually not reached in gas measurements. In general, the maximum flow velocity should not exceed 33 % of the sonic velocity of the fluid.

5.3.5 Insulation and heat tracing

In case that the fluid temperature deviates more than 80 °C (176 °F) from the ambient temperature, insulating the sensor is recommended to avoid negative effects from temperature fluctuations on accuracy.



Overview of device options for insulation and heat tracing for remote type

Description	Options
▪ Insulation	T10
▪ Insulation ▪ Heat tracing without ventilation	T21, T22, T26
▪ Insulation ▪ Heat tracing with ventilation	T31, T32, T36

For details about the ordering information see chapter under the same heading *Insulation and heat tracing [▸ 95]* in the model code description.

If the sensor is insulated subsequently, the following must be noted:

- Do not insulate transmitter as well.
- In case of remote type, do not insulate the terminal box of the sensor.
- Do not expose transmitters to ambient temperatures exceeding 60 °C (140 °F).
- The preferred insulation is 80 mm (3.15 inch) thick with a heat transfer coefficient of 0.4 W/m² K (0.07 Btu/ ft² °F).

Maximum temperature of heat carrier

Temperature range	Model code position 8	Maximum temperature range of heat carrier in °C (°F)
Standard	0	0 – 150 (32 – 302)
Mid-range	2	0 – 230 (32 – 446)[1)]
High	3	0 – 350 (32 – 662)

[1)] With Ex Approval 0 – 220 °C (32 – 428 °F)

Pressure ratings of heat tracing are defined based on heat tracing connection, refer to *Pressure [▸ 25]*.

Electrical heating can be provided subsequently. Electromagnetic insulation is required in case the heating device is controlled by phase-fired control or pulse train.

In hazardous areas, subsequent application of insulation, heating jacket or heating strips is not permitted.

5.3.6 Secondary containment

Some applications or environment conditions require secondary containment retaining the process pressure for increased safety. All Rotamass Total Insight have a secondary containment filled with inert gas. The rupture pressure typical values of the secondary housing are defined in the table below.

Typical rupture pressure

Rupture pressure in bar (psi)		
Giga 1FS	Giga 1FH	Giga 2HS
65 (942)		50 (725)

5.4 Ambient conditions

Rotamass Total Insight can be used at demanding ambient conditions.

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

As ambient temperature is intend the air surrounding the device.

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

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

Ambient temperature

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

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

[2] Check derating for high fluid temperature, see *Process fluid temperature range [▷ 25]*, *Process conditions [▷ 25]* and *Allowed ambient temperature for sensor [▷ 31]*

[3] Lower temperature specification valid for fixed installation only

Storage temperature

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

Further ambient conditions

Ranges and specifications	
Relative humidity	0 – 95 %
IP code	IP66/67 for transmitters and sensors when using the appropriate cable glands
Allowable pollution degree in surrounding area acc.: EN 61010-1	4 (in operation)
Resistance to vibration acc.: IEC 60068-2-6 (not with option T_ _)	Transmitter: 10 – 500 Hz, 1g Sensor: 25 – 100 Hz, 4g

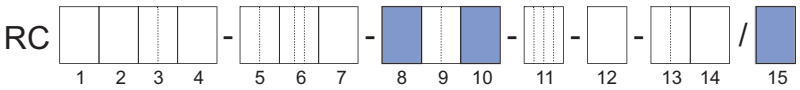
Ranges and specifications	
Electromagnetic compatibility (EMC) ▪ IEC/EN 61326-1, Table 2 ▪ IEC/EN 61326-2-3 ▪ NAMUR NE 21 recommendation ▪ DNVGL-CG-0339, chapter 14 This includes ▪ Surge immunity acc.: – EN 61000-4-5 for lightning protection ▪ Emission acc.: – IEC/EN 61000-3-2, Class A – IEC/EN 61000-3-3, Class A – NAMUR NE 21 recommendation – DNVGL-CG-0339, chapter 14	Immunity assessment criterion: The output signal fluctuation is within ±1% of the output span.
Maximum altitude	2000 m (6600 ft) above mean sea level (MSL)
Overvoltage category according to IEC/EN 61010-1	II

5.4.1 Allowed ambient temperature for sensor

As ambient temperature is intended the temperature of the air surrounding the device. If the device is operating outdoors be sure that solar irradiation does not increase the surface temperature higher than the allowed maximum ambient temperature.

The allowed ambient temperature depends on the following product properties:

- Process fluid temperature, see *Process fluid temperature range [▷ 25]*
- Design type
  - Integral type
  - Remote type
- Connecting cable type (options L_ _ _ and Y_ _ _)



The allowed combinations of process fluid and ambient temperature for the sensor are illustrated as gray areas in the diagrams below.

Allowed process fluid and ambient temperature ranges in hazardous areas depend on classifications defined by applications, refer to *Temperature specification in hazardous areas [▷ 34]*.

Temperature specification Standard, integral type

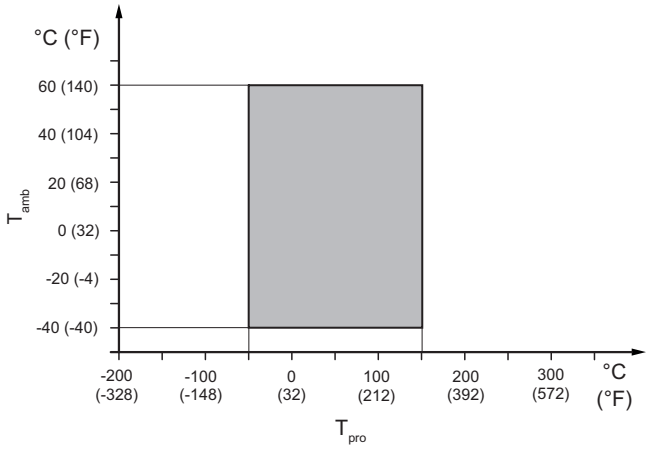


Fig. 17: Allowed fluid and ambient temperatures, integral type

T_{amb} Ambient temperature
T_{pro} Process fluid temperature

Temperature specification Standard, remote type

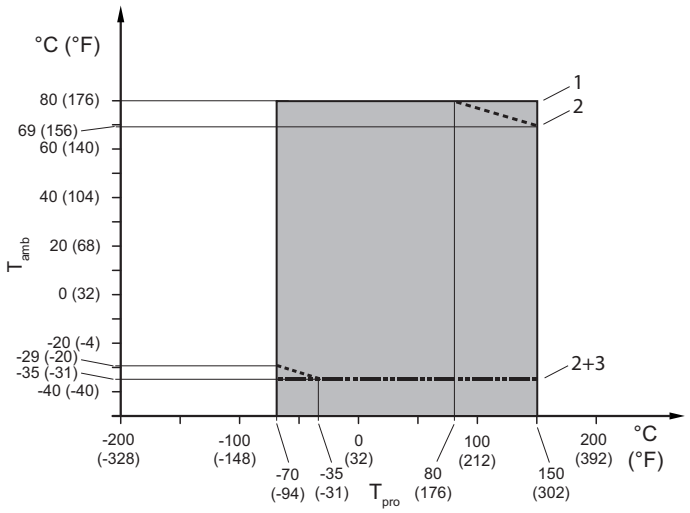


Fig. 18: Allowed process fluid and ambient temperatures, remote type

1 Standard cable option L␣␣␣
2 Limitation for fire retardant cable option Y␣␣␣ for standard neck or long neck with option T␣␣
3 Limitation for fire retardant cable option Y␣␣␣ for long neck without option T␣␣

Temperature specification Mid-range, remote type

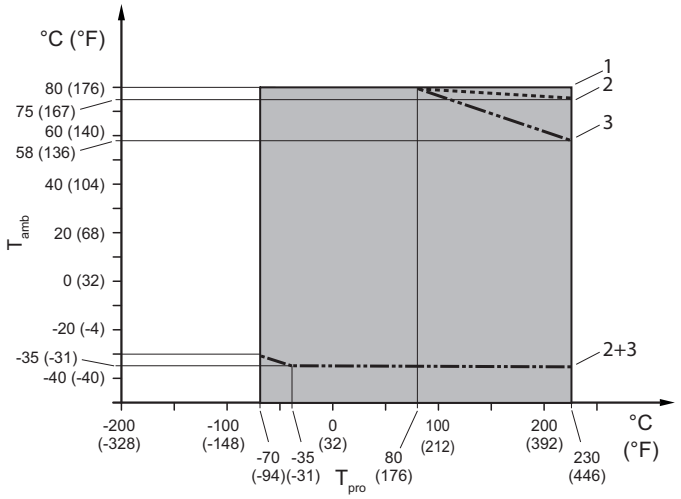


Fig. 19: Allowed process fluid and ambient temperatures, remote type

1 Standard cable option L⎵⎵⎵
2 Limitation for fire retardant cable option Y⎵⎵⎵ without option T⎵⎵
3 Limitation for fire retardant cable option Y⎵⎵⎵ with option T⎵⎵

Temperature specification High-range, remote type

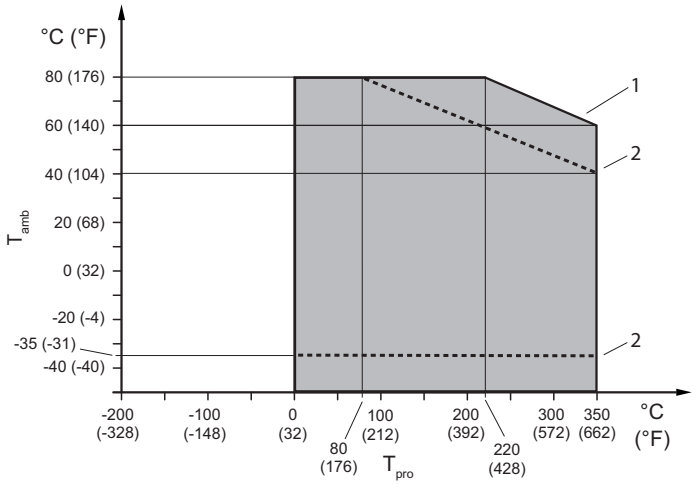


Fig. 20: Allowed process fluid and ambient temperatures, remote type

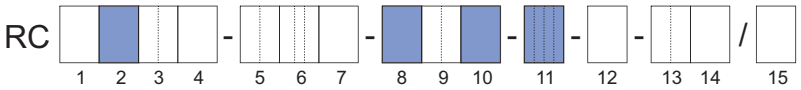
1 Standard cable option L⎵⎵⎵
2 Limitation for fire retardant cable option Y⎵⎵⎵

5.4.2 Temperature specification in hazardous areas

The maximum ambient and process fluid temperatures depending on explosion groups and temperature classes can be determined via the model code or via the model code together with the Ex code (see the corresponding Explosion Proof Type Manual).

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: 0, 2
Pos. 11: ␣F21, FF11
Ex code:
7.89.89.90.54.10

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

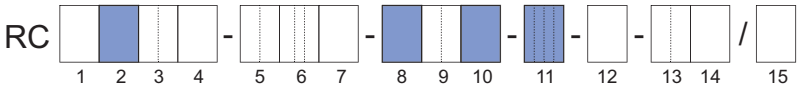


Tab. 4: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)	Maximum fluid temperature in °C (°F)
T6	39 (102)	70 (158)
T5	54 (129)	85 (185)
T4	60 (140)	121 (249)
T3	60 (140)	150 (302)
T2	60 (140)	150 (302)
T1	60 (140)	150 (302)

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: 0, 2
Pos. 11: ␣F22, FF12
Ex code:
7.84.84.86.54.10

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

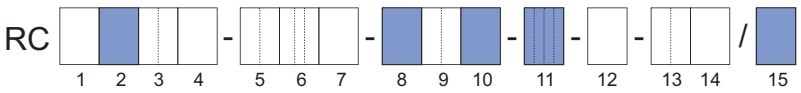


Tab. 5: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)	Maximum fluid temperature in °C (°F)
T6	41 (105)	65 (149)
T5	56 (132)	80 (176)
T4	60 (140)	117 (242)
T3	60 (140)	150 (302)
T2	60 (140)	150 (302)
T1	60 (140)	150 (302)

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: A, E, J
Pos. 11: ␣F21, FF11
Ex code:
7.89.89.90.54.10

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



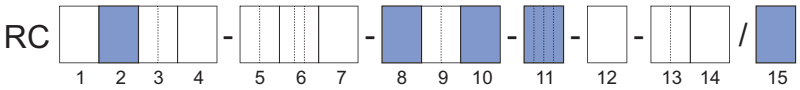
Tab. 6: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	37 (98)	37 (98)	70 (158)
T5	52 (125)	52 (125)	85 (185)
T4	80 (176)	60 (140)	121 (249)
T3	78 (172)	49 (120)	150 (302)
T2	78 (172)	49 (120)	150 (302)
T1	78 (172)	49 (120)	150 (302)

Option Y␣␣␣ not with model code pos. 11: FF11

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: A, E, J
Pos. 11: ␣F22, FF12
Ex code:
7.84.84.86.54.10

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



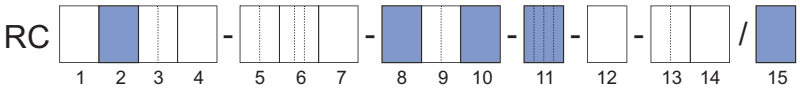
Tab. 7: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	39 (102)	39 (102)	65 (149)
T5	54 (129)	54 (129)	80 (176)
T4	80 (176)	62 (143)	117 (242)
T3	78 (172)	49 (120)	150 (302)
T2	78 (172)	49 (120)	150 (302)
T1	78 (172)	49 (120)	150 (302)

Option Y␣␣␣ not with model code pos. 11: FF12

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: B, F, K
Pos. 11: ␣F21, FF11
Ex code:
7.89.89.90.54.10

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



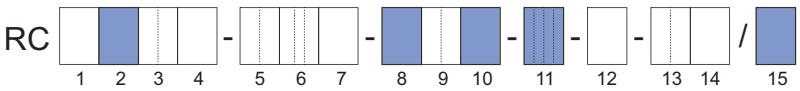
Tab. 8: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	44 (111)	44 (111)	70 (158)
T5	59 (138)	59 (138)	85 (185)
T4	80 (176)	73 (163)	121 (249)
T3	80 (176)	70 (158)	150 (302)
T2	80 (176)	70 (158)	150 (302)
T1	80 (176)	70 (158)	150 (302)

Option Y␣␣␣ not with model code pos. 11: FF11

Model code:
Pos. 2: G
Pos. 8: 0
Pos. 10: B, F, K
Pos. 11: ␣F22, FF12
Ex code:
7.84.84.86.54.10

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



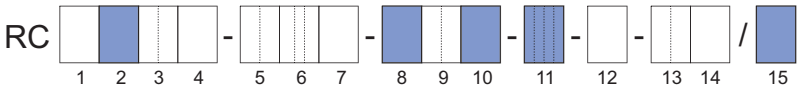
Tab. 9: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	44 (111)	44 (111)	65 (149)
T5	59 (138)	59 (138)	80 (176)
T4	80 (176)	74 (165)	117 (242)
T3	80 (176)	70 (158)	150 (302)
T2	80 (176)	70 (158)	150 (302)
T1	80 (176)	70 (158)	150 (302)

Option Y␣␣␣ not with model code pos. 11: FF12

Model code:
Pos. 2: G
Pos. 8: 2
Pos. 10: B, F, K
Pos. 11: ␣F21, FF11
Ex code:
7.89.89.90.90.80

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



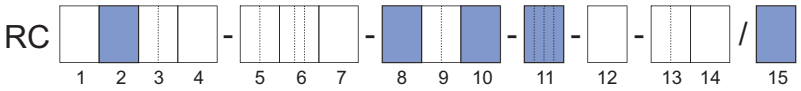
Tab. 10: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	44 (111)	44 (111)	70 (158)
T5	59 (138)	59 (138)	85 (185)
T4	80 (176)	73 (163)	121 (249)
T3	80 (176)	64 (147)	186 (366)
T2	80 (176)	59 (138)	220 (428)
T1	80 (176)	59 (138)	220 (428)

Option Y␣␣␣ not with model code pos. 11: FF11

Model code:
Pos. 2: G
Pos. 8: 2
Pos. 10: B, F, K
Pos. 11: ␣F22, FF12
Ex code:
7.84.84.86.87.80

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



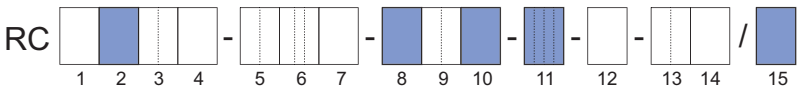
Tab. 11: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	44 (111)	44 (111)	65 (149)
T5	59 (138)	59 (138)	80 (176)
T4	80 (176)	74 (165)	117 (242)
T3	80 (176)	64 (147)	183 (361)
T2	80 (176)	59 (138)	220 (428)
T1	80 (176)	59 (138)	220 (428)

Option Y␣␣␣ not with model code pos. 11: FF12

Model code:
Pos. 2: G
Pos. 8: 3
Pos. 10: B, F, K
Pos. 11: ␣F21, ␣F22, FF11, FF12
Ex code:
–

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



Tab. 12: Temperature classification

Temperature class	Maximum ambient temperature in °C (°F)		Maximum fluid temperature in °C (°F)
	Option L␣␣␣	Option Y␣␣␣	
T6	62 (143)	62 (143)	65 (149)
T5	77 (170)	77 (170)	80 (176)
T4	80 (176)	74 (165)	115 (239)
T3	80 (176)	65 (149)	180 (356)
T2	73 (163)	50 (122)	275 (527)
T1	60 (140)	40 (104)	350 (662)

Option Y␣␣␣ not with model code pos. 11: FF11, FF12

6 Mechanical specification

6.1 Design

The Rotamass Giga flow meter is available with two design types:

- Integral type, sensor and transmitter are firmly connected
- Remote type
  - Standard neck
  - Long neck

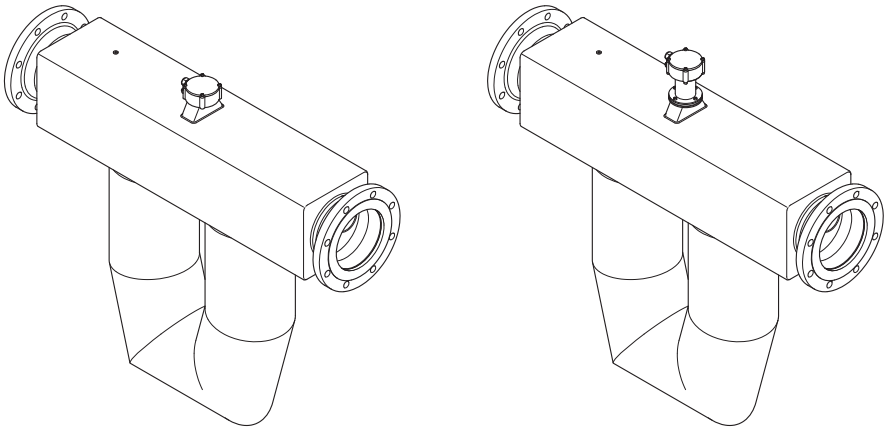
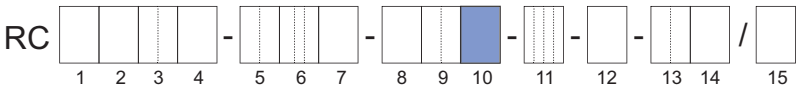


Fig. 21: Standard and long neck



Design type	Design version	Process fluid temperature range	Model code position 10
Integral type	Direct connection	Standard	0, 2
Remote type	Standard neck		A, E, J
	Long neck	Standard Mid-range High	B, F, K

If insulation (e.g. device option / T⎵⎵) is planned, it is mandatory to use the remote type with long neck.

