Ex instruction manual

Rotamass Coriolis mass flow meter

ROTAMASS Total Insight

IECEx

Table of contents

1 Introduction

1.1 Scope of application

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

- Rotamass Nano
- Rotamass Supreme
- Rotamass Giga
- Rotamass Prime
- Rotamass Intense
- Rotamass Hygienic
- Rotamass CNG
- Rotamass LPG
- Rotamass TI transmitter in combination with a Rotamass 3 sensor

1.2 Applicable documents

The following documents are part of these instructions:

- Quick reference guide
- Operating instructions
- Software user instructions
- General specification

1.3 Explanation

_ is used as a Placeholder for a single character.

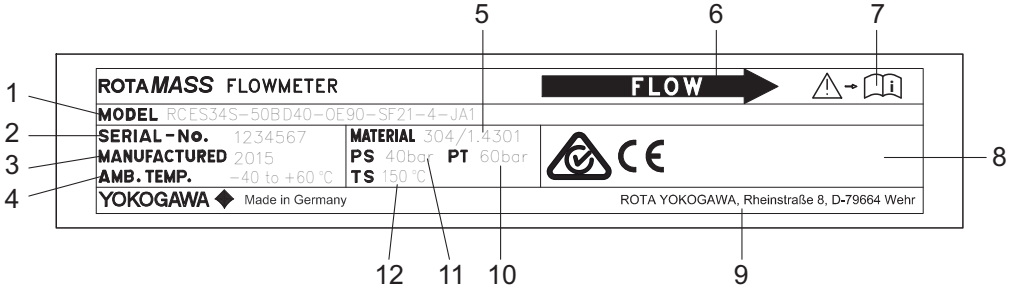
2 Nameplates

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

The variants of the nameplates are described below.

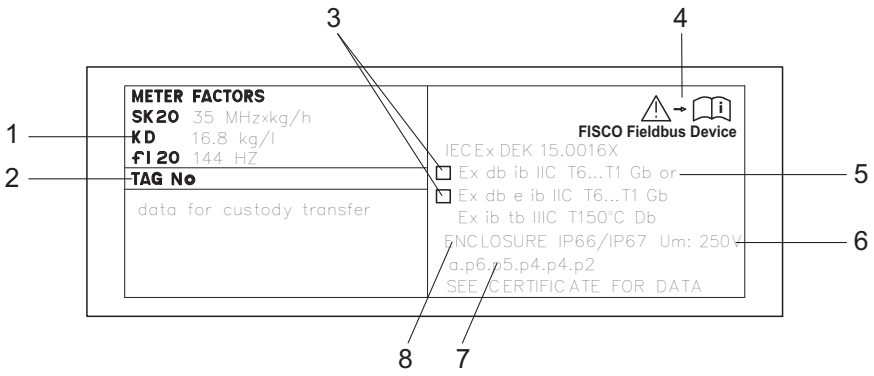
2.1 Sensor, integral type

Main nameplate



1 MS code
2 Serial number
3 Year of manufacture
4 Ambient temperature range
5 Material wetted parts
6 Flow direction
7 Warning that requires reading of the documentation
8 Area for conformity marking
9 Manufacturer's address
10 Test pressure
11 Maximum allowed working pressure at room temperature
12 Maximum allowed process temperature

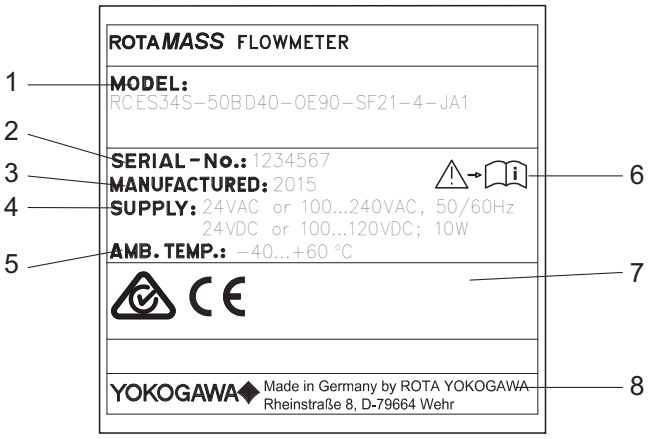
Additional nameplate



1 Calibration constants of sensor
2 Customer-specific identification
3 Identification field for use according to Ex db or Ex db e
4 Reference to documentation
5 Identification of type of protection, explosion group, temperature classes and equipment protection level
6 Maximum r.m.s. a.c. or d.c. voltage
7 Ex code
8 IP code

2.2 Transmitter, integral type

Main nameplate



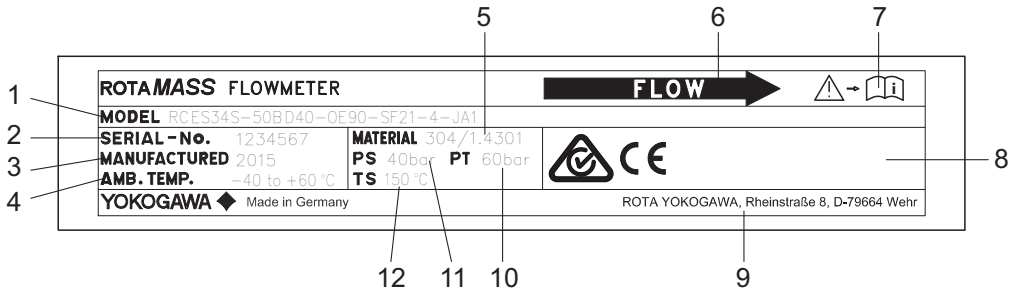
1 MS code
2 Serial number
3 Year of manufacture
4 Power supply range
5 Ambient temperature range
6 Reference to documentation
7 Approvals, identifications, test and quality seals
8 Manufacturer's address

Additional nameplate

1 Identification field for use according to Ex db or Ex db e
2 Reference to documentation
3 Identification of type of protection, explosion group, temperature classes and equipment protection level
4 Maximum r.m.s. a.c. or d.c. voltage
5 IP code

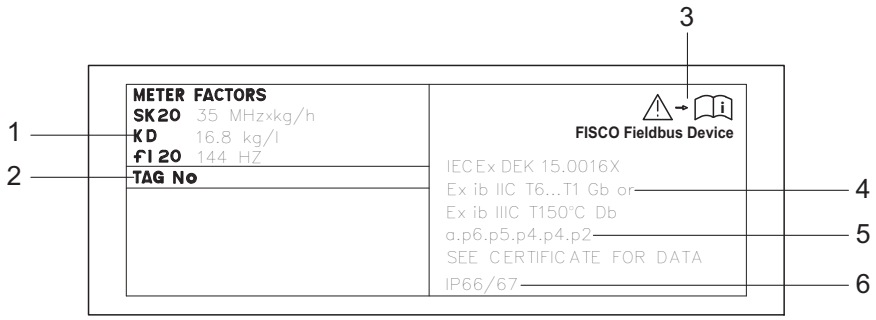
2.3 Sensor, remote type

Main nameplate



1 MS code
2 Serial number
3 Year of manufacture
4 Ambient temperature range
5 Material wetted parts
6 Flow direction
7 Warning that requires reading of the documentation
8 Area for conformity marking
9 Manufacturer's address
10 Test pressure
11 Maximum allowed working pressure at room temperature
12 Maximum allowed process temperature