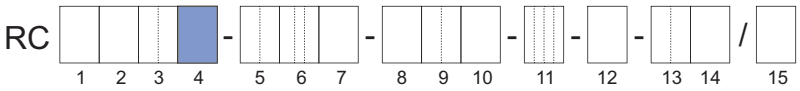
The design influences the temperature specification for Ex-approved Rotamass, see Explosion Proof Type Manual (IM 01U10X⎵⎵-00EN-R).

6.2 Material

6.2.1 Material wetted parts

The wetted parts of Rotamass Giga are available in two material versions.

For corrosive fluids, use of a corrosion-resistant nickel alloy (nickel alloy C-22/2.4602) is recommended for wetted parts.

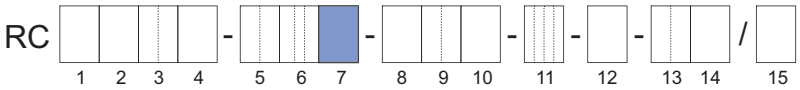


Material	Model code position 4
Stainless steel 1.4404/316L	S
Nickel alloy C-22/2.4602	H

6.2.2 Non-wetted parts

Housing material of sensor and transmitter are specified via model code position 7 and position 10.

Sensor housing material

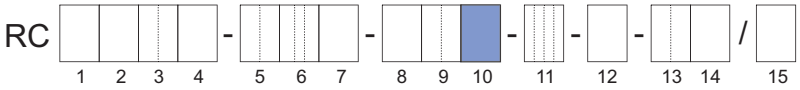


Housing material	Model code position 7
Stainless steel 1.4301/304, 1.4404/316L	0
Stainless steel 1.4404/316L	1

Transmitter housing, coating and bracket material

The transmitter housing is available with different coatings:

- Standard coating
  Urethane-cured polyester powder coating
- Corrosion protection coating
  Three-layer coating with high chemical resistance (polyurethane coating on two layers of epoxy coating)



Housing material	Coating	Design type	Model code position 10	Bracket material
Aluminum Al-Si10Mg(Fe)	Standard coating	Integral type	0	–
		Remote type	A, B	Stainless steel 1.4301/304
	Corrosion protection coating	Integral type	2	–
		Remote type	E, F	Stainless steel 1.4301/304
Stainless steel CF8M	–	Remote type	J, K	Stainless steel 1.4404/316L
	–			

See also *Design and housing [▷ 88]*.

Nameplate

For stainless steel transmitter the nameplates are made of stainless steel 1.4404/316L. Aluminum transmitter nameplates are made of foil.

In case of sensor housing material stainless steel 1.4404/316L (Model code position 7, value 1), nameplates of sensor are made of stainless steel 1.4404/316L. With other sensor housing material and with process fluid temperature range standard the sensor nameplates are made of foil, for other temperature ranges the nameplates are made of stainless steel 1.4404/316L.

6.3 Process connections, dimensions and weights of sensor

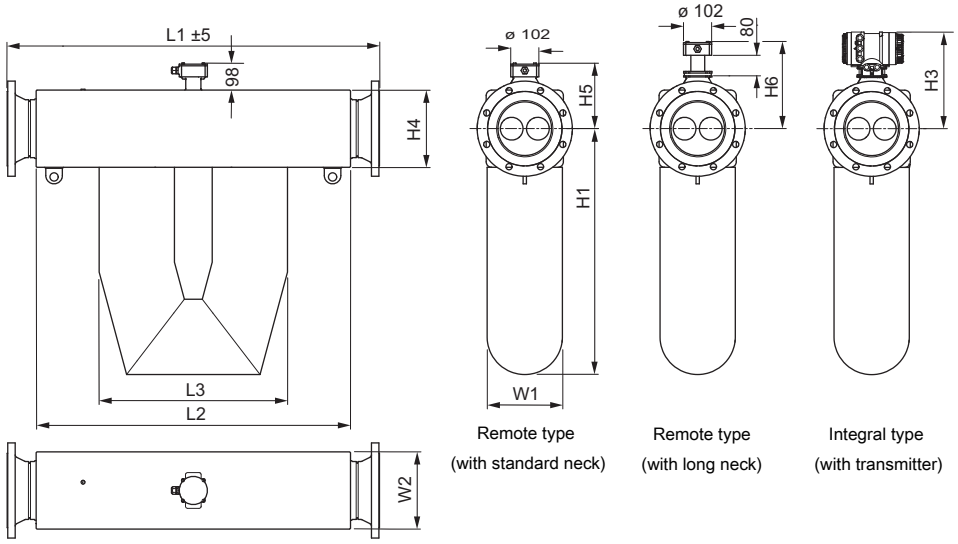


Fig. 22: Dimensions in mm

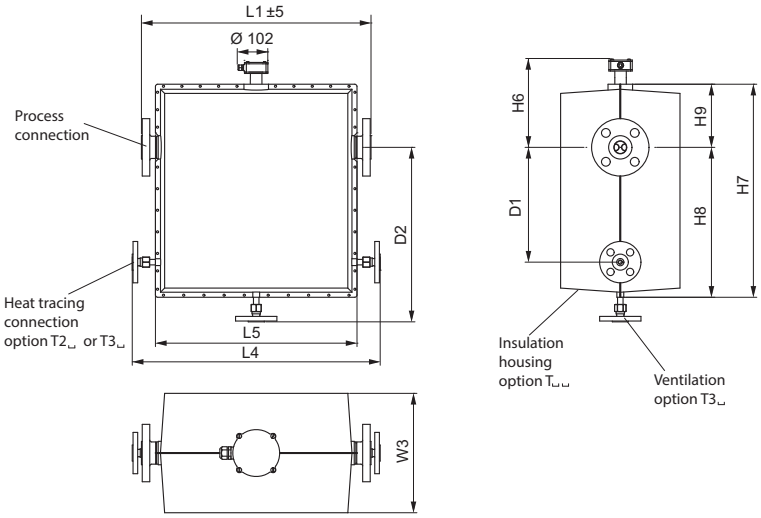


Fig. 23: Dimensions in mm: version with insulation housing

Tab. 13: Dimensions without length L1

Meter size	L2	L3	L4	L5	W1	W2	W3	D1	D2
	in mm (inch)								
Giga 1F	892 (35.1)	691 (27.2)	1050 (41.3)	944 (37.2)	168 (6.6)	176 (6.9)	342 (13.5)	350 (13.8)	677 (26.7)
Giga 2H	1140 (44.9)	683 (26.9)	- (-)	- (-)	273 (10.7)	280 (11)	- (-)	- (-)	- (-)

Meaning of "–": not available

Tab. 14: Dimensions without length L1

Meter size	H1	H3	H4	H5	H6	H7	H8	H9
	in mm (inch)							
Giga 1F	556 (21.9)	327 (12.9)	176 (6.9)	186 (7.3)	266 (10.5)	818 (32.2)	625 (24.6)	193 (7.6)
Giga 2H	891 (35.1)	380 (15)	280 (11)	238 (9.4)	320 (12.6)	- (-)	- (-)	- (-)

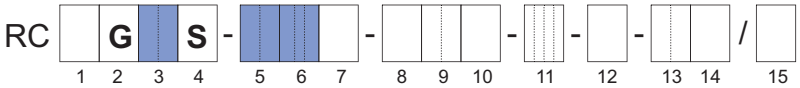
Meaning of "–": not available

Overall length L1 and weight

The overall length of the sensor depends on the selected process connection (type and size of flange). The following tables list the overall length and weight (without insulation or heat tracing) as functions of the individual process connection.

The weights in the tables are for the remote type with standard neck. Additional weight for the remote type with long neck: 1 kg (2.2 lb). Additional weight for the integral type: 3.5 kg (7.7 lb).

Process connections suitable for ASME B16.5

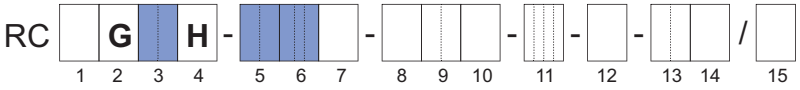


Tab. 15: Overall length L1 and weight of sensor (process connections: ASME, wetted parts: stainless steel)

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
ASME 4" class 150, raised face (RF)	1H	BA1	1100 (43.3)	95 (210)	–	–
ASME 4" class 300, raised face (RF)		BA2	1100 (43.3)	103 (227)	–	–
ASME 4" class 600, raised face (RF)		BA4	1100 (43.3)	112 (246)	–	–
ASME 4" class 600, ring joint (RJ)		CA4	1100 (43.3)	112 (247)	–	–
ASME 5" class 150, raised face (RF)	1Q	BA1	1100 (43.3)	97 (214)	–	–
ASME 5" class 300, raised face (RF)		BA2	1100 (43.3)	109 (239)	–	–
ASME 5" class 600, raised face (RF)		BA4	1160 (45.7)	136 (299)	–	–
ASME 5" class 600, ring joint (RJ)		CA4	1160 (45.7)	136 (301)	–	–

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
ASME 6" class 150, raised face (RF)	1F	BA1	1100 (43.3)	101 (223)	1350 (53.1)	290 (639)
ASME 6" class 300, raised face (RF)		BA2	1100 (43.3)	118 (259)	1350 (53.1)	307 (677)
ASME 6" class 600, raised face (RF)		BA4	1200 (47.2)	149 (329)	1390 (54.7)	332 (732)
ASME 6" class 600, ring joint (RJ)		CA4	1200 (47.2)	150 (331)	1390 (54.7)	333 (733)
ASME 8" class 150, raised face (RF)	2H	BA1	–	–	1350 (53.1)	302 (666)
ASME 8" class 300, raised face (RF)		BA2	–	–	1350 (53.1)	324 (714)
ASME 8" class 600, raised face (RF)		BA4	–	–	1440 (56.7)	371 (818)
ASME 8" class 600, ring joint (RJ)		CA4	–	–	1440 (56.7)	372 (821)

Meaning of "–": not available

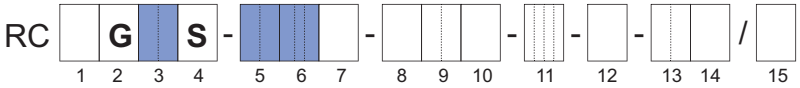


Tab. 16: Overall length L1 and weight of sensor (process connection: ASME, wetted parts: Ni alloy C-22/2.4602)

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
ASME 5" class 150, raised face (RF)	1Q	BA1	1100 (43.3)	99 (219)	–	–
ASME 5" class 300, raised face (RF)		BA2	1100 (43.3)	111 (245)	–	–
ASME 5" class 600, raised face (RF)		BA4	1110 (43.7)	133 (293)	–	–
ASME 6" class 150, raised face (RF)	1F	BA1	1100 (43.3)	106 (235)	–	–
ASME 6" class 300, raised face (RF)		BA2	1100 (43.3)	124 (274)	–	–

Meaning of "–": not available

Process connections suitable for EN 1092-1



Tab. 17: Overall length L1 and weight of sensor (process connections: EN, wetted parts: stainless steel)

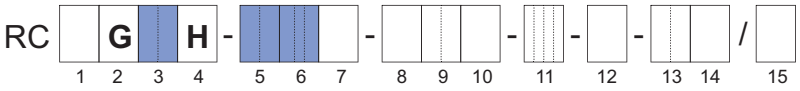
Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
EN DN100 PN16, type B1, raised face (RF)	1H	BD2	1100 (43.3)	92 (202)	–	–
EN DN100 PN16, type D, with groove		GD2	1100 (43.3)	91 (201)	–	–
EN DN100 PN16, type E, with spigot		ED2	1100 (43.3)	91 (200)	–	–
EN DN100 PN16, type F, with recess		FD2	1100 (43.3)	91 (201)	–	–
EN DN100 PN40, type B1, raised face (RF)		BD4	1100 (43.3)	95 (209)	–	–
EN DN100 PN40, type D, with groove		GD4	1100 (43.3)	94 (208)	–	–
EN DN100 PN40, type E, with spigot		ED4	1100 (43.3)	94 (207)	–	–
EN DN100 PN40, type F, with recess		FD4	1100 (43.3)	94 (206)	–	–
EN DN100 PN63, type B1, raised face (RF)		BD5	1100 (43.3)	100 (220)	–	–
EN DN100 PN63, type D, with groove		GD5	1100 (43.3)	99 (219)	–	–
EN DN100 PN63, type E, with spigot		ED5	1100 (43.3)	98 (217)	–	–
EN DN100 PN63, type F, with recess		FD5	1100 (43.3)	99 (218)	–	–
EN DN100 PN100, type B1, raised face (RF)		BD6	1100 (43.3)	106 (233)	–	–
EN DN100 PN100, type D, with groove		GD6	1100 (43.3)	105 (232)	–	–
EN DN100 PN100, type E, with spigot		ED6	1100 (43.3)	104 (230)	–	–
EN DN100 PN100, type F, with recess		FD6	1100 (43.3)	105 (231)	–	–

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
EN DN125 PN16, type B1, raised face (RF)	1Q	BD2	1100 (43.3)	95 (209)	–	–
EN DN125 PN16, type D, with groove		GD2	1100 (43.3)	94 (208)	–	–
EN DN125 PN16, type E, with spigot		ED2	1100 (43.3)	94 (206)	–	–
EN DN125 PN16, type F, with recess		FD2	1100 (43.3)	94 (207)	–	–
EN DN125 PN40, type B1, raised face (RF)		BD4	1100 (43.3)	99 (218)	–	–
EN DN125 PN40, type D, with groove		GD4	1100 (43.3)	99 (217)	–	–
EN DN125 PN40, type E, with spigot		ED4	1100 (43.3)	98 (216)	–	–
EN DN125 PN40, type F, with recess		FD4	1100 (43.3)	98 (216)	–	–
EN DN125 PN63, type B1, raised face (RF)		BD5	1100 (43.3)	109 (240)	–	–
EN DN125 PN63, type D, with groove		GD5	1100 (43.3)	108 (239)	–	–
EN DN125 PN63, type E, with spigot		ED5	1100 (43.3)	107 (237)	–	–
EN DN125 PN63, type F, with recess		FD5	1100 (43.3)	108 (238)	–	–
EN DN125 PN100, type B1, raised face (RF)		BD6	1140 (44.9)	121 (267)	–	–
EN DN125 PN100, type D, with groove		GD6	1140 (44.9)	121 (266)	–	–
EN DN125 PN100, type E, with spigot		ED6	1140 (44.9)	119 (263)	–	–
EN DN125 PN100, type F, with recess		FD6	1140 (44.9)	120 (265)	–	–

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
EN DN150 PN16, type B1, raised face (RF)	1F	BD2	1100 (43.3)	98 (216)	1350 (53.1)	288 (634)
EN DN150 PN16, type D, with groove		GD2	1100 (43.3)	98 (215)	1350 (53.1)	287 (633)
EN DN150 PN16, type E, with spigot		ED2	1100 (43.3)	97 (214)	1350 (53.1)	286 (631)
EN DN150 PN16, type F, with recess		FD2	1100 (43.3)	97 (214)	1350 (53.1)	287 (632)
EN DN150 PN40, type B1, raised face (RF)		BD4	1100 (43.3)	105 (231)	1350 (53.1)	294 (648)
EN DN150 PN40, type D, with groove		GD4	1100 (43.3)	104 (230)	1350 (53.1)	293 (647)
EN DN150 PN40, type E, with spigot		ED4	1100 (43.3)	103 (228)	1350 (53.1)	293 (645)
EN DN150 PN40, type F, with recess		FD4	1100 (43.3)	104 (228)	1350 (53.1)	293 (646)
EN DN150 PN63, type B1, raised face (RF)		BD5	1140 (44.9)	124 (274)	1350 (53.1)	311 (685)
EN DN150 PN63, type D, with groove		GD5	1140 (44.9)	124 (273)	1350 (53.1)	310 (684)
EN DN150 PN63, type E, with spigot		ED5	1140 (44.9)	122 (269)	1350 (53.1)	309 (681)
EN DN150 PN63, type F, with recess		FD5	1140 (44.9)	123 (272)	1350 (53.1)	310 (683)
EN DN150 PN100, type B1, raised face (RF)		BD6	1180 (46.5)	138 (303)	–	–
EN DN150 PN100, type D, with groove		GD6	1180 (46.5)	137 (302)	–	–
EN DN150 PN100, type E, with spigot		ED6	1180 (46.5)	136 (299)	–	–
EN DN150 PN100, type F, with recess		FD6	1180 (46.5)	137 (301)	–	–