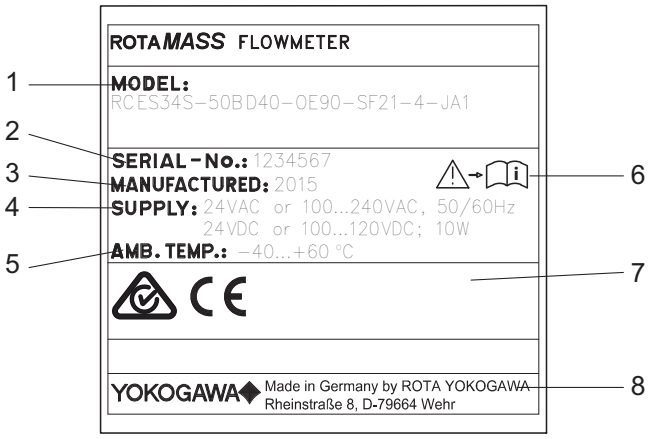
Additional nameplate



1 Calibration constants of sensor
2 Customer-specific identification
3 Reference to documentation
4 Identification of type of protection, explosion group, temperature classes and equipment protection level
5 Ex code
6 IP code

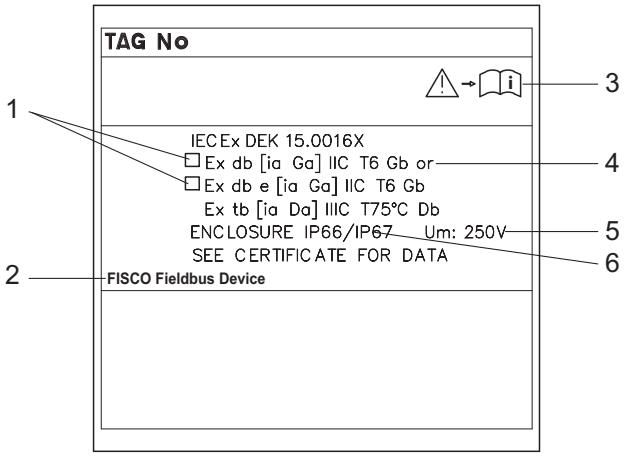
2.4 Transmitter, remote type

Main nameplate



1 MS code
2 Serial number
3 Year of manufacture
4 Power supply range
5 Ambient temperature range
6 Reference to documentation
7 Approvals, identifications, test and quality seals
8 Manufacturer's address

Additional nameplate



1 Identification field for use according to Ex db or Ex db e
2 FISCO marking (only present for devices with Fieldbus communication)
3 Reference to documentation
4 Identification of type of protection, explosion group, temperature classes and equipment protection level
5 Maximum r.m.s. a.c. or d.c. voltage
6 IP code

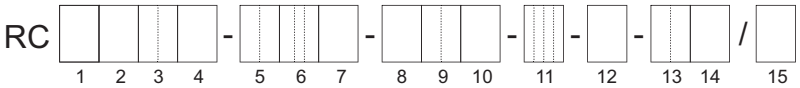
3 Ordering information

3.1 MS code

The MS code of the Rotamass TI 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.	Medium 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

Details are available in the general Specifications of the corresponding Rotamass series.

4 Installation

4.1 General installation rules

⚠ DANGER

Explosion hazard from electrostatic discharge or brush discharge

Life-threatening injuries or ignition of explosive atmospheres

- Avoid actions that could lead to electrostatic discharges. For example, do not wipe the coated surface of the transmitter using a piece of cloth.
- Install the device in zone 1 or 21 so as to avoid the risk of electrostatic discharges and brush discharges caused by rapid dust flow.

Modifying the coriolis mass flow meter as well as using unauthorized parts is prohibited and will void the certification.

- Only trained personnel may install and operate the device in an industrial environment.
- The instructions have to be read and understood by all persons authorized with the transport, storage, installation, electrical installation, commissioning, operation, maintenance and disposal of the Coriolis mass flow meter in hazardous areas.
- The respective applicable national safety regulations concerning the installation of the Coriolis mass flow meter in hazardous areas must be followed.
- Only media to which the wetted parts are sufficiently resistant may be used.
- The use of suitable cable glands must be ensured, see *Threads for cable glands [▸ 11]*.
- Ambient and medium temperature must not exceed the respective maximum values for the applicable *Temperature specification by temperature classes [▸ 44]*.
- The integral type and the remote-type transmitter must not be insulated.

4.2 Threads for cable glands

The terminal box in the transmitter for connecting the sensor is certified as Ex i. IP66/67-certified cable glands and blind plugs must be used for this connection. At a minimum, the allowable temperature range for cable glands and blind plugs must extend from -40...+80 °C. Blind plugs for redundant bushings and cable glands are factory-installed.

The housing of the transmitter is designed as type of protection Ex db. Optionally, the terminal box for the power supply and the inputs/outputs is also certified as Ex e. Properly certified cable glands and blind plugs must be used for this purpose. At a minimum, the allowable temperature range for cable glands and blind plugs must extend from -40...+80 °C. The type of protection is to be indicated on the nameplate's identification fields, see *Nameplates [▷ 5]*.

If the device is to be operated without communication lines, the cable gland provided must be replaced by a blind plug of the same classification.

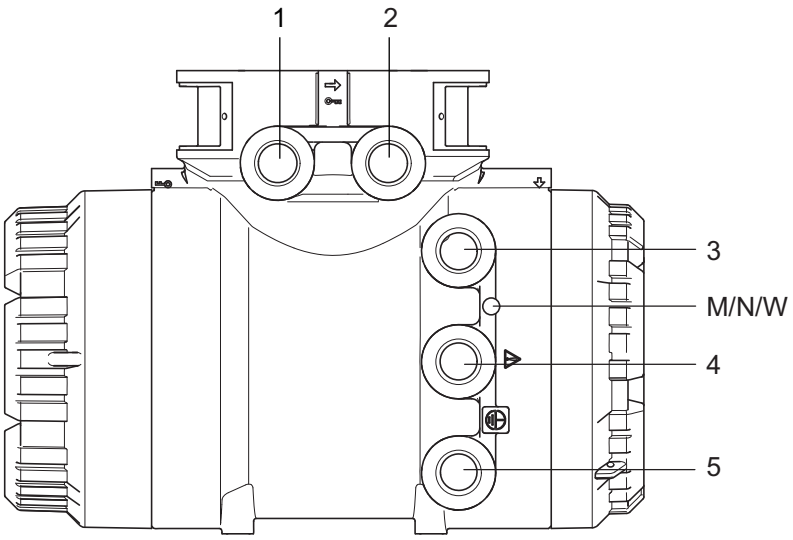
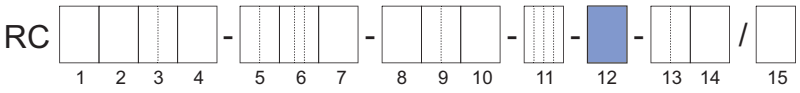


Fig. 1: Threads for the cable glands of the transmitter

1...5	Thread position, see the following table
M	Marking of thread size: ISO M20 × 1.5
N or W	Marking of thread size: ANSI 1/2" NPT

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



Thread	MS code Position 12	Thread position	Delivery state		Notes
			Integral type	Remote type	
ISO M20 × 1.5	4	1	Blind plug IP66/67, factory-installed	Metal cable gland IP66/67, factory-installed	–
		2	Blind plug IP66/67, factory-installed	Blind plug IP66/67, factory-installed	–
		3	Cable gland Ex e tb IP66/67, factory-added		A properly certified IP66/67 cable gland must be provided and professionally installed by the user for type of protection Ex db.
		4	Blind plug Ex e ta IP66/67, factory-installed		A properly certified IP66/67 blind plug must be provided and professionally installed by the user for type of protection Ex db.
		5	Cable gland Ex e tb IP66/67, factory-added		A properly certified IP66/67 cable gland must be provided and professionally installed by the user for type of protection Ex db.
ANSI 1/2" NPT	2	1	Blind plug IP66/67, factory-installed	Metal cable gland IP66/67, factory-installed	–
		2	Blind plug IP66/67, factory-installed	Blind plug IP66/67, factory-installed	–
		3	–		Depending on the type of protection used – Ex e, Ex db, Ex tb – properly certified cable glands with IP66/67 must be provided and professionally installed by the user.
		4	Blind plug Ex db e ta IP66/67, factory-installed		–
		5	–		Depending on the type of protection used – Ex e, Ex db, Ex tb – properly certified cable glands with IP66/67 must be provided and professionally installed by the user.

The cable gland on the sensor is factory-installed. At a minimum, the allowable cable gland temperature must include the range from -50...+100 °C for option L␣␣␣ and the range -50...+80 °C for option Y␣␣␣.

4.3 Ex d-relevant transmitter threads

Ex-certified models are equipped with an Ex d transmitter housing.

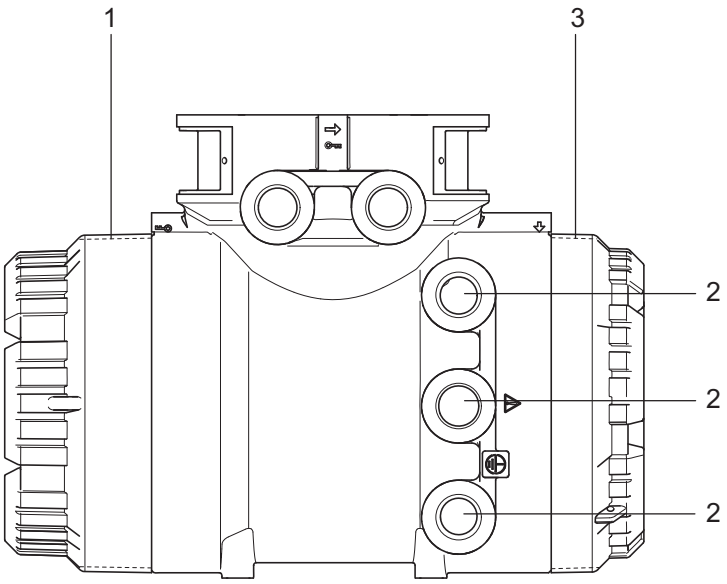


Fig. 2: Ex d-relevant transmitter threads

1 Thread for display cover
2 Threads for cable glands
3 Thread for back cover

Technical data of Ex d-relevant threads

Thread		Lead in mm	Tolerance field	Threads in engagement in mm	Minimum screw-in depth in mm
Display cover		2	6g/6H	≥ 8	≥ 16
Back cover		2			
Cable glands	ISO M20 × 1.5	1.5	6H	≥ 10	≥ 15
	ANSI 1/2" NPT	1.814	acc. to ANSI B 1.20.1	≥ 6	≥ 13.605

5 Electrical installation

5.1 General rules

⚠ DANGER

Insufficient connection to the potential equalization system

Life-threatening injuries from electric shock or ignition of explosive atmospheres

- ▸ Connect remote-type sensor via the grounding terminal outside of the housing to the potential equalization system, see *Grounding connections and intrinsically safe circuits [▸ 15]*.
- ▸ Connect transmitter to the potential equalization system via the grounding terminal outside of the housing, see *Grounding connections and intrinsically safe circuits [▸ 15]*.
- ▸ Connect grounding cable of power supply cable to the grounding screw in the terminal box, see *Grounding connections and intrinsically safe circuits [▸ 15]*.

- The relevant national standards must be considered for the electrical installation.
- Rotamass must be integrated into the potential equalization system of the hazardous area.
- The potential equalization must be ensured alongside the intrinsically safe circuit.
- The power supply must be established with a voltage ≤ 250 V at the terminals L/+ and N/-.
- The grounding screw in the terminal box must be mechanically firmly connected with the threaded hole.
- If the type of protection Ex e is used, cable cross sections of 0.8 to 2.5 mm^2 must be used for the cables of the power supply and the cables of the inputs/outputs. The insulation of the cores must be stripped off 5 to 6 mm.
- The cable connections for the inputs/outputs must be established according to the *connection tables [▸ 16]*. In the process, it must be ensured that the connection type matches the corresponding position of the MS code on the nameplate.
- The maximum input parameters of the intrinsically safe outputs must not be exceeded.