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
EN DN200 PN16, type B1, raised face (RF)	2H	BD2	–	–	1350 (53.1)	294 (649)
EN DN200 PN16, type D, with groove		GD2	–	–	1350 (53.1)	294 (647)
EN DN200 PN16, type E, with spigot		ED2	–	–	1350 (53.1)	293 (646)
EN DN200 PN16, type F, with recess		FD2	–	–	1350 (53.1)	293 (646)
EN DN200 PN40, type B1, raised face (RF)		BD4	–	–	1350 (53.1)	311 (685)
EN DN200 PN40, type D, with groove		GD4	–	–	1350 (53.1)	310 (683)
EN DN200 PN40, type E, with spigot		ED4	–	–	1350 (53.1)	308 (680)
EN DN200 PN40, type F, with recess		FD4	–	–	1350 (53.1)	309 (682)
EN DN200 PN63, type B1, raised face (RF)		BD5	–	–	1350 (53.1)	333 (733)
EN DN200 PN63, type D, with groove		GD5	–	–	1350 (53.1)	332 (732)
EN DN200 PN63, type E, with spigot		ED5	–	–	1350 (53.1)	330 (728)
EN DN200 PN63, type F, with recess		FD5	–	–	1350 (53.1)	331 (730)

Meaning of "–": not available

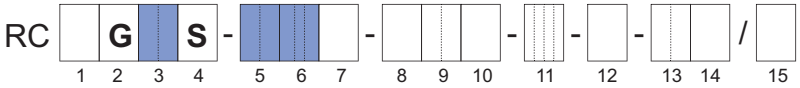


Tab. 18: Overall length L1 and weight of sensor (process connections: EN, wetted parts: Ni alloy C-22/2.4602)

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
EN DN125 PN16, type B1, raised face (RF)	1Q	BD2	1100 (43.3)	96 (212)	–	–
EN DN125 PN40, type B1, raised face (RF)		BD4	1100 (43.3)	101 (222)	–	–
EN DN150 PN16, type B1, raised face (RF)	1F	BD2	1100 (43.3)	103 (227)	–	–
EN DN150 PN40, type B1, raised face (RF)		BD4	1100 (43.3)	110 (241)	–	–

Meaning of "–": not available

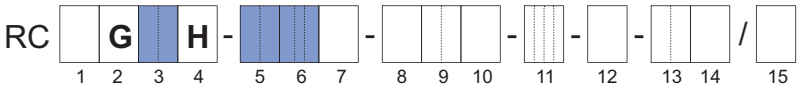
Process connections suitable for JIS B 2220



Tab. 19: Overall length L1 and weight of sensor (process connections: JIS, wetted parts: stainless steel)

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
JIS DN100 10K	1H	BJ1	1100 (43.3)	91 (200)	–	–
JIS DN100 20K		BJ2	1100 (43.3)	94 (208)	–	–
JIS DN125 10K	1Q	BJ1	1100 (43.3)	94 (207)	–	–
JIS DN125 20K		BJ2	1100 (43.3)	101 (222)	–	–

Meaning of "–": not available



Tab. 20: Overall length L1 and weight of sensor (process connections: JIS, wetted parts: Ni alloy C-22/2.4602)

Process connections	Model code pos.		Giga 1F		Giga 2H	
	5	6	L1 in mm (inch)	Weight in kg (lb)	L1 in mm (inch)	Weight in kg (lb)
JIS DN125 10K	1Q	BJ1	1100 (43.3)	97 (213)	–	–
JIS DN125 20K		BJ2	1100 (43.3)	103 (228)	–	–

Meaning of "–": not available

6.4 Transmitter dimensions and weights

Transmitter dimensions

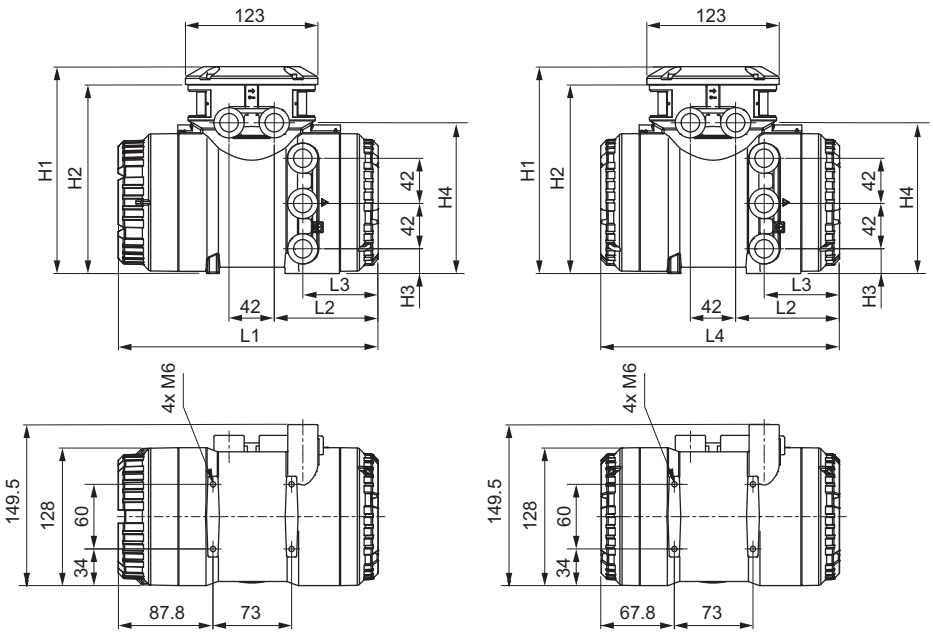


Fig. 24: Dimensions of transmitter in mm
(left: transmitter with display, right: transmitter without display)

Tab. 21: Overall length L1 - L4 and height H1 - H4 of transmitter (material: stainless steel, aluminum)

Material	L1 in mm (inch)	L2 in mm (inch)	L3 in mm (inch)	L4 in mm (inch)	H1 in mm (inch)	H2 in mm (inch)	H3 in mm (inch)	H4 in mm (inch)
Stainless steel	255.5 (10.06)	110.5 (4.35)	69 (2.72)	235 (9.25)	201 (7.91)	184 (7.24)	24 (0.94)	150.5 (5.93)
Aluminum	241.5 (9.51)	96.5 (3.8)	70 (2.76)	221 (8.7)	192 (7.56)	175 (6.89)	23 (0.91)	140 (5.51)

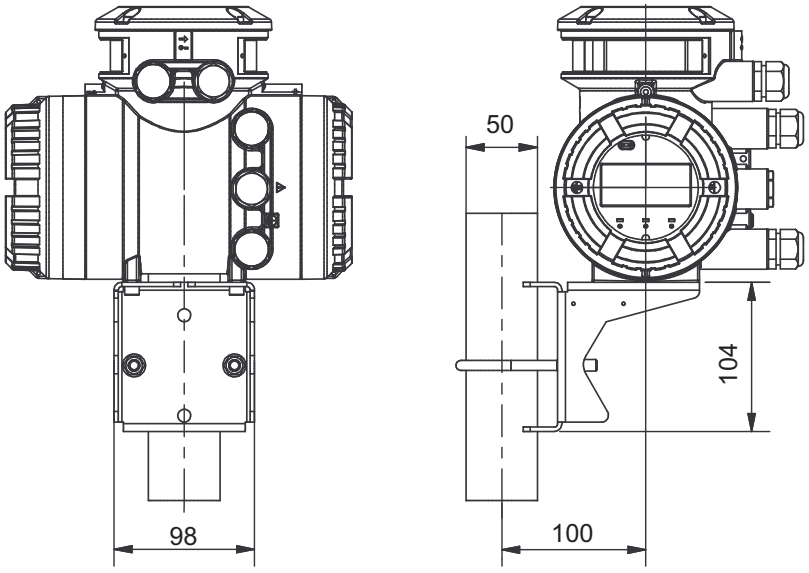
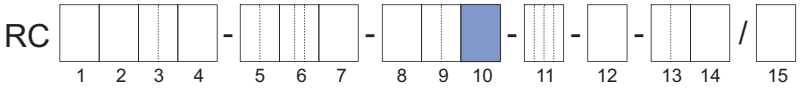


Fig. 25: Dimensions of transmitter in mm, attached by sheet metal console (bracket)

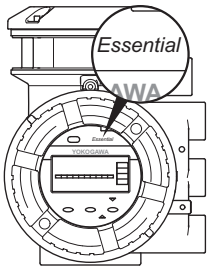
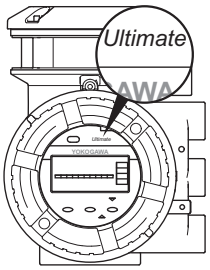


Transmitter weights

Model code (pos. 10)	Design type	Housing material of transmitter	Weight in kg (lb)
A, B, E, F	Remote	Aluminum	4.2 (9.3)
J, K		Stainless steel	12.5 (27.6)

7 Transmitter specification

Overview of functional scope of the Rotamass transmitter

	Transmitter	
Functional scope	Essential	Ultimate
		
Model code (position 1)	E	U
4-line Dot-Matrix display	●	●
Universal power supply (V_{DC} and V_{AC})	●	●
microSD card	●	●
Installation		
Integral type	●	●
Remote type	●	●
Features on Demand	–	●
Special functions		
Wizard	●	●
Event management	●	●
Total health check[1)] (diagnostic function)	●	●
Dynamic pressure compensation[2)]	–	●
Advanced functions		
Standard concentration measurement	–	●
Advanced concentration measurement	–	●
Measurement of heat quantity[2)]	–	●
Net Oil Computing following API standard	–	●
Tube health check (diagnostic function)	●	●
Batching function	–	●
Viscosity function[2)]	–	●
Inputs and outputs		
Analog output	●	●
Pulse/frequency output	●	●
Status output	●	●
Analog input	–	●
Status input	●	●
Communication		
HART	●	●
Modbus	●	●

meaning of "–": not available;
meaning of "●": available

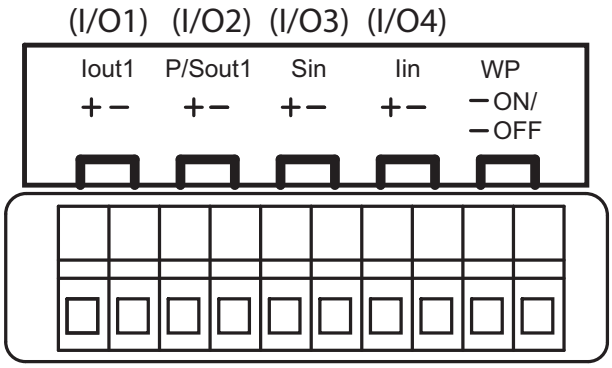
[1)] Function is based on external software (FieldMate)

[2)] Only in combination with an analog input

7.1 Inputs and outputs

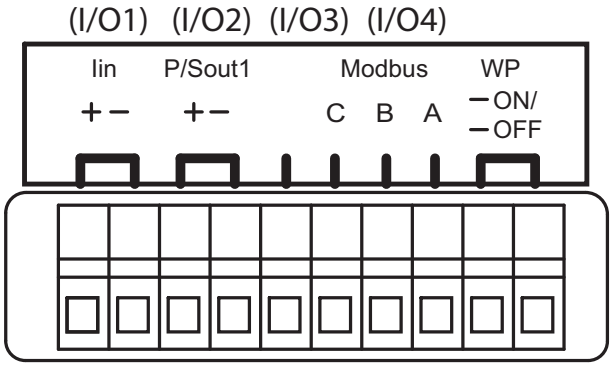
Depending on the flow meter specification, there are different configurations of the connection terminal. Following are configuration examples of the connection terminal (value JK and M7 on model code position 13 - see *Communication type and I/O [▶ 89]* for details):

HART



I/O1:	Iout1	Current output (active/passive)
I/O2:	P/Sout1	Pulse or status output (passive)
I/O3:	Sin	Status input
I/O4:	Iin	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

7.1.1 Output signals

Galvanic isolation

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

Active current output *Iout*

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

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

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

- 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 *Iout1*. 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
Additive maximum deviation	8 µA
Additive output deviation for deviation from 20 °C ambient temperature	0.8 µA/ °C

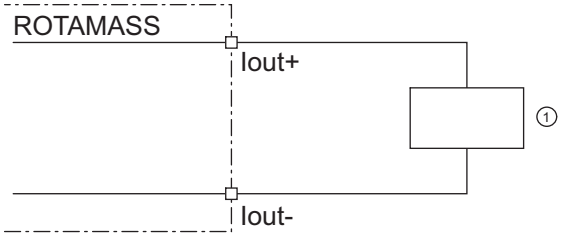


Fig. 26: Active current output connection *Iout* HART

① Receiver

Passive current output *Iout*

	Value
Nominal output current	4 – 20 mA
Maximum output current range	2.4 – 21.6 mA
External power supply	10.5 – 32 V_{DC}
Load resistance for secure HART communication	230 – 600 Ω
Load resistance at current output	≤ 911 Ω
Additive maximum deviation	8 µA
Additive output deviation for deviation from 20 °C ambient temperature	0.8 µA/ °C

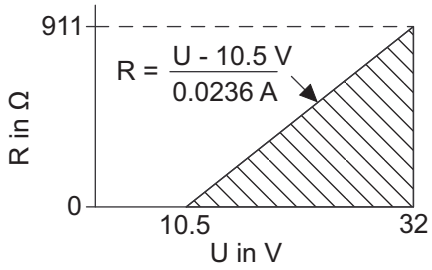


Fig. 27: Maximum load resistance as a function of an external power supply voltage

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.

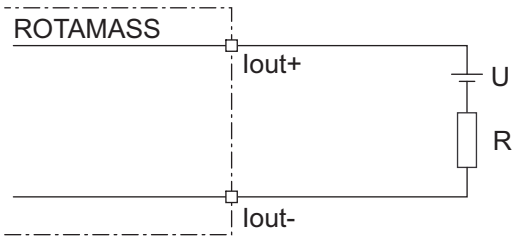


Fig. 28: Passive current output connection *Iout*

Active pulse output *P/Sout*

Connection of an electronic counter

Maximum voltage and correct polarity must be observed for wiring.

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

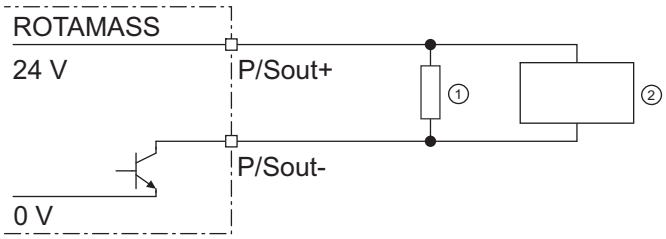


Fig. 29: Active pulse output connection *P/Sout*

① Load resistance
② Electronic counter

Connection of an electromechanical counter

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

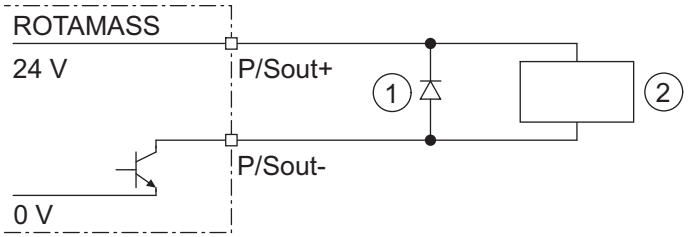


Fig. 30: Active pulse output *P/Sout* connection with electromechanical counter

① Protective diode
② Electromechanical counter

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

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

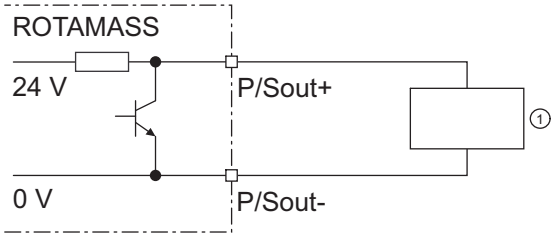


Fig. 31: Active pulse output *P/Sout* with internal pull-up resistor

① Electronic counter

Passive pulse output *P/Sout*

Maximum voltage and correct polarity must be observed for wiring.

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

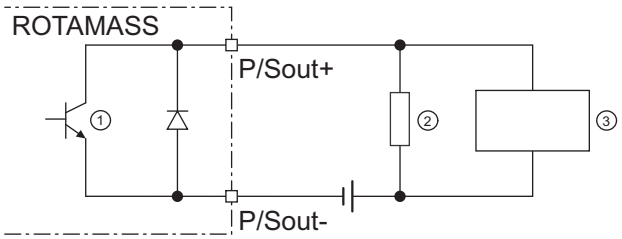


Fig. 32: Passive pulse output connection *P/Sout* with electronic counter

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

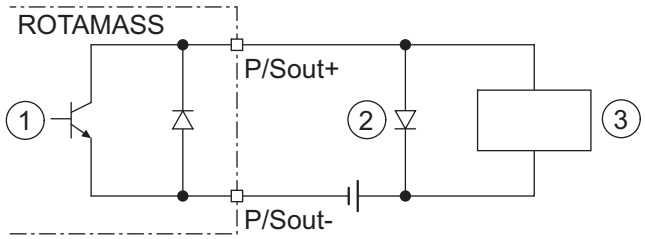


Fig. 33: Passive pulse output *P/Sout* connection with electromechanical counter

① Passive pulse or status output
② Protective diode
③ Electromechanical counter

Active status output *P/Sout*

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

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

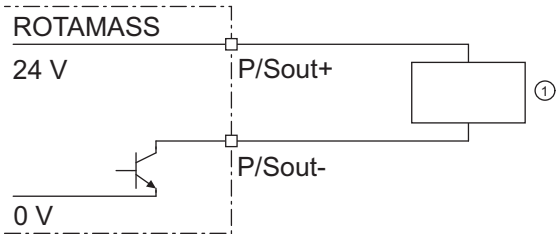


Fig. 34: Active status output connection *P/Sout*

① External device with load resistance

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

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

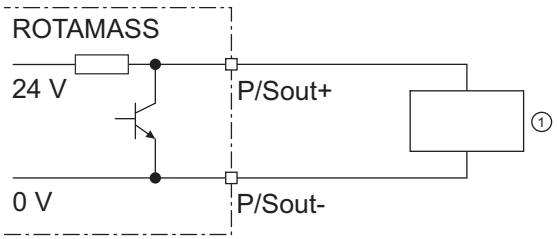


Fig. 35: Active status output *P/Sout* with internal pull-up resistor

① External device

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

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

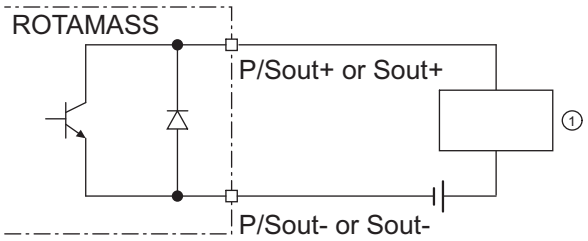


Fig. 36: Passive status output connection *P/Sout* or *Sout*

① External device

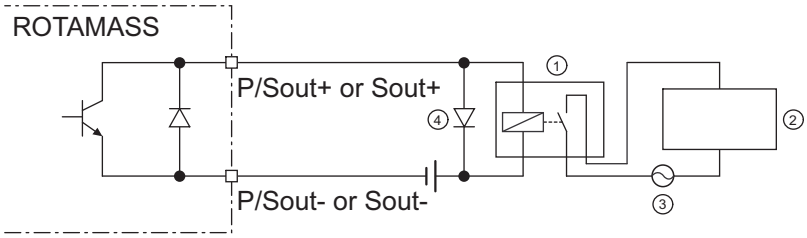


Fig. 37: Passive status output connection *P/Sout* or *Sout* for solenoid valve circuit

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):

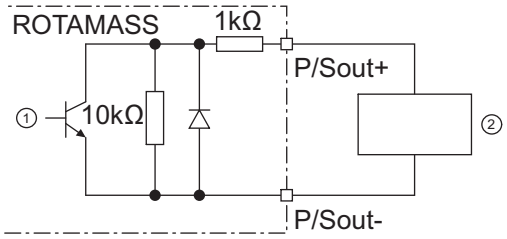


Fig. 38: Passive pulse or status output with switching amplifier connected in series

① Passive pulse or status output
② Switching amplifier

7.1.2 Input signals

Active current input *lin*

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

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

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

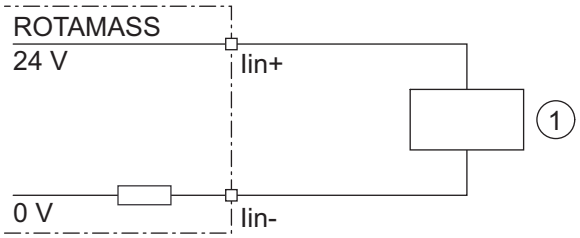


Fig. 39: Connection of external device with passive current output

① External passive current output device

Passive current input *lin*

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

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

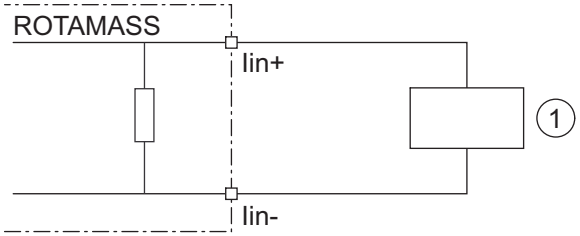


Fig. 40: Connection of external device with active current output

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

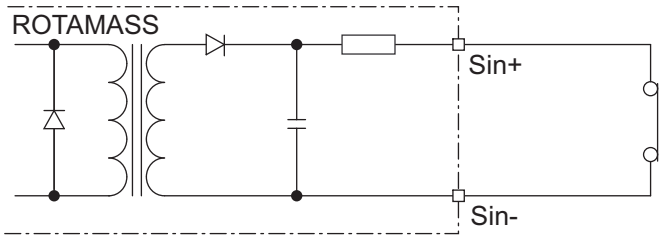


Fig. 41: Status input connection

7.2 Power supply

Power supply

Alternating voltage (rms):

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

Direct-current voltage:

- Power supply[1)]: 24 V_{DC} +20 % -15 % or 100 – 120 V_{DC} +8,3 % -10 %

[1)] for option MC_ (DNV GL approval) supply voltage is limited to 24 V

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.

7.3 Cable specification

With the remote type, the original connecting cable from Rota Yokogawa must be used to connect the sensor with the transmitter. The connecting cable included in the delivery may be shortened. An assembly set along with the appropriate instructions are enclosed for this purpose.

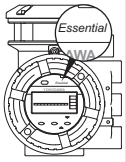
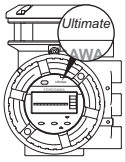
The connecting cable can be ordered as option in various lengths as a standard type (device options L____) or as marine approved fire retardant cable (device options Y____), see chapters *Connecting cable type and length [▶ 93]* and *Marine Approval [▶ 100]* for details.

The maximum cable length to keep the specification is 30 m (98.4 ft). Longer cables must be ordered as a separate item, refer to *Connecting cable type and length [▶ 93]*.

8 Advanced functions and Features on Demand (FOD)

Rotamass Total Insight includes many dedicated application and maintenance functions that can be ordered simultaneously with the device or can be purchased and activated in a second time (only with the Ultimate transmitter).

Advanced functions

	Transmitter		Communication type and I/O		
Functional scope	Essential	Ultimate	Available type		Mandatory I/O
			HART	Modbus	
Model code (pos. 1 and 13)	E	U	J␣	M␣	
Standard concentration measurement	–	●	●	●	Not needed
Advanced concentration measurement	–	●	●	●	
Net Oil Computing following API standard	–	●	●	●	
Tube health check	●	●	●	●	
Batching function	–	●	●	–	1 status output for one-stage batching 2 status outputs for two-stage batching
Viscosity function	–	●	●	–	1 analog input
Measurement of heat quantity	–	●	●	●	1 analog input

meaning of "–": not available;
meaning of "●": available

8.1 Concentration and petroleum measurement

Standard concentration measurement

The standard concentration measurement (option CST) can be used for concentration measurements of emulsions or suspensions when density of the fluid involved depends only on temperature.

The standard concentration measurement can also be used for many low-concentration solutions if there is only minor interaction between the liquids or if the miscibility is negligible. For questions regarding a specific application, contact the responsible Yokogawa sales organization. The appropriate density coefficients must be determined prior to using this option and input into the transmitter. To do so, the recommendation is to determine the necessary parameters from density data using DTM in the Yokogawa FieldMate program or the calculation tool included in the delivery.

Petroleum measurement function NOC (option C52)

"NOC" is an abbreviation for the "Net Oil Computing" function that provides real-time measurements of water cut and includes "API" (American Petroleum Institute) correction according to API MPMS Chapter 11.1.

Oil sometimes contains entrained gas. Rotamass Total Insight measures the density of the emulsion oil and gas that result to be lower than the oil density. If the measured density is used to calculate volume flow of oil, the result would not be correct. Therefore NOC function (option C52) includes also a Gas Void Fraction function (GVF). GVF may reduce the error in oil volume flow calculation at a minimum recognizing the occurrence of gas in the oil and using the oil density to calculate the volume flow.

Oil properties can be selected using Oil type's pre-settings or using "Alpha 60".

Oil and water types predefined in the functions	
Oil types	Water types
▪ Crude ▪ Refined Products: Fuel, Jet Fuel, Transition, Gasoline ▪ Lubricating ▪ Custom Oil	▪ Standard Mean Ocean Water ▪ UNESCO 1980 ▪ Fresh water density by API MPMS 11.4 ▪ Produced water density by API MPMS 20.1 Appendix A.1 ▪ Brine water density by El-Dessouky, Ettouy (2002) ▪ Custom

In addition to water cut, the function can calculate: Net oil mass flow, net water mass flow, net oil volume flow, net water volume flow and net corrected oil volume flow.

Advanced concentration measurement

The advanced concentration measurement (option AC␣) is recommended for more complex applications, such as for liquids that interact.

Following is a table that lists possible pre-configured concentrations. The desired data sets must be requested by the customer to the Yokogawa sales organization at the time the order is placed. The customer is responsible to ensure chemical compatibility of the material of the wetted parts with the measured chemicals. For strong acids or oxidizers which attack steel pipes a variant with wetted parts made of Ni alloy C-22/2.4602 is necessary.

Set	Fluid A / B	Concentration range	Unit	Temperature range in °C	Density range in kg/l	Data source for density data
C01	Sugar / Water	0 – 85	°Bx	0 – 80	0.97 – 1.45	PTB... Messages 100 5/90: "The density of watery sucrose solutions after the introduction of the international temperature scale of 1990 (ITS1990)" Table 5
C02 [1)]	NaOH / Water	0 – 54	WT%	0 – 100	0.95 – 1.58	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
C03	KOH / Water	1 – 55	WT%	54 – 100	1.01 – 1.58	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
C04	NH_4NO_3 / Water	1 – 50	WT%	0 – 80	0.97 – 1.24	Table of density data on request
C05	NH_4NO_3 / Water	20 – 70	WT%	20 – 100	1.04 – 1.33	Table of density data on request
C06 [1)]	HCl / Water	22 – 34	WT%	20 – 60	1.08 – 1.17	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
C07	HNO_3 / Water	50 – 67	WT%	10 – 60	1.26 – 1.40	Table of density data on request
C09 [1)]	H_2O_2 / Water	30 – 75	WT%	4.5 – 43.5	1.00 – 1.20	Table of density data on request
C10 [1)]	Ethylene glycol / Water	10 – 50	WT%	-20 – 40	1.005 – 1.085	Table of density data on request
C11	Starch / Water	33 – 42.5	WT%	35 – 45	1.14 – 1.20	Table of density data on request
C12	Methanol / Water	35 – 60	WT%	0 – 40	0.89 – 0.96	Table of density data on request
C20	Alcohol / Water	55 – 100	VOL%	10 – 40	0.76 – 0.94	Table of density data on request
C21	Sugar / Water	40 – 80	°Bx	75 – 100	1.15 – 1.35	Table of density data on request
C30	Alcohol / Water	66 – 100	WT%	15 – 40	0.77 – 0.88	Standard Copersucar 1967
C37	Alcohol / Water	66 – 100	WT%	10 – 40	0.772 – 0.885	Brazilian Standard ABNT

[1)] We recommend using devices with wetted parts made of nickel alloy C22. Contact the Yokogawa sales organization about availability.

Maximum 4 C␣␣ option sets can be ordered for one device simultaneously.

For details about the ordering information, see *Concentration and petroleum measurement [▷ 94]*.

8.2 Batching function

Batching and filling processes are typical applications in different industries as food and beverage, cosmetic, pharmaceutical, chemical and oil & gas.

Rotamass Total Insight offers an integrated “Batching function” to automatize the task. A “self-learning” algorithm optimizes the process and allows high accurate results.

The function supports two filling modes:

- one-stage mode with single valve
- two-stage mode to control two valves for accurate filling

Without using an external flow computer, data related to the process can be transmitted via communication protocol. The error management function allows the user to set alarms and warnings accordingly the application needs.

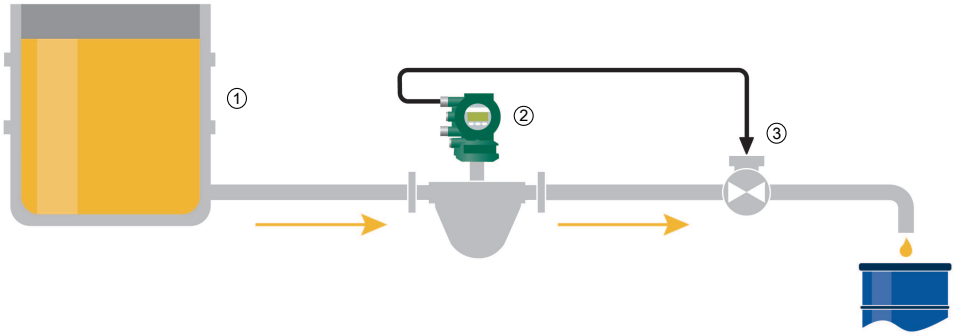


Fig. 42: One-stage mode (The above diagram illustrates the fundamental functionality for one of several combination possibilities)

①	Storage tank	③	Valve
②	Rotamass Total Insight		

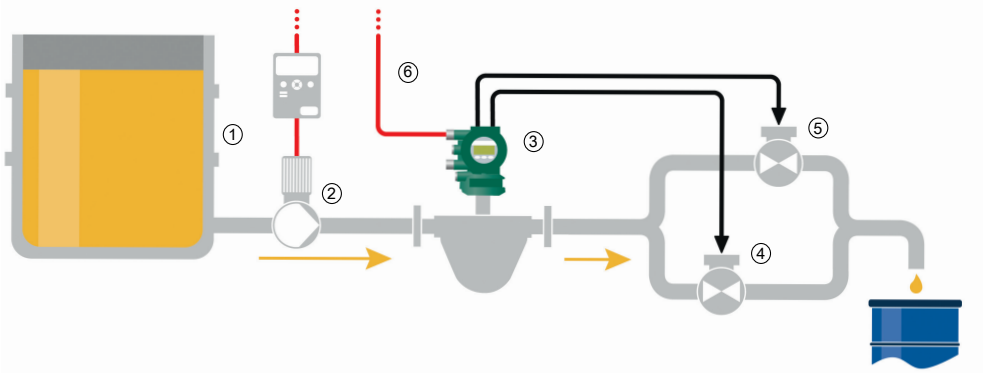


Fig. 43: Two-stage mode (The above diagram illustrates the fundamental functionality for one of several combination possibilities)

①	Storage tank	④	Valve "A"
②	Pump	⑤	Valve "B"
③	Rotamass Total Insight	⑥	HART

For details about the ordering information, see *Batching function [▶ 94]*.

8.3 Viscosity function

Viscosity function allows the user to have an estimation of the viscosity of the fluid.

The function can be used as redundant viscosity control or as reference value to activate other processes like for instance fluid heating systems.

The viscosity estimation is calculated based on a comparison between measured pressure loss Δp and a “calculated” Δp_{cal} between two points of the pipe nearby the flow meter (refer to related instruction manual for the correct installation).

In order to use the function a pressure measurement device (separate order) directly connected to the analog input of the Rotamass Total Insightis necessary. Based on iteration process, Rotamass Total Insight finds the value of viscosity μ that returns a Δp_{cal} closed to the measured Δp.

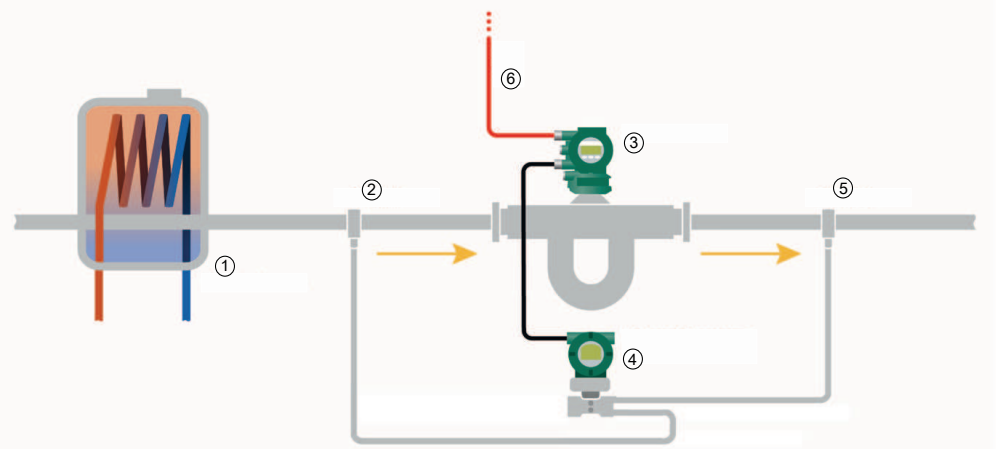


Fig. 44: Viscosity function returns a reference value used to activate a heating system (The above diagramm illustrates the fundamental functionality for one of several installation possibilities)

①	Heat exchanger	④	Differential pressure transmitter
②	Pressure tap 1	⑤	Pressure tap 2
③	Rotamass Total Insight	⑥	HART

For details about the ordering information, see *Viscosity function [▷ 94]*.

8.4 Tube health check

Tube health check function is a valuable diagnostic function that returns the status of the measuring tubes of the Rotamass Total Insight giving the possibility to set up a real predictive maintenance system or to detect corrosion or clogging of the measuring tubes.

The function is able to measure periodically the change of the stiffness of the measuring tubes. Storage of the values in the internal microSD card is available for HART communication type.
Measurement values can be also transmitted via HART or Modbus protocol and therefore integrated in the customers condition monitoring system.
An alarm or an external event can be activated directly from Rotamass Total Insight in case the measured value exceeds a threshold defined by the user.

Thanks to the PC based software FieldMate, the single measurements can be plotted in a diagram and printed in a report for quality and maintenance documentation.

For details about the ordering information, see *Tube health check [▷ 99]*.

8.5 Measurement of heat quantity

The function allows to evaluate the total fuel calorific value of the measured fluid.
The function can work with a constant value of the calorific value of the fluid, but in order to have a precise evaluation we suggest to use an additional device like a gas chromatograph (not included in the supply). The external device that supplies the instantaneous calorific value is connected with the current input of the transmitter (model code position 13: from JH to JN). Based on the mass flow, the total calorific energy of the fluid is calculated as below:

Formula for total calorific energy

$$\Sigma E_{cal} = \Sigma (Q_m \times H_i \times \Delta t)$$

E_{cal}	Calorific energy
Q_m	Mass flow rate
H_i	Calorific value variable
Δt	Time interval between two measurements

Other formula based on volume and corrected volume are included in the function and can be set using the display or the configuration PC software FieldMate.

For details about the ordering information, see *Measurement of heat quantity [▷ 99]*.

8.6 Features on Demand (FOD)

In combination with the “Ultimate” transmitter, the functions can be purchased and activated later as “Features on Demand”.

After the order, the user receives a KeyCode for input in the transmitter. To activate the desired functions, refer to related software instruction manual (IM01U10S0␣-00␣␣-R).

The options of FOD functions for Rotamass Total Insight are shown below.

To order these functions refer to the related general specifications for FOD functions (GS01U10B20-00␣␣-R).

Option category	Options	Description	Valid from main SW rev.[1]	
			Modbus	HART
Concentration and petroleum measurement	CST	Standard concentration measurement	R1.01.01	R1.01.02
	AC0	Advanced concentration measurement, customer settings		
	C52	Net Oil Computing (NOC) following API standard		R3.01.01
Batching function	BT	Batching and filling function	–	
Viscosity function	VM	Viscosity computing function for liquids		
Measurement of heat quantity	CGC	Measurement of the total transported energy content of a fuel in connection with a sensor for determining the fuel's calorific value (e.g. a gas chromatograph, not included in scope of delivery).	R1.01.01	R1.01.02
Tube health check	TC	Tube health check	R1.01.01	R1.01.02[2]

[1] Main software revision is given by the transmitter for which the FODs are intended for. For details refer to software instruction manual (IM01U10S0␣-00␣␣-R).