5.2 Grounding connections and intrinsically safe circuits

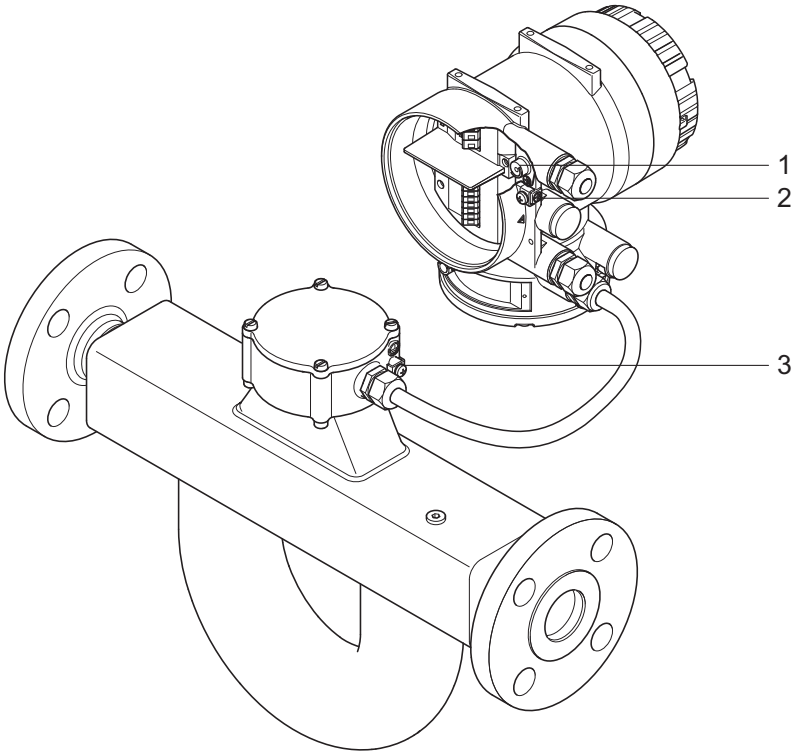


Fig. 3: Grounding connections on transmitter and sensor

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

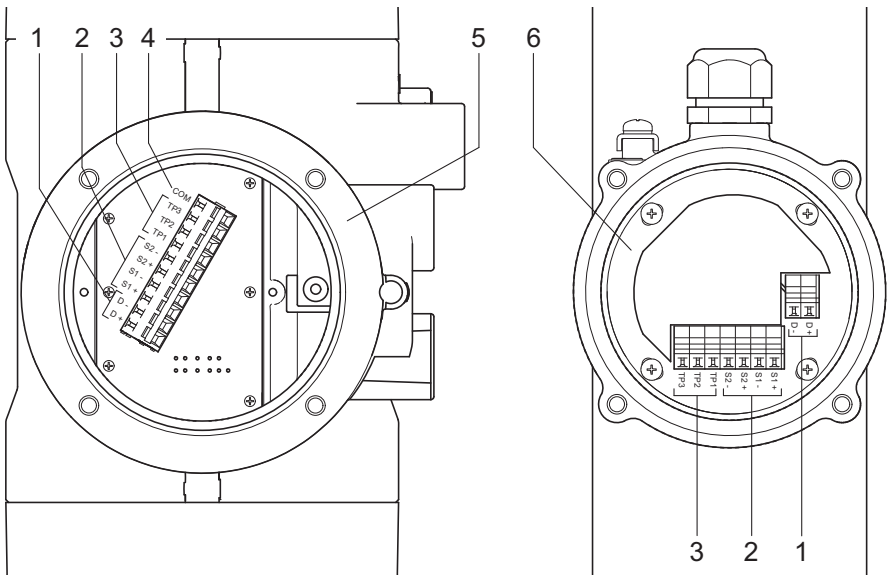


Fig. 4: Connection terminal circuits (transmitter on the left side, sensor on the right side)

1 Driver circuit
2 Sensor circuits
3 Temperature measurement circuits
4 Signal grounding
5 Transmitter
6 Sensor

5.3 Transmitter connection terminals

5.3.1 Configuration of input/output terminals for HART communication and Foundation Fieldbus

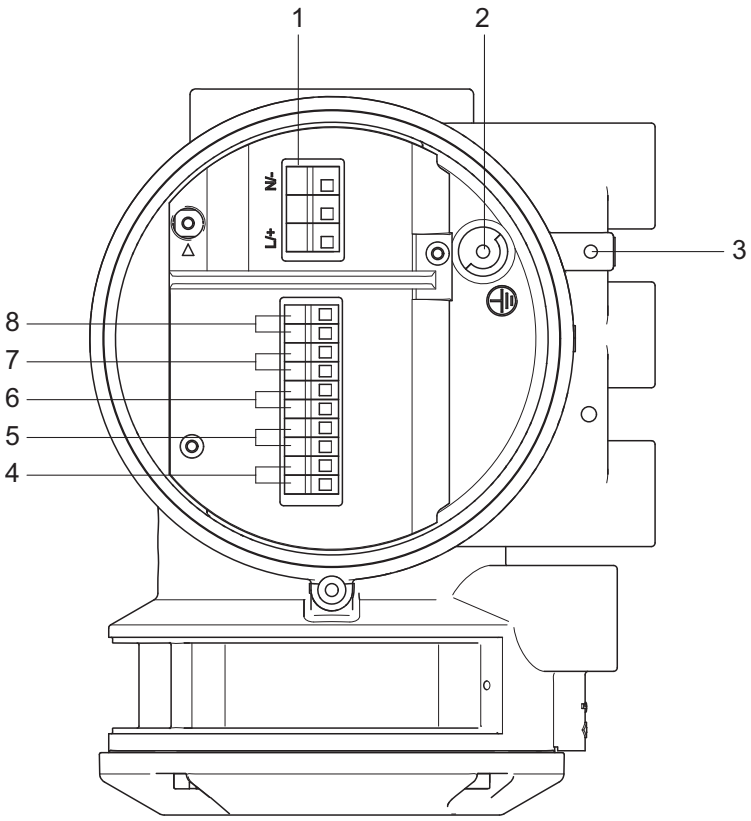
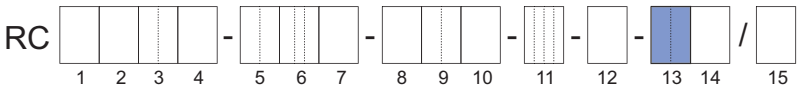


Fig. 5: Terminal box for connection to external devices for HART and for the transmitter power supply

1	Power supply connection terminals	5	I/O2 +/-
2	Grounding screw in terminal box	6	I/O3 +/-
3	Grounding terminal	7	I/O4 +/-
4	I/O1 +/-	8	WP

The applicable operating instructions must be observed for connecting the cables.

The connection type is defined according to the product variant ordered. The following figure shows the relevant position of the MS code:



MS code	Connection terminal assignment				
Position 13	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

MS code	Connection terminal assignment				
Position 13	I/O1 +/-	I/O2 +/-	I/O3 +/-	I/O4 +/-	WP
JE	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Passive	Write-protect
JF	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active Internal pull-up resistor	Write-protect
JG	Iout1 Active	P/Sout1 Passive	Sin	P/Sout2 Active	Write-protect
JH	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Active	Write-protect
JJ	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Active	Write-protect
JK	Iout1 Active	P/Sout1 Passive	Sin	Iin Active	Write-protect
JL	Iout1 Active	P/Sout1 Passive	Iout2 Passive	Iin Passive	Write-protect
JM	Iout1 Active	P/Sout1 Passive	P/Sout2 Passive	Iin Passive	Write-protect
JN	Iout1 Active	P/Sout1 Passive	Sin	Iin Passive	Write-protect
JP	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	–	Write-protect
JQ	Iout1 Passive	P/Sout1 Passive	Iout2 Passive	P/Sout2 Passive	Write-protect
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
F␣	Foundation Fieldbus	–	–	–	Write-protect

Iout1 Active or passive current output with HART communication
Iout2 Active or passive current output
Iin Active or passive current input
P/Sout1 Passive pulse or status output
P/Sout2 Active or passive pulse or status output
Sin Status input
Sout Status output
␣ digit

5.3.2 Configuration of input/output terminals for Modbus communication

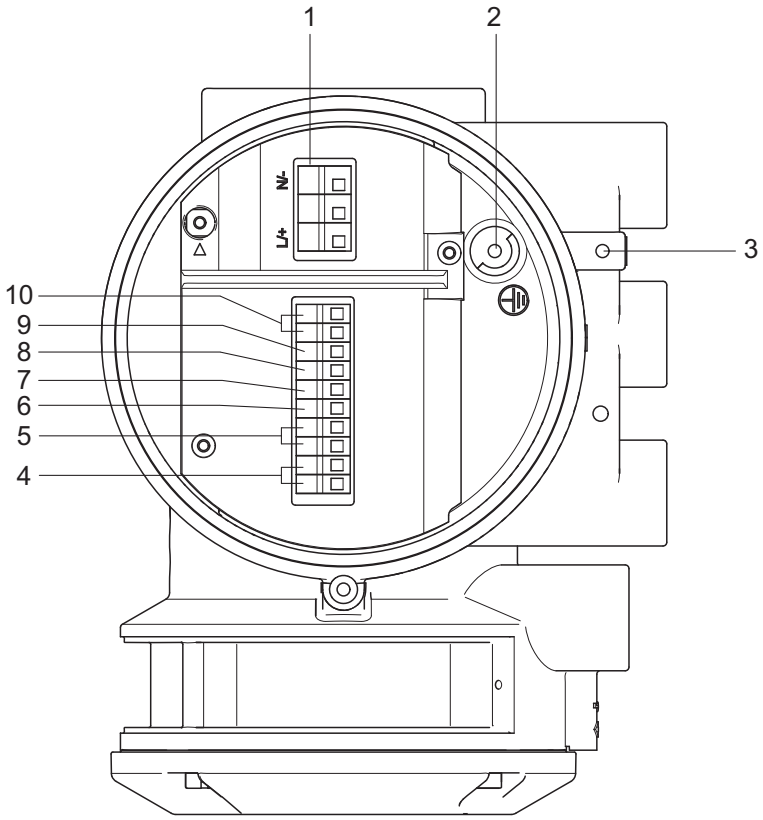
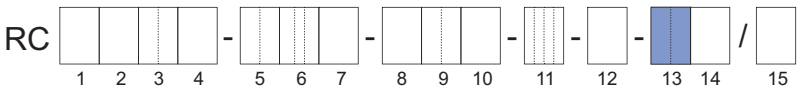


Fig. 6: Terminal box for connection to external devices for Modbus and for the transmitter power supply

1	Power supply connection terminals	6	I/O3 +
2	Grounding screw in terminal box	7	I/O3 -
3	Grounding terminal	8	I/O4 +
4	I/O1 +/-	9	I/O4 -
5	I/O2 +/-	10	WP

The applicable operating instructions must be observed for connecting the cables.

The connection type is defined according to the product variant ordered. The following figure shows the relevant position of the MS code:



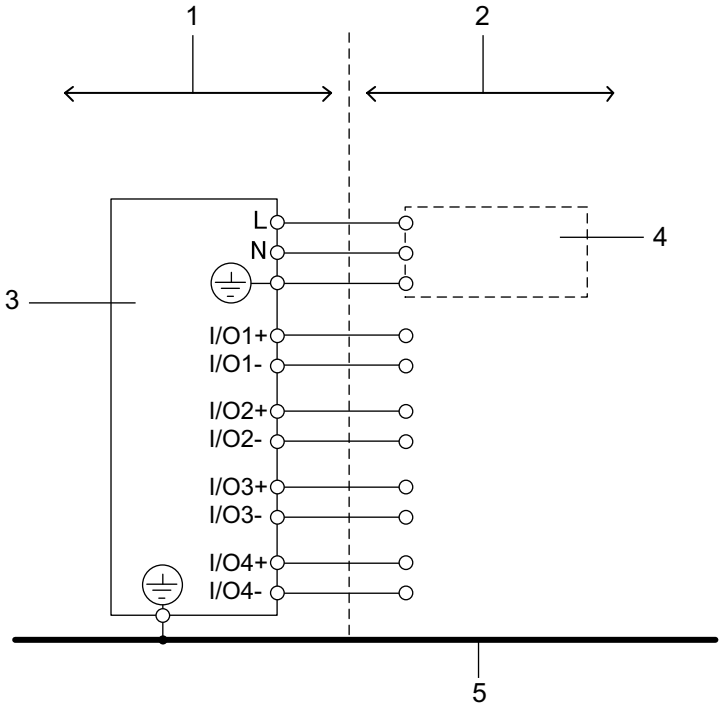
MS code	Connection terminal assignment						
Position 13	I/O1 +/-	I/O2 +/-	I/O3 +	I/O3 -	I/O4 +	I/O4 -	WP
M0	–	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M2	Iin Active	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M3	P/Sout Passive	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M4	P/Sout Active	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect

MS code	Connection terminal assignment						
Position 13	I/O1 +/-	I/O2 +/-	I/O3 +	I/O3 -	I/O4 +	I/O4 -	WP
M5	P/Sout Active Internal pull-up resistor	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M6	Iout Active	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect
M7	Iin Passive	P/Sout Passive	–	Modbus C	Modbus B	Modbus A	Write-protect

Iout Active current output, no HART
Iin Active or passive current input
P/Sout Active or passive pulse or status output

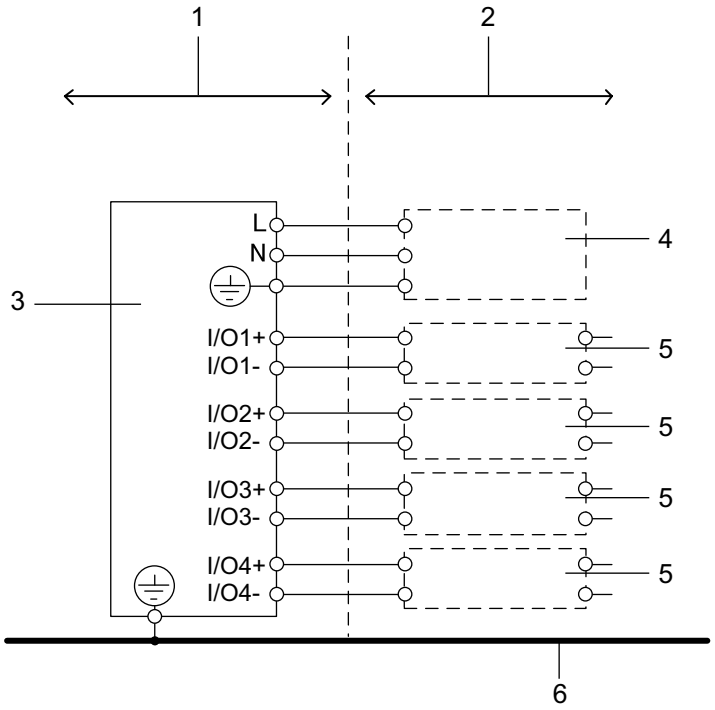
5.4 Installation diagrams

5.4.1 Integral type without intrinsically safe I/O outputs



1 Hazardous area
2 Safe area
3 Rotamass
4 Power supply
5 Potential equalization system

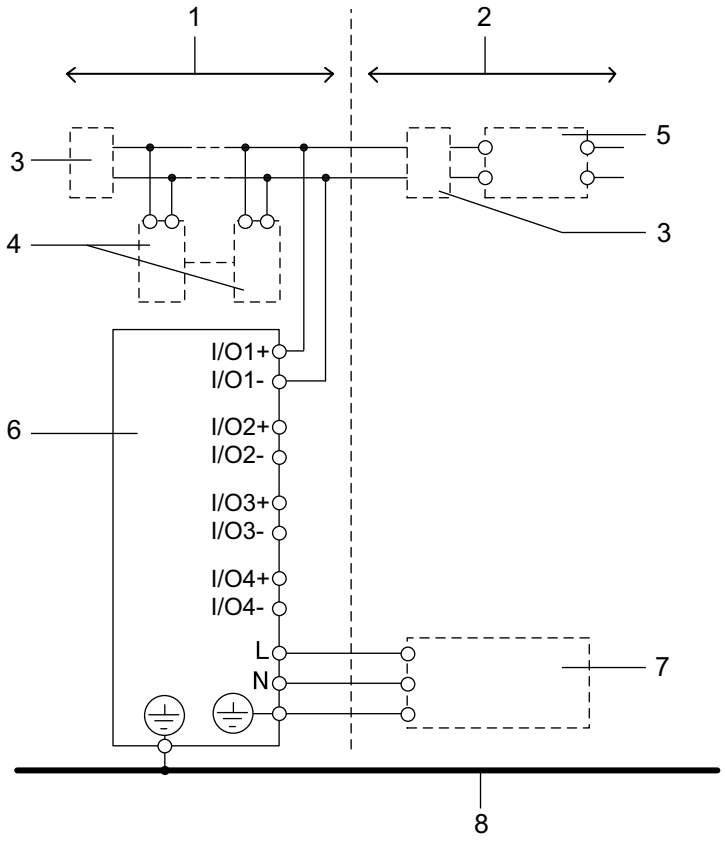
5.4.2 Integral type with intrinsically safe I/O outputs