[2] From software rev. R3.01.01 tube health check includes trend line report (by FieldMate) and the possibility to store the data on microSD card.

Please be sure that your device is compatible with the selected function and in case of doubts please contact Yokogawa Service Department providing the serial number or the model code of the device where you want activate the function.

9 Approvals and declarations of conformity

CE marking

The Rotamass Total Insight meets the statutory requirements of the applicable EU Directives. By attaching the CE mark, Rota Yokogawa confirms conformity of the field instrument with the requirements of the applicable EU Directives. The EU Declaration of Conformity is enclosed with the product on a data carrier.

RCM

Rotamass Total Insight meets the EMC requirements of the Australian Communications and Media Authority (ACMA).

Ex approvals

All data relevant for explosion protection are included in separate Explosion Proof Type Manuals.

NACE

Chemical composition of wetted materials 316L/316/1.4404/1.4401/1.4435 and Ni-Alloy C-22/2.4602 are conform to:

- ANSI / NACE-MR0175 / ISO15156-2
- ANSI / NACE-MR0175 / ISO15156-3
- NACE MR0103

For details please see Rota Yokogawa declaration about NACE conformity 8660001.

Pressure equipment approvals

The Rotamass Total Insight is in compliance with the statutory requirements of the applicable EU Pressure Equipment Directive (PED).

The customer is fully responsible of selecting proper materials which withstand 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 or erosion. If corrosion or erosion may happen, the user has to check periodically if the necessary wall thickness is still in place.

Functional safety

The Rotamass Total Insight with HART communication type complies with the relevant safety management requirements of IEC 61508:2010 SIL3. The Rotamass Total Insight product families can be used to implement a SIL 2 safety function (with HFT = 0) or a SIL 3 safety function (with HFT = 1) with all its 4 – 20 mA outputs. The available number of outputs depends on the model code. For further information please contact Yokogawa sales department or look here
http://www.exida.com/SAEL-Safety/yokogawa-electric-corporation-rotamass-ti-series

Tab. 22: Approvals and certifications

Type	Approval or certification
ATEX	EU Directive 2014/34/EU ATEX approval: DEKRA 15ATEX0023 X CE $_{0344}$ II2G or II2(1)G or II2D or II2(1)D Applied standards: ▪ EN 60079-0 +A11 ▪ EN 60079-1 ▪ EN 60079-7 ▪ EN 60079-11 ▪ EN 60079-31
	Remote transmitter (depending on the model code): Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb or Ex db [ia Ga] IIB T6 Gb or Ex db e [ia Ga] IIB T6 Gb Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex db e [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex tb [ia Da] IIIC T75 °C Db Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.
	Remote sensor (depending on the model code): Ex ib IIC T6…T1 Gb or Ex ib IIB T6…T1 Gb Ex ib IIIC T150 °C Db or Ex ib IIIC T220 °C Db or Ex ib IIIC T350 °C Db
	Integral type (depending on the model code): Ex db ib IIC T6...T1 Gb or Ex db e ib IIC T6...T1 Gb or Ex db ib IIB T6...T1 Gb or Ex db e ib IIB T6...T1 Gb or Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db e ib [ia Ga] IIC T6...T1 Gb or Ex db ib [ia IIC Ga] IIB T6...T1 Gb or Ex db e ib [ia IIC Ga] IIB T6...T1 Gb Ex ib tb IIIC T150 °C Db or Ex ib tb [ia Da] IIIC T150 °C Db Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.

Type	Approval or certification
IECEx	IECEx approval: IECEx DEK 15.0016X Applied standards: ▪ IEC 60079-0 ▪ IEC 60079-1 ▪ IEC 60079-7 ▪ IEC 60079-11 ▪ IEC 60079-31
	Remote transmitter (depending on the model code): Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb or Ex db [ia Ga] IIB T6 Gb or Ex db e [ia Ga] IIB T6 Gb Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex db e [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex tb [ia Da] IIIC T75 °C Db Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.
	Remote sensor (depending on the model code): Ex ib IIC T6…T1 Gb or Ex ib IIB T6…T1 Gb Ex ib IIIC T150 °C Db or Ex ib IIIC T220 °C Db or Ex ib IIIC T350 °C Db
	Integral type (depending on the model code): Ex db ib IIC T6...T1 Gb or Ex db e ib IIC T6...T1 Gb or Ex db ib IIB T6...T1 Gb or Ex db e ib IIB T6...T1 Gb or Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db e ib [ia Ga] IIC T6...T1 Gb or Ex db ib [ia IIC Ga] IIB T6...T1 Gb or Ex db e ib [ia IIC Ga] IIB T6...T1 Gb Ex ib tb IIIC T150 °C Db or Ex ib tb [ia Da] IIIC T150 °C Db Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.

Type	Approval or certification
FM (CA/US)	FM approvals: ▪ US Cert No. FM16US0095X ▪ CA Cert No. FM16CA0031X Applied standards: ▪ Class 3600 ▪ Class 3610 ▪ Class 3615 ▪ Class 3810 ▪ Class 3616 ▪ NEMA 250 ▪ ANSI/IEC 60529 ▪ CSA-C22.2 No. 0-10 ▪ CSA-C22.2 No. 0.4-04 ▪ CSA-C22.2 No. 0.5-1982 ▪ CSA-C22.2 No. 94.1-07 ▪ CSA-C22.2 No. 94.2-07 ▪ CAN/CSA-C22.2 No. 60079-0 ▪ CAN/CSA-C22.2 No. 60079-11 ▪ CAN/CSA-C22.2 No. 61010-1-04 ▪ CSA-C22.2 No. 25-1966 ▪ CSA-C22.2 No. 30-M1986 ▪ CSA-C22.2 No. 60529
	Remote transmitter (depending on the model code): CL I, DIV 1, GP ABCD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIC; Associated Apparatus CL I/II/III DIV 1, GP ABCDEFG; CL I ZN 0 GP IIC Entity Temperature class T6 or CL I, DIV 1, GP ABCD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIC; Associated Apparatus CL I/II/III DIV 1, GP ABCDEFG; CL I ZN 0 GP IIC Temperature class T6; Associated Apparatus CL I/II/III DIV 1, GP ABCDEFG; CL I ZN 0 GP IIC Entity Temperature class T6 or CL I, DIV 1, GP CD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIB; Associated Apparatus CL I/II/III DIV 1, GP CDEFG; CL I ZN 0 GP IIB Entity Temperature class T6 or CL I, DIV 1, GP CD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIB; Associated Apparatus CL I/II/III DIV 1, GP CDEFG; CL I ZN 0 GP IIB Temperature class T6; Associated Apparatus CL I/II/III DIV 1, GP ABCDEFG; CL I ZN 0 GP IIB Entity Temperature class T6
	Remote sensor (depending on the model code): IS CL I/II/III, DIV 1, GP ABCDEFG; CL I, ZN 0, GP IIC Temperature class T* or IS CL I/II/III, DIV 1, GP ABCDEFG; CL I, ZN 0, GP IIB Temperature class T*

Type	Approval or certification
FM (CA/US)	Integral type (depending on the model code): CL I, DIV 1, GP ABCD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIC Temperature class T* or CL I, DIV 1, GP ABCD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIC Associated Apparatus CL I/II/III DIV 1 GP ABCDEFG; CL I ZN 0 GP IIC Entity Temperature class T* or CL I, DIV 1, GP CD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIB Temperature class T* or CL I, DIV 1, GP CD, CL II/III, DIV 1, GP EFG; CL I ZN 1 GP IIB Associated Apparatus CL I/II/III DIV 1 GP ABCDEFG; CL I ZN 0 GP IIC Entity Temperature class T*
INMETRO (BR)	INMETRO approval: DEKRA 16.0012X Applied standards: ▪ ABNT NBR IEC 60079-0 ▪ ABNT NBR IEC 60079-1 ▪ ABNT NBR IEC 60079-7 ▪ ABNT NBR IEC 60079-11 ▪ ABNT NBR IEC 60079-31
	Remote transmitter (depending on the model code): Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb or Ex db [ia Ga] IIB T6 Gb or Ex db e [ia Ga] IIB T6 Gb Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex db e [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex tb [ia Da] IIIC T75 °C Db
	Remote sensor (depending on the model code): Ex ib IIC T6…T1 Gb or Ex ib IIB T6…T1 Gb Ex ib IIIC T150 °C Db or Ex ib IIIC T220 °C Db or Ex ib IIIC T350 °C Db
	Integral type (depending on the model code): Ex db ib IIC T6...T1 Gb or Ex db e ib IIC T6...T1 Gb or Ex db ib IIB T6...T1 Gb or Ex db e ib IIB T6...T1 Gb or Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db e ib [ia Ga] IIC T6...T1 Gb or Ex db ib [ia IIC Ga] IIB T6...T1 Gb or Ex db e ib [ia IIC Ga] IIB T6...T1 Gb Ex ib tb IIIC T150 °C Db or Ex ib tb [ia Da] IIIC T150 °C Db

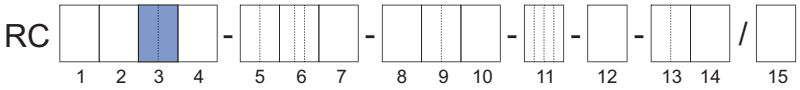
Type	Approval or certification
NEPSI (CN)	Applied standards: ▪ GB3836.1 ▪ GB3836.2 ▪ GB3836.3 ▪ GB3836.4 ▪ GB3836.19 ▪ GB3836.20
	Remote transmitter (depending on the model code): Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb or Ex db [ia Ga] IIB T6 Gb or Ex db e [ia Ga] IIB T6 Gb Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex db e [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex [iaD 20] tD A21 IP6X T75°C Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.
	Remote sensor (depending on the model code): Ex ib IIC T6…T1 Gb or Ex ib IIB T6…T1 Gb Ex ibD 21 IP6X T150°C or Ex ibD 21 IP6X T220°C or Ex ibD 21 IP6X T350°C
	Integral type (depending on the model code): Ex db ib IIC T6...T1 Gb or Ex db e ib IIC T6...T1 Gb or Ex db ib IIB T6...T1 Gb or Ex db e ib IIB T6...T1 Gb or Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db e ib [ia Ga] IIC T6...T1 Gb or Ex db ib [ia IIC Ga] IIB T6...T1 Gb or Ex db e ib [ia IIC Ga] IIB T6...T1 Gb Ex ibD 21 tD A21 IP6X T150°C or Ex [iaD 20] ibD 21 tD A21 IP6X T150°C Note: The marking on the product may be changed from Ex e to Ex eb based on statutory requirements.

Type	Approval or certification
PESO (IN)	PESO approval: PESO approval is based on ATEX certification by DEKRA Certificate Number: DEKRA 15ATEX0023 X PESO approval is only valid for type of protection “d” flameproof enclosure. Option Q11 must be ordered for conformity of device with PESO requirements. PESO Equip. Ref. No. P4...: P400958/␣ P400964/␣ P400966/␣ P400967/␣ P400969/␣ P400970/␣ P400971/␣ P400972/␣ P400973/␣ Applied standards: ▪ EN 60079-0 +A11 ▪ IS/IEC 60079-1 ▪ EN 60079-11
	Remote transmitter (depending on the model code): Ex db [ia Ga] IIC T6 Gb or Ex db [ia Ga] IIB T6 Gb or Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb
	Remote sensor (depending on the model code): Ex ib IIC T6…T1 Gb or Ex ib IIB T6…T1 Gb
	Integral type (depending on the model code): Ex db ib IIC T6...T1 Gb or Ex db ib IIB T6...T1 Gb or Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db ib [ia IIC Ga] IIB T6...T1 Gb

Type	Approval or certification
Safety Label (TW)	Please refer to IECEx approval for specifications. A device with IECEx approval (model code position 11, value: SF2␣) must be ordered to comply with Safety Label requirements. For export to Taiwan and to get the Safety Label the Yokogawa representative in Taiwan must be contacted in advance.
Ingress protection	IP66/67 and NEMA 4X
EMC	EU directive 2014/30/EU per EN 61326-1 Class A Table 2 and EN 61326-2-3
	NAMUR NE21
	RCM in Australia/New Zealand
	KC mark in Korea
	TR CU 020 in EAC area
Korea Ex	For further information please contact your Yokogawa representative
EAC Ex	
LVD	EU directive 2014/35/EU per EN 61010-1 and EN 61010-2-030
	TR CU 004 in EAC area
PED	EU directive 2014/68/EU per AD 2000 Code
	TR CU 032 in EAC area
Marine	DNV GL Type approval according to DNVGL-CP-0338 for options MC2 and MC3
RoHS	EU directive 2011/65/EU per EN 50581
WEEE	EU directive 2012/19/EU (Waste Electrical and Electronic Equipment) is only valid in the European Economic Area. This instrument is intended to be sold and used only as a part of equipment which is excluded from the WEEE directive, such as large-scale stationary industrial tools, a large-scale fixed installation etc., and therefore it is in principle fully compliant with WEEE directive. The instrument should be disposed of in accordance with appplicable national legislations or regulations, respectively.
SIL	Exida Certifcate per IEC61508:2010 Parts 1-7 SIL 2 @ HFT=0; SIL 3 @ HFT =1
NAMUR	NAMUR NE95 compliant
Metrological Regulations	Rotamass Total Insight is registered as a measuring instrument in the following countries: ▪ China ▪ Russia Please contact your Yokogawa representative regarding respective “Pattern Approval Certificate of Measuring Instruments” and export to these countries.
ASME	ASME B31.3 compliance

10 Ordering information

10.1 Overview model code Giga 1F

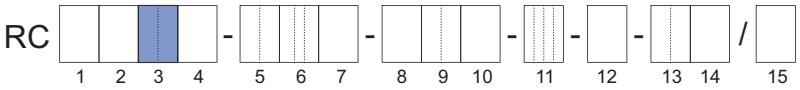


Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Transmitter	E														Essential (base function)	not with accuracy C5, 50 not with communication type and I/O JH, JJ, JK, JL, JM, JN, M2, M7 not with option CST, AC_, CGC, C52, BT, VM
	U														Ultimate (high function)	not with accuracy 70 not with display 0
Sensor		G													Giga	–
Meter size			1F												Nominal mass flow : 250 t/h (9200 lb/min) Maximum mass flow: 300 t/h (11000 lb/min)	–
Material wetted parts				S											Stainless steel 1.4404/316L	–
				H											Ni alloy C-22/2.4602	not with option RT, RTA, MC_, FE, P2_
Process connection size					1H										DN100, 4"	only material wetted parts S
					1Q										DN125, 5"	–
					1F										DN150, 6"	only process connection type ASME, EN
Process connection type						BA1									ASME flange class 150, suitable for ASME B16.5, raised face (RF)	see tables on page *[▷ 40]* and the following page
						BA2									ASME flange class 300, suitable for ASME B16.5, raised face (RF)	
						BA4									ASME flange class 600, suitable for ASME B16.5, raised face (RF)	
						CA4									ASME flange class 600, suitable for ASME B16.5, ring joint (RJ)	
						BD2									EN flange PN 16, suitable for EN 1092-1 type B1, raised face (RF)	not with option WPA, RTA, PTA, P2_ see tables on page *[▷ 42]* and the following pages
						ED2									EN flange PN 16, suitable for EN 1092-1 type E, spigot	
						FD2									EN flange PN 16, suitable for EN 1092-1 type F, recess	
						GD2									EN flange PN 16, suitable for EN 1092-1 type D, groove	
						BD4									EN flange PN 40, suitable for EN 1092-1 type B1, raised face (RF)	
						ED4									EN flange PN 40, suitable for EN 1092-1 type E, spigot	
						FD4									EN flange PN 40, suitable for EN 1092-1 type F, recess	
						GD4									EN flange PN 40, suitable for EN 1092-1 type D, groove	
						BD5									EN flange PN 63, suitable for EN 1092-1 type B1, raised face (RF)	
						ED5									EN flange PN 63, suitable for EN 1092-1 type E, spigot	
						FD5									EN flange PN 63, suitable for EN 1092-1 type F, recess	
						GD5									EN flange PN 63, suitable for EN 1092-1 type D, groove	
						BD6									EN flange PN 100, suitable for EN 1092-1 type B1, raised face (RF)	
						ED6									EN flange PN 100, suitable for EN 1092-1 type E, spigot	
						FD6									EN flange PN 100, suitable for EN 1092-1 type F, recess	
						GD6									EN flange PN 100, suitable for EN 1092-1 type D, groove	
						BJ1									JIS flange 10K, suitable for JIS B 2220	not with option WPA, RTA, PTA, P2_
						BJ2									JIS flange 20K, suitable for JIS B 2220	see tables on page *[▷ 46]*
Sensor housing material							0								Stainless steel 1.4301/304, 1.4404/316L	–
							1								Stainless steel 1.4404/316L	not with option SA
Process fluid temperature range								0							Standard, integral type: -50 – 150 °C (-58 – 302 °F), remote type: -70 – 150 °C (-94 – 302 °F)	–
								2							Mid-range: -70 – 230 °C (-94 – 446 °F)	not with design and housing 0, 2, A, E, J
								3							High: 0 – 350 °C (32 – 662 °F)	not with option RB, MC_

Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Mass flow and density accuracy									E7						Liquid: 0.2 % maximum mass flow deviation D_{flat}, 4 g/l density deviation	–
									C5						Liquid: 0.1 % maximum mass flow deviation D_{flat}, 2 g/l density deviation	not with transmitter E
									70						Gas: 0.75% maximum mass flow deviation D_{flat},	not with transmitter U not with option CST, AC_, C52, VM
									50						Gas: 0.5% maximum mass flow deviation D_{flat},	not with transmitter E not with option CST, AC_, C52, VM
Design and housing										0					Integral type with "urethane-cured polyester powder coating" coated aluminum transmitter housing	not with process fluid temperature range 2, 3
										2					Integral type with "corrosion protection coating" coated aluminum transmitter housing	not with option T_ _, L_ _ _, MC_, Y_ _ _
										A					Remote type with "urethane-cured polyester powder coating" coated aluminum transmitter housing and standard neck sensor	not with process fluid temperature range 2, 3 not with option RB, T_ _
										B					Remote type with "urethane-cured polyester powder coating" coated aluminum transmitter housing and long neck sensor	not with option RB
										E					Remote type with "corrosion protection coating" coated aluminum transmitter housing and standard neck sensor	not with process fluid temperature range 2, 3 not with option RB, T _ _
										F					Remote type with "corrosion protection coating" coated aluminum transmitter housing and long neck sensor	not with option RB
										J					Remote type stainless steel transmitter and standard neck sensor	not with process fluid temperature range 2, 3 not with Ex approval KF21, SF21, GF21, UF21, NF21, PF21 not with option RB, T_ _
										K					Remote type stainless steel transmitter and long neck sensor	not with Ex approval KF21, SF21, GF21, UF21, NF21, PF21 not with option RB
Ex approval											NN00				None	not with communication type and I/O JP, JQ, JR, JS not with option Q11
											KF21				ATEX, explosion group IIC and IIIC	not with design and housing J, K
											KF22				ATEX, explosion group IIB and IIIC	–
											SF21				IECEx, explosion group IIC and IIIC	not with design and housing J, K not with option Q11
											SF22				IECEx, explosion group IIB and IIIC	not with option Q11
											GF21				EAC Ex, explosion group IIC and IIIC	not with design and housing J, K only with option VE or VR not with option Q11
											GF22				EAC Ex, explosion group IIB and IIIC	only with option VE or VR not with option Q11
											FF11				FM, groups A, B, C, D, E, F, G	not with cable entries 4
											FF12				FM, groups C, D, E, F, G	not with option Y_ _ _, Q11
											UF21				INMETRO, explosion group IIC and IIIC	not with design and housing J, K not with option Q11
											UF22				INMETRO, explosion group IIB and IIIC	not with option Q11
											NF21				NEPSI, explosion group IIC and IIIC	not with design and housing J, K only with option CN not with option Q11
											NF22				NEPSI, explosion group IIB and IIIC	only with option CN not with option Q11
											PF21				Korea Ex, explosion group IIC and IIIC	not with design and housing J, K only with option KC not with option Q11
											PF22				Korea Ex, explosion group IIB and IIIC	only with option KC not with option Q11
Cable entries												2			ANSI ½" NPT	–
												4			ISO M20x1.5	not with Ex approval FF11 or FF12

Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Communication type and I/O													JA		1 active current output HART, 1 passive pulse or status output	not with option CGC, VM
													JB		2 active current outputs one with HART, 2 passive pulse or status outputs	
													JC		2 active current outputs one with HART, 1 passive pulse or status output, 1 voltage-free status input	
													JD		1 active current output HART, 2 passive pulse or status outputs, 1 passive status output	
													JE		1 active current output HART, 2 passive pulse or status outputs, 1 voltage-free status input	
													JF		1 active current output HART, 1 passive pulse or status output, 1 active pulse or status output with pull-up resistor, 1 voltage-free status input	
													JG		1 active current output HART, 1 passive pulse or status output, 1 active pulse or status output, 1 voltage-free status input	
													JH		1 active current output HART, 1 passive pulse or status output, 1 passive current output, 1 active current input	not with transmitter E
													JJ		1 active current output HART, 2 passive pulse or status outputs, 1 active current input	
													JK		1 active current output HART, 1 passive pulse or status output, 1 voltage-free status input, 1 active current input	
													JL		1 active current output HART, 1 passive pulse or status output, 1 passive current output, 1 passive current input	
													JM		1 active current output HART, 2 passive pulse or status outputs, 1 passive current input	
													JN		1 active current output HART, 1 passive pulse or status output, 1 voltage-free status input, 1 passive current input	
Communication type and I/O													JP		2 passive current outputs one with HART, 1 passive pulse or status output	not with Ex approval NN00 not with option CGC, MC2, MC3, VM
													JQ		2 passive current outputs one with HART, 2 passive pulse or status outputs	
													JR		2 passive current outputs one with HART, 1 passive NAMUR pulse or status output	
													JS		2 passive current outputs one with HART, 2 passive NAMUR pulse or status outputs	
													M0		Modbus output, 1 passive pulse or status output	not with option CGC, PS, BT, VM
													M2		Modbus output, 1 passive pulse or status output, 1 active current input	not with transmitter E, not with option PS, BT, VM
													M3		Modbus output, 2 passive pulse or status outputs	not with option CGC , PS, BT, VM
													M4		Modbus output, 1 passive pulse or status output, 1 active pulse or status output	
													M5		Modbus output, 1 passive pulse or status output, 1 active pulse or status output with pull-up resistor	
													M6		Modbus output, 1 passive pulse or status output, 1 active current output	
													M7		Modbus output, 1 passive pulse or status output, 1 passive current input	not with transmitter E, not with option PS, BT, VM
Display														0	No display	not with transmitter U
														1	With display	–

10.2 Overview model code Giga 2H

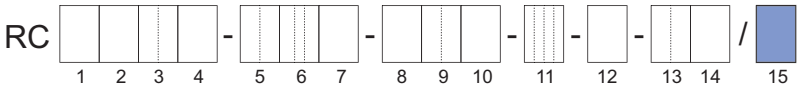


Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Transmitter	E														Essential (base function)	not with accuracy C5, 50 not with communication type and I/O JH, JJ, JK, JL, JM, JN, M2, M7 not with option CST, AC_, CGC, C52, BT, VM
	U														Ultimate (high function)	not with accuracy 70 not with display 0
Sensor		G													Giga	–
Meter size			2H												Nominal mass flow : 500 t/h (18000 lb/min) Maximum mass flow: 600 t/h (22000 lb/min)	not with option T_ _, P15, MC_
Material wetted parts				S											Stainless steel 1.4404/316L	–
Process connection size					1F										DN150, 6"	–
					2H										DN200, 8"	
Process connection type						BA1									ASME flange class 150, suitable for ASME B16.5, raised face (RF)	see tables on page *[40]* and following page
						BA2									ASME flange class 300, suitable for ASME B16.5, raised face (RF)	
						BA4									ASME flange class 600, suitable for ASME B16.5, raised face (RF)	
						CA4									ASME flange class 600, suitable for ASME B16.5, ring joint (RJ)	
						BD2									EN flange PN 16, suitable for EN 1092-1 type B1, raised face (RF)	not with option WPA, RTA, PTA, P2_ see tables on pages *[42]* and following pages
						ED2									EN flange PN 16, suitable for EN 1092-1 type E, spigot	
						FD2									EN flange PN 16, suitable for EN 1092-1 type F, recess	
						GD2									EN flange PN 16, suitable for EN 1092-1 type D, groove	
						BD4									EN flange PN 40, suitable for EN 1092-1 type B1, raised face (RF)	
						ED4									EN flange PN 40, suitable for EN 1092-1 type E, spigot	
						FD4									EN flange PN 40, suitable for EN 1092-1 type F, recess	
						GD4									EN flange PN 40, suitable for EN 1092-1 type D, groove	
						BD5									EN flange PN 63, suitable for EN 1092-1 type B1, raised face (RF)	
						ED5									EN flange PN 63, suitable for EN 1092-1 type E, spigot	
						FD5									EN flange PN 63, suitable for EN 1092-1 type F, recess	
						GD5									EN flange PN 63, suitable for EN 1092-1 type D, groove	
Sensor housing material							0								Stainless steel 1.4301/304, 1.4404/316L	–
							1								Stainless steel 1.4404/316L	not with option SA
Process fluid temperature range								0							Standard, integral type: -50 – 150 °C (-58 – 302 °F), remote type: -70 – 150 °C (-94 – 302 °F)	–
								2							Mid-range: -70 – 230 °C (-94 – 446 °F)	not with design and housing 0, 2, A, E, J
								3							High: 0 – 350 °C (32 – 662 °F)	not with option RB
Mass flow and density accuracy									E7						Liquid: 0.2 % maximum mass flow deviation D_{flat}, 4 g/l density deviation	–
									C5						Liquid: 0.1 % maximum mass flow deviation D_{flat}, 2 g/l density deviation	not with transmitter E
									70						Gas: 0.75% maximum mass flow deviation D_{flat},	not with transmitter U not with option CST, AC_, C52, VM
									50						Gas: 0.5% maximum mass flow deviation D_{flat},	not with transmitter E not with option CST, AC_, C52, VM

Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Design and housing										0					Integral type with "urethane-cured polyester powder coating" coated aluminum transmitter housing	not with process fluid temperature range 2, 3 not with option L___, Y___
										2					Integral type with "corrosion protection coating" coated aluminum transmitter housing	
										A					Remote type with "urethane-cured polyester powder coating" coated aluminum transmitter housing and standard neck sensor	not with process fluid temperature range 2, 3 not with option RB
										B					Remote type with "urethane-cured polyester powder coating" coated aluminum transmitter housing and long neck sensor	not with option RB
										E					Remote type with "corrosion protection coating" coated aluminum transmitter housing and standard neck sensor	not with process fluid temperature range 2, 3 not with option RB
										F					Remote type with "corrosion protection coating" coated aluminum transmitter housing and long neck sensor	not with option RB
										J					Remote type stainless steel transmitter and standard neck sensor	not with process fluid temperature range 2, 3 not with Ex approval KF21, SF21, GF21, UF21, NF21, PF21 not with option RB
										K					Remote type stainless steel transmitter and long neck sensor	not with Ex approval KF21, SF21, GF21, UF21, NF21, PF21 not with option RB
Ex approval											NN00				None	not with communication type and I/O JP, JQ, JR, JS not with option Q11
											KF21				ATEX, explosion group IIC and IIIC	not with design and housing J, K
											KF22				ATEX, explosion group IIB and IIIC	–
											SF21				IECEx, explosion group IIC and IIIC	not with design and housing J, K not with option Q11
											SF22				IECEx, explosion group IIB and IIIC	not with option Q11
											GF21				EAC Ex, explosion group IIC and IIIC	not with design and housing J, K only with option VE or VR not with option Q11
											GF22				EAC Ex, explosion group IIB and IIIC	only with option VE or VR not with option Q11
											FF11				FM, groups A, B, C, D, E, F, G	not with cable entries 4
											FF12				FM, groups C, D, E, F, G	not with option Y___, Q11
											UF21				INMETRO, explosion group IIC and IIIC	not with design and housing J, K not with option Q11
											UF22				INMETRO, explosion group IIB and IIIC	not with option Q11
											NF21				NEPSI, explosion group IIC and IIIC	not with design and housing J, K only with option CN not with option Q11
											NF22				NEPSI, explosion group IIB and IIIC	only with option CN not with option Q11
											PF21				Korea Ex, explosion group IIC and IIIC	not with design and housing J, K only with option KC not with option Q11
											PF22				Korea Ex, explosion group IIB and IIIC	only with option KC not with option Q11
Cable entries												2			ANSI ½" NPT	–
												4			ISO M20x1.5	not with Ex approval FF11 or FF12

Model code position	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	Description	Restriction
Communication type and I/O													JA		1 active current output HART, 1 passive pulse or status output	not with option CGC, VM
													JB		2 active current outputs one with HART, 2 passive pulse or status outputs	
													JC		2 active current outputs one with HART, 1 passive pulse or status output, 1 voltage-free status input	
													JD		1 active current output HART, 2 passive pulse or status outputs, 1 passive status output	
													JE		1 active current output HART, 2 passive pulse or status outputs, 1 voltage-free status input	
													JF		1 active current output HART, 1 passive pulse or status output, 1 active pulse or status output with pull-up resistor, 1 voltage-free status input	
													JG		1 active current output HART, 1 passive pulse or status output, 1 active pulse or status output, 1 voltage-free status input	
													JH		1 active current output HART, 1 passive pulse or status output, 1 passive current output, 1 active current input	not with transmitter E,
													JJ		1 active current output HART, 2 passive pulse or status outputs, 1 active current input	
													JK		1 active current output HART, 1 passive pulse or status output, 1 voltage-free status input, 1 active current input	
													JL		1 active current output HART, 1 passive pulse or status output, 1 passive current output, 1 passive current input	
													JM		1 active current output HART, 2 passive pulse or status outputs, 1 passive current input	
													JN		1 active current output HART, 1 passive pulse or status output, 1 voltage-free status input, 1 passive current input	
Communication type and I/O													JP		2 passive current outputs one with HART, 1 passive pulse or status output	not with Ex approval NN00 not with option CGC, VM
													JQ		2 passive current outputs one with HART, 2 passive pulse or status outputs	
													JR		2 passive current outputs one with HART, 1 passive NAMUR pulse or status output	
													JS		2 passive current outputs one with HART, 2 passive NAMUR pulse or status outputs	
													M0		Modbus output, 1 passive pulse or status output	not with option CGC, PS, BT, VM
													M2		Modbus output, 1 passive pulse or status output, 1 active current input	not with transmitter E, not with option PS, , BT, VM
													M3		Modbus output, 2 passive pulse or status outputs	not with option CGC , PS, BT, VM
													M4		Modbus output, 1 passive pulse or status output, 1 active pulse or status output	
													M5		Modbus output, 1 passive pulse or status output, 1 active pulse or status output with pull-up resistor	
													M6		Modbus output, 1 passive pulse or status output, 1 active current output	
													M7		Modbus output, 1 passive pulse or status output, 1 passive current input	not with transmitter E, not with option PS, BT, VM
Display														0	No display	not with transmitter U
														1	With display	–

10.3 Overview options



Option category	Options	Description	Restriction
Additional nameplate information	BG	Nameplate with customer device location identification	–
Presetting of customer parameters	PS	Presetting according to customer parameters	not with communication type and I/O M␣
Country-specific delivery	PJ	Delivery to Japan	not with option QR
	CN	Delivery to China	
	KC	Delivery to Korea	
	VE	Delivery to EAC area	–
	VR	Delivery to EAC area and Russia Pattern Approval marking	–
Country-specific application	Q11	PESO approval delivery	only with Ex proof KF2␣
	QR	Primary calibration valid in Russia, including certificate	only with option VE or VR
Concentration and petroleum measurement	AC0	Advanced concentration measurement, customer settings	not with transmitter type E not with mass flow and density accuracy 70, 50
	AC1	Advanced concentration measurement, one default data set	
	AC2	Advanced concentration measurement, two default data sets	
	AC3	Advanced concentration measurement, three default data sets	
	AC4	Advanced concentration measurement, four default data sets	
	CST	Standard concentration measurement	
	C52	Net Oil Computing (NOC) following API standard	
Rupture disc	RD	Rupture disc	not with option T␣␣
Mass flow calibration	K2	Customer-specific 5-point mass flow calibration with factory calibration certificate (mass flow or volume flow of water). A table listing the desired calibration points must be supplied with the order.	–
	K5	Customer-specific 10-point mass flow calibration with DAkkS calibration certificate (mass flow or volume flow of water). A table listing the desired calibration points must be supplied with the order.	
Accordance with terms of order	P2	Declaration of compliance with the order 2.1 according to EN 10204	
	P3	Quality Inspection Certificate (Inspection Certificate 3.1 according to EN 10204)	not with option P10, P11, P12, P13, P21, P22
Material certificates	P6	Certificate of Marking Transfer and Raw Material Certificates (Inspection Certificate 3.1 according to EN 10204)	not with option P10, P11, P12, P13, P21, P22
Pressure testing	P8	Hydrostatic Pressure Test Certificate (Inspection Certificate 3.1 according to EN 10204)	not with option P10, P12, P13, P14, P21

Option category	Options	Description	Restriction
Surfaces free of oil and grease	H1	Degreasing of wetted surfaces according to ASTM G93-03 (Level C), including test report	–
Welding certificates	WP	WPS according to DIN EN ISO 15609-1	not with option P13, P14, P15, P2␣
		WPQR according to DIN EN ISO 15614-1	
		WQC according to DIN EN 287-1 or DIN EN ISO 6906-4	
	WPA	Welding procedures and Certificate according to ASME IX	only with process connection type BA␣ or CA␣ not with option P12, P13, P14, P2␣
Calibration certificate	L2	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards, including a list of working standards used for calibration. Language: English/Japanese	–
	L3	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards, including a list of primary standards to which the delivered product is traceable. Language: English/Japanese	
	L4	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards and that the calibration system of Rota Yokogawa is traceable to national standards. Language: English/Japanese	
X-ray inspection of flange weld seam	RT	X-ray inspection of flange weld seam according to DIN EN ISO 17636-1/B Evaluation according to AD 2000 HP 5/3 and DIN EN ISO 5817/C, including certificate	not with material wetted parts H not with option P15, P2␣
	RTA	X-ray test according to ASME V	not with material wetted parts H only with process connection type BA␣ or CA␣ not with option P12, P13, P14, P2␣
Dye penetration test of weld seams	PT	Dye penetration test of process connection weld seams according to DIN EN ISO 3452-1, including certificate	not with option P12, P13, P15, P2␣
	PTA	Dye Penetrant test of flange welding according to ASME V	only with process connection type BA␣ or CA␣ not with option P12, P13, P14, P2␣
Ferrite testing	FE	Ferrite test for flange welding acc. DIN EN ISO 8249	not with material wetted parts H
Transmitter housing rotated 180°	RB	Alignment of transmitter housing rotated 180°	not with design and housing A, B, E, F, J, K not with process fluid temperature range 2, 3 not with option T␣␣

Option category	Options	Description	Restriction
Insulation and heat tracing	T10	Insulation	not with design and housing 0, 2, A, E, J not with meter size 2H not with option RD, RB, P15, MC␣
	T21	Insulation and heat tracing, ½" ASME class 150, raised face (RF)	
	T22	Insulation and heat tracing, ½" ASME class 300, raised face (RF)	
	T26	Insulation and heat tracing, DN15, PN40	
	T31	Insulation, heat tracing with ventilation, ½" ASME class 150, raised face (RF)	
	T32	Insulation, heat tracing with ventilation, ½" ASME class 300, raised face (RF)	
	T36	Insulation, heat tracing with ventilation, DN15, PN40	
Measurement of heat quantity	CGC	Measurement of the total transported energy content of a fuel in connection with a sensor for determining the fuel's calorific value (e.g. a gas chromatograph, not included in scope of delivery)	not with transmitter type E only with communication type and I/O JH, JJ, JK, JL, JM, JN, M2, M7
Connecting cable type and length	L000	without standard connecting cable	not with design and housing 0, 2 not with option MC␣
	L005	5 meter (16.4 ft) remote connecting cable terminated std. gray / Ex blue	
	L010	10 meter (32.8 ft) remote connecting cable terminated std. gray / Ex blue	
	L015	15 meter (49.2 ft) remote connecting cable terminated std. gray / Ex blue	
	L020	20 meter (65.6 ft) remote connecting cable terminated std. gray / Ex blue	
	L030	30 meter (98.4 ft) remote connecting cable terminated std. gray / Ex blue	
Connecting cable type and length	Y000	without fire retardant connecting cable	not with design and housing 0, 2 not with Ex approval FF11, FF12
	Y005	5 meter (16.4 ft) remote fire retardant connecting cable not terminated	
	Y010	10 meter (32.8 ft) remote fire retardant connecting cable not terminated	
	Y015	15 meter (49.2 ft) remote fire retardant connecting cable not terminated	
	Y020	20 meter (65.6 ft) remote fire retardant connecting cable not terminated	
	Y030	30 meter (98.4 ft) remote fire retardant connecting cable not terminated	