1 Hazardous area
2 Safe area
3 Rotamass
4 Power supply
5 Associated apparatus
6 Potential equalization system

Multi-core cable connecting separated intrinsically safe circuits IO1, IO2, IO3, IO4 shall be type A or B in accordance with IEC 60079-14.

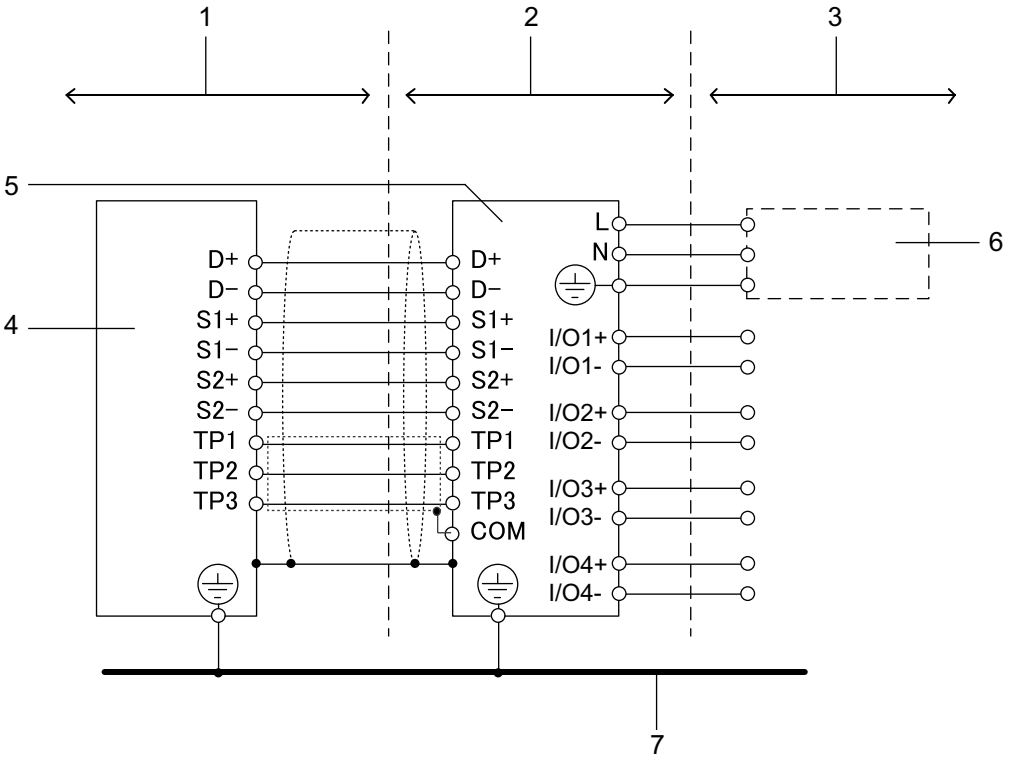
5.4.3 Integral type for Foundation Fieldbus communication (intrinsically safe)



1 Hazardous area
2 Safe area
3 Terminator
4 Field device
5 Associated apparatus
6 Rotamass
7 Power supply
8 Potential equalization system

5.4.4 Remote type without intrinsically safe I/O outputs

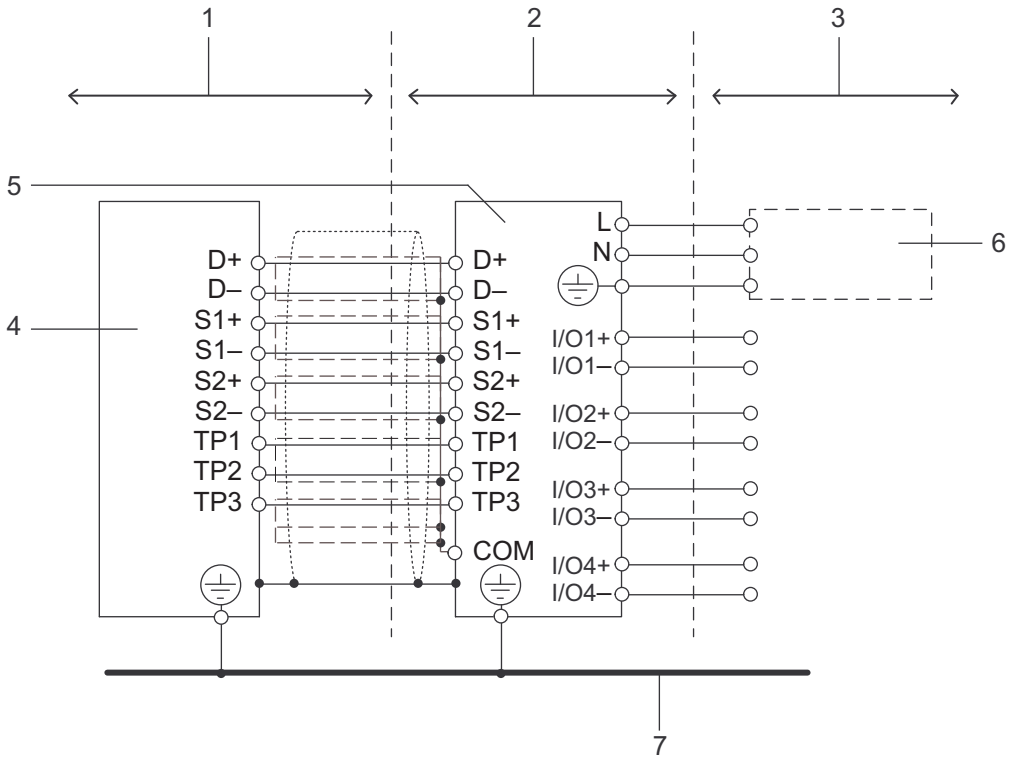
Option L□□□



1	Hazardous area
2	Hazardous area or safe area
3	Safe area
4	Sensor
5	Transmitter
6	Power supply
7	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

Option Y⎵⎵⎵

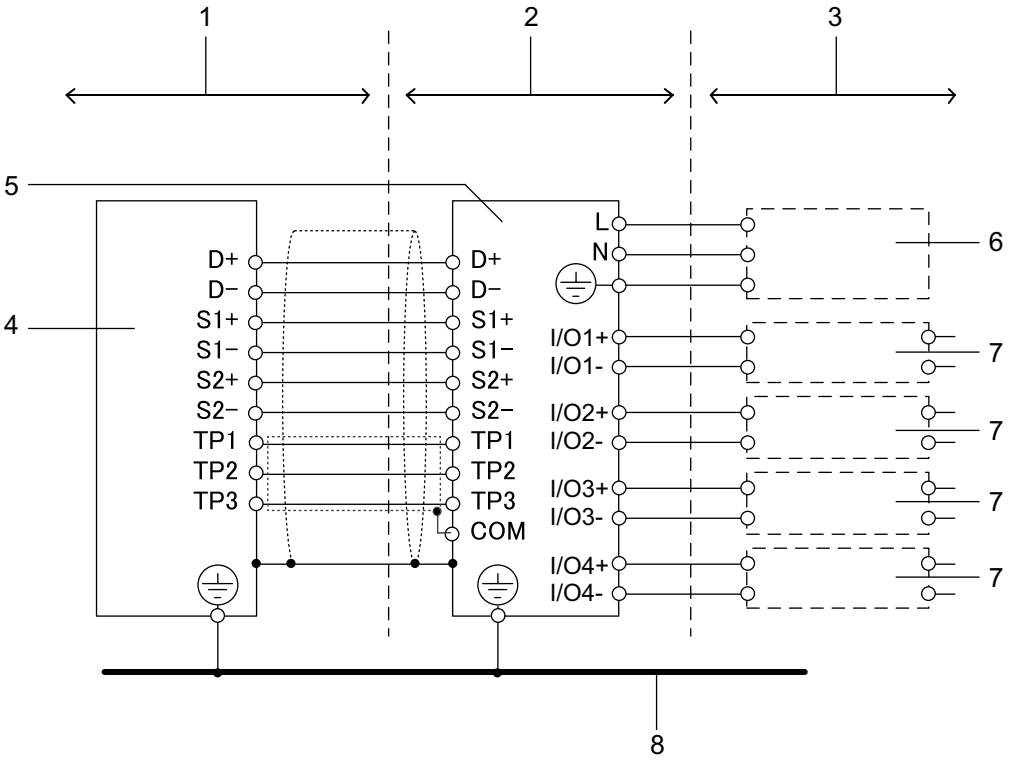


1	Hazardous area
2	Hazardous area or safe area
3	Safe area
4	Sensor
5	Transmitter
6	Power supply
7	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

5.4.5 Remote type with intrinsically safe I/O outputs

Option L□□□

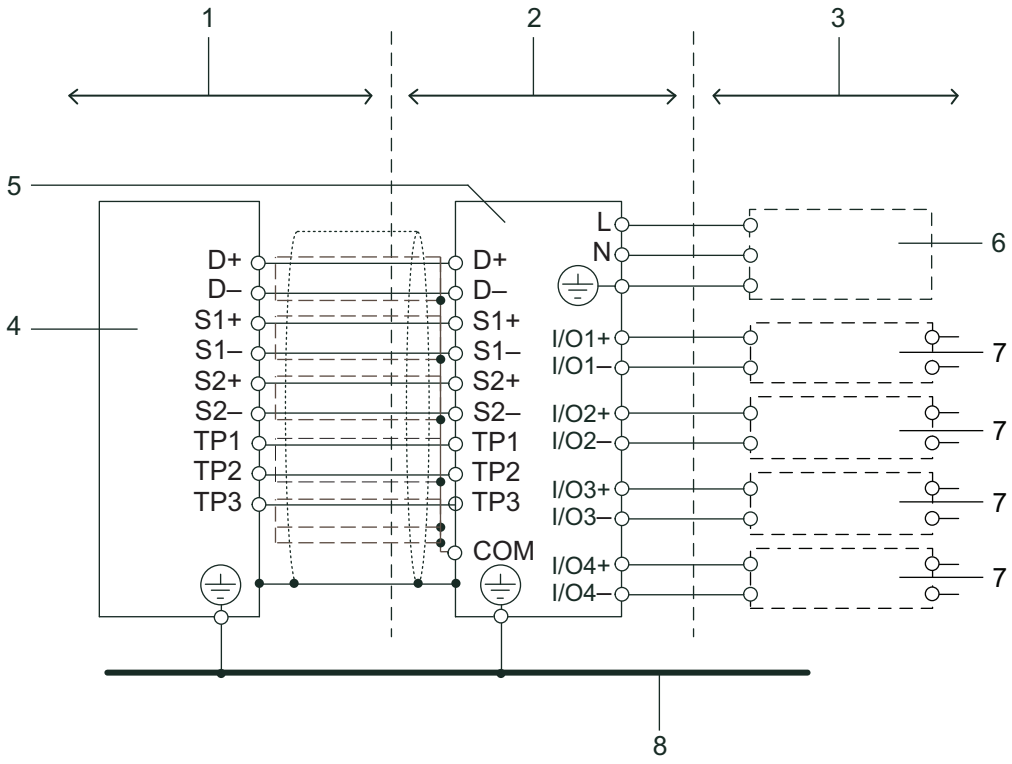


1	Hazardous area
2	Hazardous area or safe area
3	Safe area
4	Sensor
5	Transmitter
6	Power supply
7	Associated apparatus
8	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits IO1, IO2, IO3, IO4 shall be type A or B in accordance with IEC 60079-14.

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

Option Y⎵⎵⎵



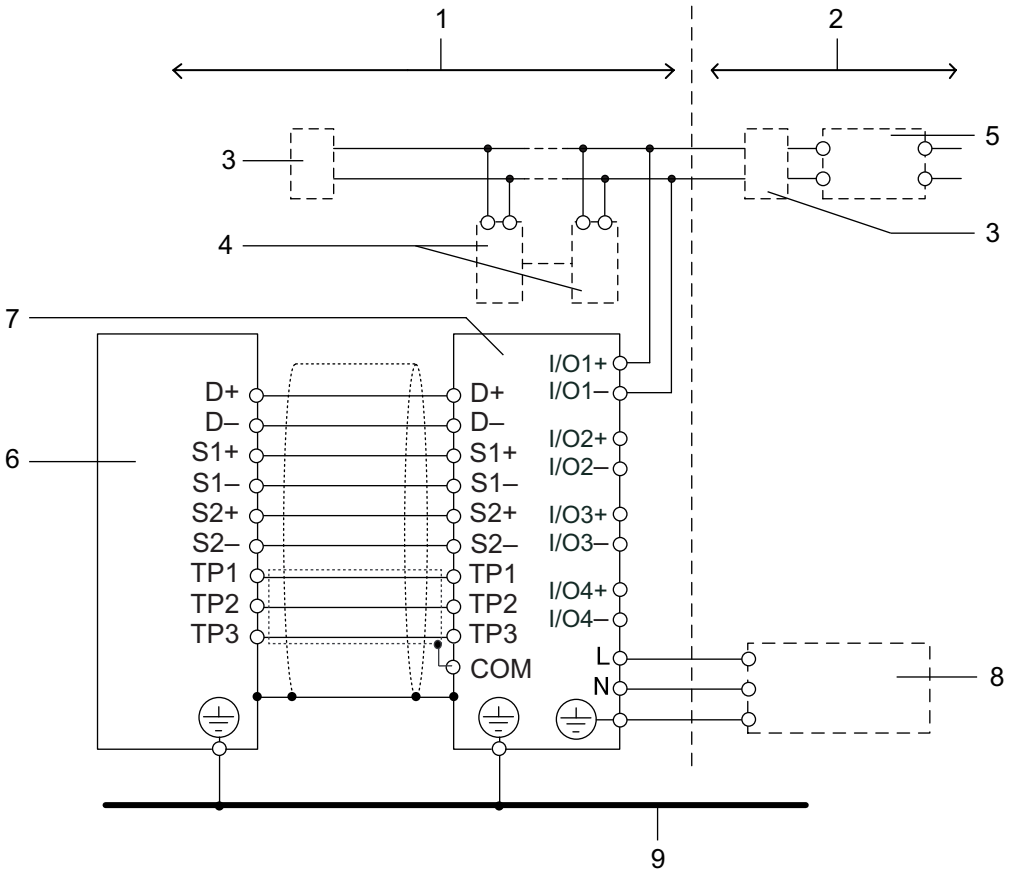
1	Hazardous area
2	Hazardous area or safe area
3	Safe area
4	Sensor
5	Transmitter
6	Power supply
7	Associated apparatus
8	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits IO1, IO2, IO3, IO4 shall be type A or B in accordance with IEC 60079-14.