Option category	Options	Description	Restriction
Marine Approval	MC2	Marine approval according to DNV GL piping class 2	not with fluid temperature range 3, material wetted parts H, design and housing 0, 2, communication type and I/O JP, JQ, JR, JS, meter size Giga 2H not with option T␣␣ only with option Y␣␣␣ in case of thermal oil applications option RT or RTA is mandatory
	MC3	Marine approval according to DNV GL piping class 3	
Combined certificate	P10	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ P8: Hydrostatic Pressure Test Certificate	not with option P3, P6, P8
	P11	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PM: Positive Material Identification of wetted parts	not with option P3, P6, PM
	P12	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PT: Dye penetration test according to DIN EN ISO 3452-1 ▪ P8: Hydrostatic Pressure Test Certificate	not with option P3, P6, P8, P15, PT, WPA, RTA, PTA
	P13	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PT: Dye penetration test according to DIN EN ISO 3452-1 ▪ PM: Positive Material Identification of wetted parts ▪ P8: Hydrostatic Pressure Test Certificate ▪ WP: Welding certificates	not with option P3, P6, P8, P15, WP, PM, PT, WPA, RTA, PTA
	P14	Combination of: ▪ PM: Positive Material Identification of wetted parts ▪ P8: Hydrostatic Pressure Test Certificate ▪ WP: Welding certificates	not with option P8, P15, WP, PM, WPA, RTA, PTA

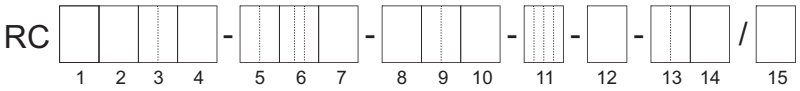
Option category	Options	Description	Restriction
Combined certificate	P20	Combination of: ▪ PTA: Dye Penetrant test of flange welding according to ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V	not with material wetted parts H not with option WP, WPA, RT, RTA, PT, PTA only with process connection type BA␣ or CA␣
	P21	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ P8: Hydrostatic Pressure Test Certificate ▪ PTA: Dye Penetrant test of flange welding according ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V	not with material wetted parts H only with process connection type BA␣ or CA␣ not with option P3, P6, P8, WP, WPA, RT, RTA, PT, PTA
	P22	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PM: Positive Material Identification of wetted parts ▪ PTA: Dye Penetrant test of flange welding according ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V	not with material wetted parts H only with process connection type BA␣ or CA␣ not with option P3, P6, WP, WPA, RT, RTA, PM, PT, PTA
Positive Material Identification of wetted parts	PM	Positive Material Identification of wetted parts, including certificate (Inspection Certificate 3.1 according to EN 10204)	not with option P11, P13, P14, P22
Tube health check	TC	Tube health check	–
ASME B31.3 compliance	P15	ASME B31.3 compliance NORMAL FLUID SERVICE	not with meter size 2H only with process connection type BA␣ CA␣ not with option WP, RT, PT, P12, P13, P14, T␣␣
Batching function	BT	Batching and filling function	not with transmitter type E only with communication type and I/O J␣
Viscosity function	VM	Viscosity computing function for liquids	not with transmitter type E not with mass flow and density accuracy 70, 50 only with communication type and I/O JH, JJ, JK, JL, JM, JN

10.4 Model code

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

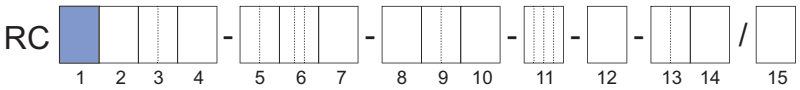
Items 1 through 14 are mandatory entries and must be specified at the time of ordering.

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



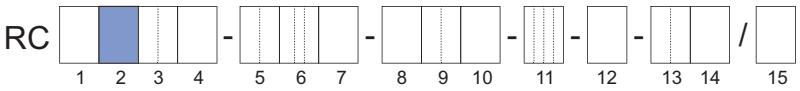
1. Transmitter
2. Sensor
3. Meter size
4. Material wetted parts
5. Process connection size
6. Process connection type
7. Sensor housing material
8. Process fluid temperature range
9. Mass flow and density accuracy
10. Design and housing
11. Ex approval
12. Cable entries
13. Communication type and I/O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

10.4.1 Transmitter



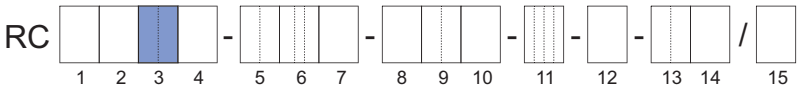
Model code position 1	Transmitter
E	Essential
U	Ultimate

10.4.2 Sensor



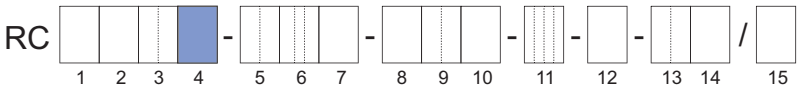
Model code position 2	Sensor
G	Giga

10.4.3 Meter size



Model code position 3	Meter size	Nominal mass flow in t/h (lb/min)	Maximum mass flow in t/h (lb/min)
1F	1F	250 (9200)	300 (11000)
2H	2H	500 (18000)	600 (22000)

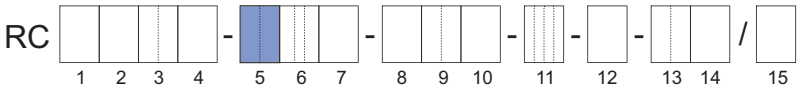
10.4.4 Material wetted parts



Model code position 4	Material wetted parts
S	Stainless steel 1.4404/316L
H	Ni alloy C-22/2.4602 (only available for Giga 1F)

Non-wetted parts of the process connection are generally made of stainless steel 1.4404/316L.

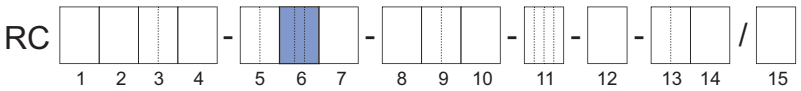
10.4.5 Process connection size



Model code position 5	Process connection size
1H	DN100, 4"
1Q	DN125, 5"
1F	DN150, 6"
2H	DN200, 8"

Available sizes depend on the actual process connection, see also chapter *Process connections, dimensions and weights of sensor [▶ 39]*.

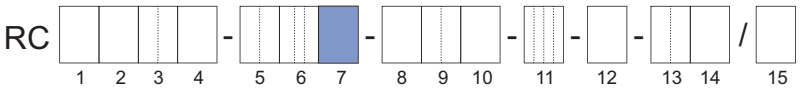
10.4.6 Process connection type



Model code position 6	Type	Process connections
BA1	Flanges suitable for ASME B16.5	ASME flange class 150, raised face (RF)
BA2		ASME flange class 300, raised face (RF)
BA4		ASME flange class 600, raised face (RF)
CA4		ASME flange class 600, ring joint (RJ)

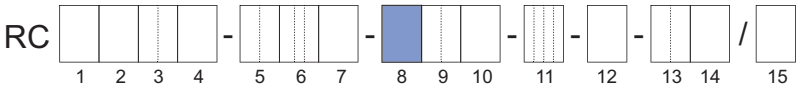
Model code position 6	Type	Process connections
BD2	Flange suitable for EN 1092-1	EN flange PN16, type B1, raised face (RF)
ED2		EN flange PN16, type E, with spigot
FD2		EN flange PN16, type F, with recess
GD2		EN flange PN16, type D, with groove
BD4		EN flange PN40, type B1, raised face (RF)
ED4		EN flange PN40, type E, with spigot
FD4		EN flange PN40, type F, with recess
GD4		EN flange PN40, type D, with groove
BD5		EN flange PN63, type B1, raised face (RF)
ED5		EN flange PN63, type E, with spigot
FD5		EN flange PN63, type F, with recess
GD5		EN flange PN63, type D, with groove
BD6		EN flange PN100, type B1, raised face (RF)
ED6		EN flange PN100, type E, with spigot
FD6		EN flange PN100, type F, with recess
GD6		EN flange PN100, type D, with groove
BJ1	Flange suitable for JIS B 2220	JIS flange 10K
BJ2		JIS flange 20K

10.4.7 Sensor housing material



Model code position 7	Housing material
0	Stainless steel 1.4301/304, 1.4404/316L
1	Stainless steel 1.4404/316L

10.4.8 Process fluid temperature range



Model code position 8	Temperature range	Process fluid temperature range
0	Standard	Integral type: -50 – 150 °C (-58 – 302 °F) Remote type: -70 – 150 °C (-94 – 302 °F)
2	Mid-range	-70 – 230 °C (-94 – 446 °F)
3	High	0 – 350 °C (32 – 662 °F)

For temperature range limits, see chapter *Process fluid temperature range [▶ 25]*.

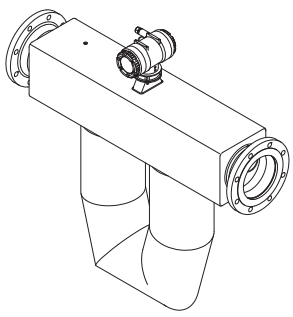
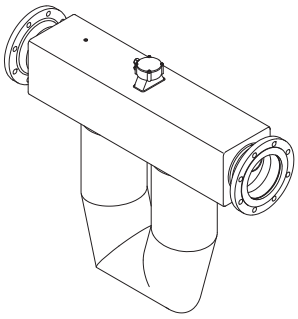
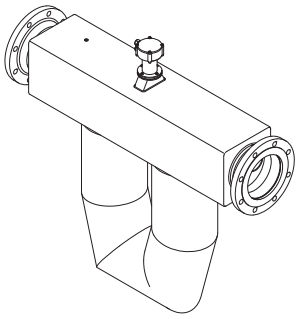
10.4.9 Mass flow and density accuracy

RC □□□□ - □□□ - □□□ - □ - □ - □□ / □
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fluid	Model code position 9	Maximum deviation		Model code position 1
		Mass flow D_0 in %	Density in g/l	
Liquid	E7	0.2	4	E, U
	C5	0.1	2	U
Gas	70	0.75	–	E
	50	0.5	–	U

10.4.10 Design and housing

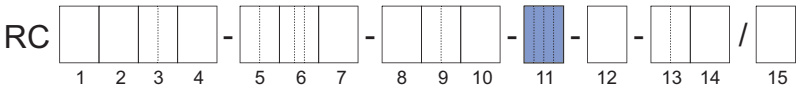
RC □□□□ - □□□ - □□□ - □ - □ - □□ / □
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Model code position 10	Design type	Transmitter housing material	Transmitter housing coating	Sensor terminal box material	Long neck
0	Integral type	Aluminum	Standard coating	–	–
2			Corrosion protection coating		
A	Remote type	Aluminum	Standard coating	Stainless steel	No
B					Yes
E			Corrosion protection coating		No
F					Yes
J		Stainless Steel	–		No
K			–		Yes

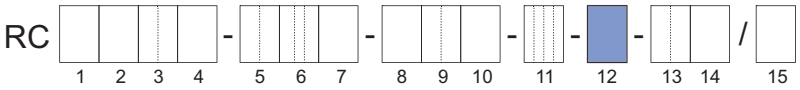
The remote type requires a connecting cable to connect sensor and transmitter. It can be selected in various lengths as a device option, see *Connecting cable type and length [▷ 93]*.

10.4.11 Ex approval



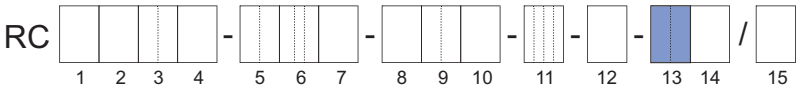
Model code position 11	Ex approval
NN00	None
KF21	ATEX, explosion group IIC and IIIC
KF22	ATEX, explosion group IIB and IIIC
SF21	IECEx, explosion group IIC and IIIC
SF22	IECEx, explosion group IIB and IIIC
FF11	FM, group A, B, C, D, E, F, G
FF12	FM, group C, D, E, F, G
GF21	EAC Ex, explosion group IIC and IIIC
GF22	EAC Ex, explosion group IIB and IIIC
UF21	INMETRO, explosion group IIC and IIIC
UF22	INMETRO, explosion group IIB and IIIC
NF21	NEPSI, explosion group IIC and IIIC
NF22	NEPSI, explosion group IIB and IIIC
PF21	Korea Ex, explosion group IIC and IIIC
PF22	Korea Ex, explosion group IIB and IIIC

10.4.12 Cable entries



Model code position 12	Cable entries
2	ANSI ½" NPT
4	ISO M20x1.5

10.4.13 Communication type and I/O



HART I/O

Model code position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
JA	Iout1 Active	P/Sout1 Passive	–	–	Write-protect
JB	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iout2 Active	Write-protect
JC	Iout1 Active	P/Sout1 Passive	Sin	Iout2 Active	Write-protect
JD	Iout1 Active	P/Sout1 Passive	Sout Passive	P/Sout2 Passive	Write-protect
JE	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Passive	Write-protect

Model code position 13	Connection terminal assignment				
	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
JF	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active Internal pull-up resistor	Write-protect
JG	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active	Write-protect
JH	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Active	Write-protect
JJ	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Active	Write-protect
JK	Iout1 Active	P/Sout1 Passive	Sin	Iin Active	Write-protect
JL	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Passive	Write-protect
JM	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Passive	Write-protect
JN	Iout1 Active	P/Sout1 Passive	Sin	Iin Passive	Write-protect

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

HART I/O, intrinsically safe

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

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

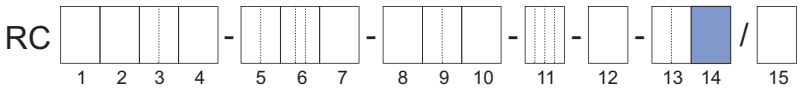
Intrinsically safe outputs are only available in combination with selecting Ex approval of the device, see chapter *Ex approval [▶ 89]*.

Modbus I/O

Model code position 13	Connection terminal assignment						
	I/O1 +/-	I/O2 +/-	I/O3 +	I/O3 -	I/O4 +	I/O4 -	WP
M0	–	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M2	Iin Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M3	P/Sout2 Passive	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M4	P/Sout2 Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M5	P/Sout2 Active Internal pull-up resistor	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M6	Iout1 Active	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M7	Iin Passive	P/Sout1 Passive	–	Modbus C	Modbus B	Modbus A	Write-protect

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

10.4.14 Display



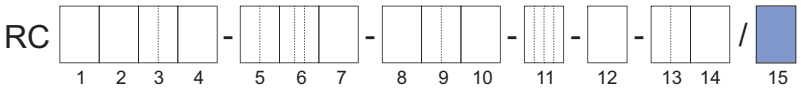
The display unit includes a slot for the microSD card.

Model code position 14	Display
0	Without display
1	With display

Devices without a display are available for Essential transmitters only (value E in model code position 1).

10.5 Options

Additional device options that can be combined may be selected; they are listed sequentially in model code position 15. In this case, each device option is preceded by a slash.



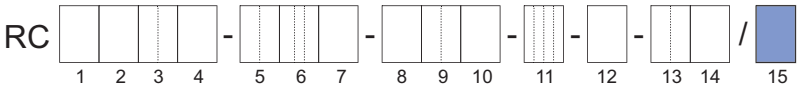
The following device options are possible:

- Connecting cable length, see chapter *Connecting cable type and length [▷ 93]*.
- Customer-specific adaptation of the nameplate, see chapter *Additional nameplate information [▷ 93]*.
- Flow meter presetting with customer parameters, see chapter *Presetting of customer parameters [▷ 93]*.
- Concentration and petroleum measurement, see chapter *Concentration and petroleum measurement [▷ 94]*.
- Batching function, see chapter *Batching function [▷ 94]*.
- Viscosity function, see chapter *Viscosity function [▷ 94]*.
- Insulation and heat tracing, see chapter *Insulation and heat tracing [▷ 95]*.
- Certificates to be supplied, see chapter *Certificates [▷ 95]*, e.g:
  - Positive Material Identification of wetted parts, see chapter *Certificates [▷ 95]*.
  - X-ray inspection of flange weld seam, see chapter *Certificates [▷ 96]*.
  - Ferrite testing, see chapter *Certificates [▷ 96]*.
- Country -specific delivery *Country-specific delivery [▷ 98]*.
- Country -specific application *Country-specific application [▷ 98]*.
- Rupture disc, see chapter *Rupture disc [▷ 98]*.
- Tube health check, see chapter *Tube health check [▷ 99]*.
- Transmitter housing rotated 180°, see chapter *Transmitter housing rotated 180° [▷ 99]*.
- Measurement of heat quantity, see chapter *Measurement of heat quantity [▷ 99]*.
- Marine type approval, see chapter *Marine Approval [▷ 100]*.

10.5.1 Connecting cable type and length

When ordering the remote type it is mandatory to select one of the below shown connecting cable lengths.

It is possible to order cables with higher length than the maximum cable length and termination kits separately . For this purpose please check the "Customers Maintenance Parts List" (Ref.: CMPL 01U10B00-00EN-R) or consult our Service team.

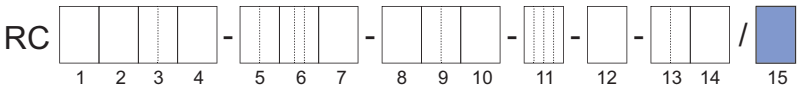


Options	Specification
L000	without standard connecting cable [1)]
L005	5 meter (16.4 ft) remote connecting cable terminated std. gray / Ex blue
L010	10 meter (32.8 ft) remote connecting cable terminated std. gray / Ex blue
L015	15 meter (49.2 ft) remote connecting cable terminated std. gray / Ex blue
L020	20 meter (65.6 ft) remote connecting cable terminated std. gray / Ex blue
L030	30 meter (98.4 ft) remote connecting cable terminated std. gray / Ex blue
Y000	without fire retardant connecting cable[1)]
Y005	5 meter (16.4 ft) remote fire retardant connecting cable, not terminated
Y010	10 meter (32.8 ft) remote fire retardant connecting cable, not terminated
Y015	15 meter (49.2 ft) remote fire retardant connecting cable, not terminated
Y020	20 meter (65.6 ft) remote fire retardant connecting cable, not terminated
Y030	30 meter (98.4 ft) remote fire retardant connecting cable, not terminated

[1)] Even without cables, it is necessary to select this option, because the device name plate shows the allowed ambient temperature depending on the selected cable type (see chapter *[▷ 31]*).

Fire retardant cable is mandatory for DNV GL type approval (Options MC2 and MC3). The minimum permissible ambient temperature for the two cable types differs (see chapter *Allowed ambient temperature for sensor [▷ 31]*). The cable type intended to be used needs to be indicated (with option L000 or Y000) even if connecting cable is ordered separately.

10.5.2 Additional nameplate information

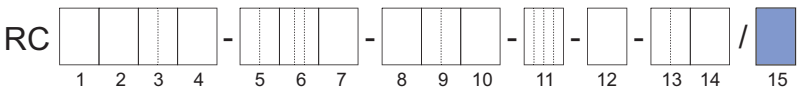


Options	Specification
BG	Nameplate with customer device location identification

This marking (Tag No.) must be provided by the customer at the time the order is placed.

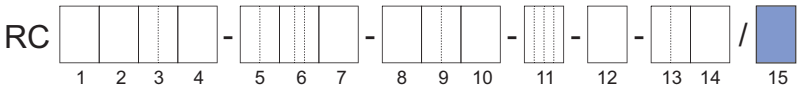
10.5.3 Presetting of customer parameters

Rotamass flow meters can be preconfigured with customer-specific data.



Options	Specification
PS	Presetting according to customer parameters.

10.5.4 Concentration and petroleum measurement



Options	Specification
CST	Standard concentration measurement
AC0	Advanced concentration measurement, customer settings
AC1	Advanced concentration measurement, one default data set
AC2	Advanced concentration measurement, two default data sets
AC3	Advanced concentration measurement, three default data sets
AC4	Advanced concentration measurement, four default data sets
C52	Net Oil Computing (NOC) following API standard

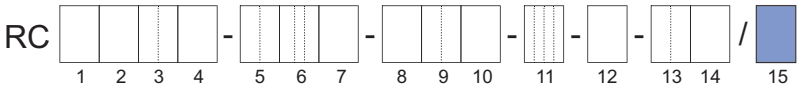
These device options are not available in combination with gas measurement devices (model code position 9 with the values: 70 or 50).

Options with CST, AC␣ and C52 are available only for Ultimate transmitters (value U in model code position 1).

Advanced concentration function can be ordered with 1 to 4 different sets of pre-configured concentrations (AC1 – AC4).

For details about the device function refer to *Concentration and petroleum measurement [▷ 60]*.

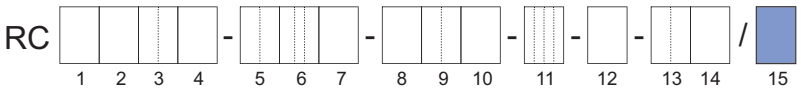
10.5.5 Batching function



Options	Specification
BT	Batching and filling function

For details about the device function refer to *Batching function [▷ 62]*.

10.5.6 Viscosity function

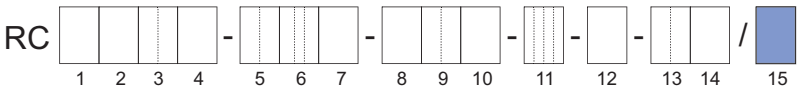


Options	Specification
VM	Viscosity computing function for liquids

For details about the device function refer to *Viscosity function [▷ 63]*.

10.5.7 Insulation and heat tracing

These device options are available only for remote type with long neck.



Options	Specification
T10	Insulation
T21	Insulation and heat tracing, ½" ASME class 150, raised face
T22	Insulation and heat tracing, ½" ASME class 300, raised face
T26	Insulation and heat tracing, EN DN15 PN40
T31	Insulation, heat tracing with ventilation, ½" ASME class 150, raised face
T32	Insulation, heat tracing with ventilation, ½" ASME class 300, raised face
T36	Insulation, heat tracing with ventilation, EN DN15 PN40

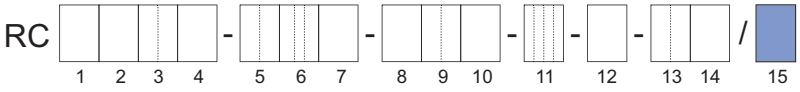
Material of components

Component	Material
Insulation housing	Stainless steel 1.4301/304
Insulation material	Mineral wool (rock wool)
Heat tracing and ventilation lines	Stainless steel 1.4301/1.4306/304 and 1.4404/316L
Heat tracing and ventilation connections	Stainless steel 1.4404/316L; flanges acc. ASME or EN

For dimensions of insulation and heating components see *Process connections, dimensions and weights of sensor [▶ 39]*.

Insulation and heat tracing is not available for process meter size 2H.

10.5.8 Certificates



Accordance with terms of order

Options	Specification
P2	Declaration of compliance with the order 2.1 according to EN 10204
P3	Quality Inspection Certificate (Inspection Certificate 3.1 according to EN 10204)

Material certificates

Options	Specification
P6	Certificate of Marking Transfer and Raw Material Certificates (Inspection Certificate 3.1 according to EN 10204)

Dye penetration test of weld seams

Options	Specification
PT	Dye penetrant test of process connection weld seams according to DIN EN ISO 3452-1, including certificate
PTA	Dye penetrant test of flange welding according to ASME V

Positive Material Identification of wetted parts

Options	Specification
PM	Positive Material Identification of wetted parts, including certificate (Inspection Certificate 3.1 according to EN 10204)

Pressure testing

Options	Specification
P8	Hydrostatic Pressure Test Certificate (Inspection Certificate 3.1 according to EN 10204)

Welding certificates

Options	Specification
WP	Welding certificates: ▪ WPS according to DIN EN ISO 15609-1 ▪ WPQR according to DIN EN ISO 15614-1 ▪ WQC according to DIN EN 287-1 or DIN EN ISO 6906-4
WPA	Welding procedures and Certificate according to ASME IX

Only for the butt welding seam between the process connection and the flow divider.

Mass flow calibration

Water is used as fluid for calibrating the Rotamass.

Options	Specification
K2	Customer-specific 5-point mass flow calibration with factory calibration certificate (mass flow or volume flow of water). A table listing the desired calibration points must be supplied with the order.
K5	Customer-specific 10-point mass flow calibration with DAkkS calibration certificate (mass flow or volume flow of water). A table listing the desired calibration points must be supplied with the order.

Calibration certificates

Options	Specification
L2	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards, including a list of working standards used for calibration. Language: English/Japanese
L3	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards, including a list of primary standards to which the delivered product is traceable. Language: English/Japanese
L4	The certificate confirms that the delivered instrument has undergone a calibration traceable to national standards and that the calibration system of Rota Yokogawa is traceable to national standards. Language: English/Japanese

Surfaces free of oil and grease

Options	Specification
H1	Degreasing of wetted surfaces according to ASTM G93-03 (Level C), including test report

X-ray inspection of flange weld seam

Options	Specification
RT	X-ray inspection of flange weld seam according to DIN EN ISO 17636-1/B Evaluation according to AD 2000 HP 5/3 and DIN EN ISO 5817/C, including certificate
RTA	X-ray test according to ASME V

This device option is not available for devices with wetted parts made of Ni alloy C-22/2.4602.

Ferrite testing

Options	Specification
FE	Ferrite test for flange welding according to DIN EN ISO 8249

Determination of ferrite content is possible for flange weld seams according to DIN EN ISO 8249 and ANSI/AWS A4.2. The pass criterion is a ferrite number < 30. An inspection certificate is delivered with the device.

Combined certificates

Options	Specification
P10	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ P8: Hydrostatic Pressure Test Certificate
P11	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PM: Positive Material Identification of wetted parts
P12	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PT: Dye penetration test according to DIN EN ISO 3452-1 ▪ P8: Hydrostatic Pressure Test Certificate
P13	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PT: Dye penetration test according to DIN EN ISO 3452-1 ▪ PM: Positive Material Identification of wetted parts ▪ P8: Hydrostatic Pressure Test Certificate ▪ WP: Welding certificates
P14	Combination of: ▪ PM: Positive Material Identification of wetted parts ▪ P8: Hydrostatic Pressure Test Certificate ▪ WP: Welding certificates
P20	Combination of: ▪ PTA: Dye Penetrant test of flange welding according to ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V
P21	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ P8: Hydrostatic Pressure Test Certificate ▪ PTA: Dye Penetrant test of flange welding according to ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V

Options	Specification
P22	Combination of: ▪ P3: Quality Inspection Certificate ▪ P6: Certificate of Marking Transfer and Raw Material Certificates ▪ PM: Positive Material Identification of wetted parts ▪ PTA: Dye Penetrant test of flange welding according to ASME V ▪ WPA: Welding procedures and Certificates according to ASME IX ▪ RTA: X-ray test according to ASME V

ASME B31.3 compliance

Options	Specification
P15	ASME B31.3 compliance NORMAL FLUID SERVICE

10.5.9 Country-specific delivery

RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Options	Specification
PJ	Delivery to Japan[1)]
CN	Delivery to China
KC	Delivery to Korea
VE	Delivery to EAC area
VR	Delivery to EAC area and Russia Pattern Approval marking

[1)] Delivery with SI units pre-setting of transmitter and Quality Inspection Certificate (English/Japanese)

10.5.10 Country-specific application

RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Options	Specification
Q11	PESO approval delivery
QR	Primary calibration valid in Russia, including certificate

10.5.11 Rupture disc

In the event of a measuring tube break, complete release of process pressure via the rupture disc cannot be ensured in every case.

The rupture disc's bursting pressure is 20 bar (291 psi), the nominal diameter 8 mm (0.315 inch). If a larger nominal diameter is required, the Yokogawa sales organization may be contacted with regard to customized designs.

RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Options	Specification
RD	Rupture disc

10.5.12 Tube health check

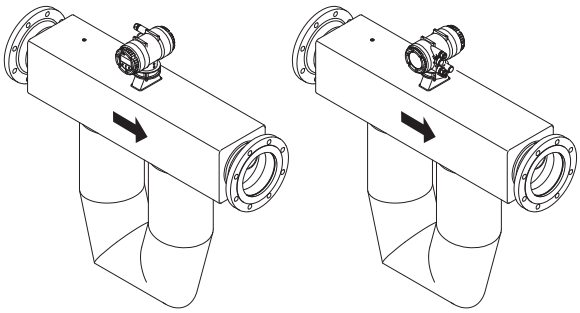
By way of the tube health check, the transmitter can determine whether the tube properties were altered due to corrosion or deposits and whether they could impact accuracy as a result.

RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Options	Specification
TC	Tube health check

10.5.13 Transmitter housing rotated 180°

RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



Standard Option RB

Options	Specification
RB	Alignment of transmitter housing rotated 180°

10.5.14 Measurement of heat quantity

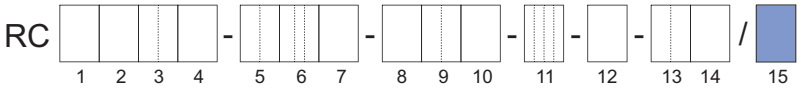
RC - - - - - /
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Options	Specification
CGC	Measurement of the total transported energy content of a fuel in connection with a sensor for determining the fuel's calorific value (e.g. a gas chromatograph, not included in scope of delivery). This option is available only together with model code position 13 JH to JN.

For details about the device function refer to *Measurement of heat quantity [▷ 64]*.

10.5.15 Marine Approval

By ordering options MC2 and MC3 the device will carry a type approval mark by DNV GL. Ordering of fire retardant cable (Y␣␣␣) is mandatory with this option. In case of thermal oil applications option RT or RTA is mandatory. Please note that DNV GL has additional requirements regarding the process conditions as reproduced in the table below. The complete requirements can be found in the classification society's rules concerning the respective use case. Marine approval is not available for all device variants, for details see exclusions in *Overview options [▷ 80]*.



	Option			
	MC2		**MC3**	
Piping system for	Class II [1]		Class III [1]	
	p in bar	T_D in °C	p in bar	T_D in °C
Steam	≤ 16	≤ 300	≤ 7	≤ 170
Thermal oil	≤ 16	≤ 300	≤ 7	≤ 150
Fuel oil, lubricating oil, flammable oil	≤ 16	≤ 150	≤ 7	≤ 60
Other media[2]	≤ 40	≤ 300	≤ 16	≤ 200

p : Design pressure

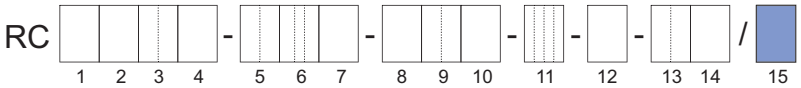
T_D : Design temperature

[1] both specified conditions (p and T_D) shall be met

[2] Cargo oil pipes on oil carriers and open ended pipes (drain overflows, vents, boiler escape pipes etc.) independently of the pressure and temperature, are pertaining to class III.

Options	Specification
MC2	Marine approval according to DNV GL piping class 2
MC3	Marine approval according to DNV GL piping class 3

10.5.16 Customer specific special product manufacture



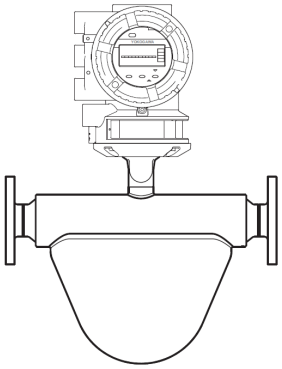
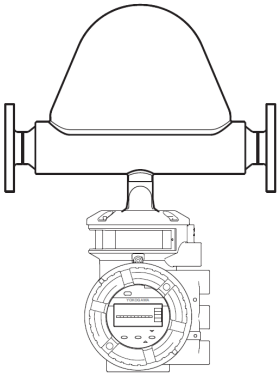
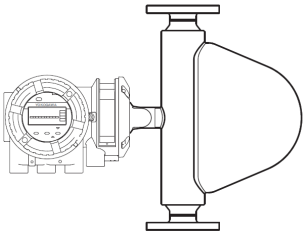
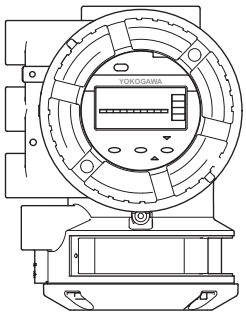
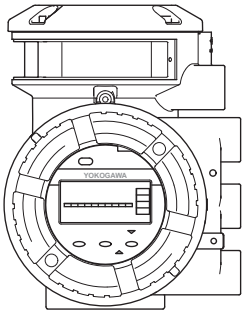
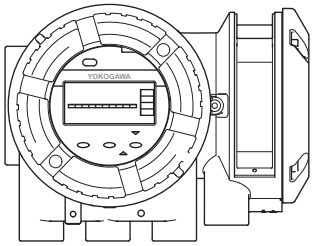
Options	Specification
Z	Deviations from the specifications in this document are possible.

10.6 Ordering Instructions

Specify the following information when ordering a product:

- Model code
- Fluid name
- Language of the quick reference instruction manual:
  - English
  - French
  - German
  - Japanese
  - Russian
  - Korean
  - Chinese
- Display language and language pack (Display only present for value 1 on position 14 of the model code):
  - EN-Pack1 - English
  - DE-Pack1 - German
  - FR-Pack1 - French
  - PT-Pack1 - Portuguese
  - JA-Pack1 - Japanese
  - IT-Pack1 - Italian
  - EN-Pack2 - English
  - DE-Pack2 - German
  - RU-Pack2 - Russian
  - PL-Pack2 - Polish
  - KZ-Pack2 - Kazakh
  - EN-Pack3 - English
  - DE-Pack3 - German
  - FR-Pack3 - French
  - PT-Pack3 - Portuguese
  - IT-Pack3 - Italian
  - ES-Pack3 - Spanish
  - CN-Pack3 - Chinese

- Orientation of the display (Display only present for value 1 on position 14 of the model code):

	Orientation 1	Orientation 2	Orientation 3
Integral type	Horizontal installation - tubes down 	Horizontal installation - tubes up 	Vertical installation 
Remote type			

In the above the figure, the case of the Prime sensor is shown. The design of sensor depend on the each series.

The parameter "Installation Orientation" in transmitter must be set by the customer according to the installation direction of the sensor.

- Tag No. to be engraved on the nameplate (option BG, up to 16 characters length)
- Software Tag No. (both short and long):
  - HART Tag No. (short): up to 8 characters length (Capital letters only)
  - HART Tag No. (long): up to 32 characters length
- Customer name for the certificates (option L2, L3, L4: up to 60 characters length)

- Advanced concentration type (option AC1 – AC4, see *Concentration and petroleum measurement [▷ 94]*):
  - C01 Sugar / Water 0 – 85 °Bx, 0 – 80 °C
  - C02 NaOH / Water 2 – 50 WT%, 0 – 100 °C
  - C03 KOH / Water 0 – 60 WT%, 54 – 100 °C
  - C04 NH4NO3 / Water 1 – 50 WT%, 0 – 80 °C
  - C05 NH4NO3 / Water 20 – 70 WT%, 20 – 100 °C
  - C06 HCl / Water 22 – 34 WT%, 20 – 40 °C
  - C07 HNO3 / Water 50 – 67 WT%, 10 – 60 °C
  - C09 H2O2 / Water 30 – 75 WT%, 4 – 44 °C
  - C10 Ethylene Glycol / Water 10 – 50 WT%, -20 – 40 °C
  - C11 Amylum = starch / Water 33 – 43 WT%, 35 – 45 °C
  - C12 Methanol / Water 35 – 60 WT%, 0 – 40 °C
  - C20 Alcohol / Water 55 – 100 VOL%, 10 – 40 °C
  - C21 Sugar / Water 40 – 80 °Bx, 75 – 100 °C
  - C30 Alcohol / Water 66 – 100 WT%, 15 – 40 °C
  - C37 Alcohol / Water 66 – 100 WT%, 10 – 40 °C

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