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

5.4.6 Remote type for Foundation Fieldbus communication (intrinsically safe)

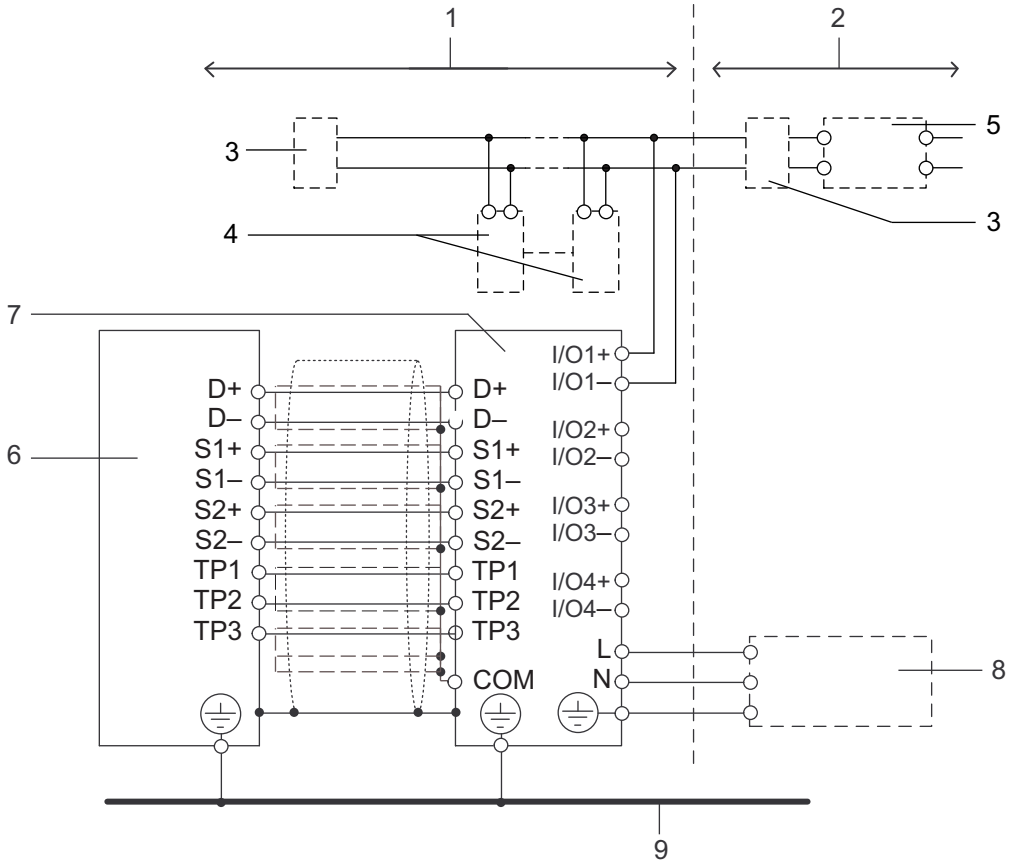
Option L□□□



1	Hazardous area
2	Safe area
3	Terminator
4	Field device
5	Associated apparatus
6	Sensor
7	Transmitter
8	Power supply
9	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

Option Y⎵⎵⎵



1	Hazardous area
2	Safe area
3	Terminator
4	Field device
5	Associated apparatus
6	Sensor
7	Transmitter
8	Power supply
9	Potential equalization system
D+/D-	Driver circuit
S1+/ S1-, S2+/S2-	Sensor circuits
TP1, TP2, TP3	Temperature measurement circuits

Multi-core cable connecting separated intrinsically safe circuits D+/D-, S1+/S1-, S2+/S2- and TP1/TP2/TP3 shall be type A or B in accordance with IEC 60079-14.

6 Operation, maintenance and repair

6.1 General rules

DANGER

Life-threatening injuries from electric shock

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

DANGER

Life-threatening injuries from ignition of explosive atmospheres

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

Modifying the coriolis mass flow meter as well as using unauthorized parts is prohibited and will void the certification.

- The locking screws of the covers may be loosened and tightened only with an Allen wrench.
- After closing and before commissioning, it must be checked whether the locking screws are tightened and the covers are closed.

6.2 Replacing the sensor

If a defective Rotamass TI sensor must be replaced, contact the Yokogawa service.

The medium temperature range is *indicated [▸ 5]* by the Ex code on the sensor's additional nameplate. Check whether there is a change in Ex code compared to the old sensor. If this is the case, the medium temperature range must be compared to the hazardous area requirements and assessed, see *Ex code [▸ 40]*.

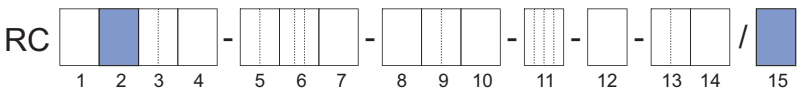
6.3 Replacing the transmitter

If a defective transmitter must be replaced, contact the Yokogawa service.

Observe the following items in order to obtain the replacement:

- Replace transmitter with option /EPT with a transmitter featuring the same option
- Transmitters as replacement for Rotamass 3 transmitters are identified by the value 3 in the MS code (position 2)

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



7 Approvals and standards

IECEx approval IECEx DEK 15.0016X

Applied standards

- IEC 60079-0:2011
- IEC 60079-1:2014
- IEC 60079-7:2006
- IEC 60079-11:2011
- IEC 60079-31:2013

8 Technical data

This chapter features the ex-relevant technical data.

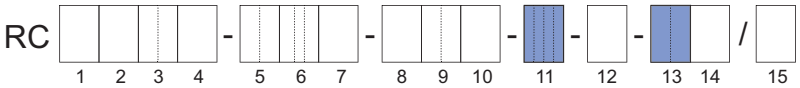
Aside from the maximum surface temperature, the technical data of the integral type as well as the remote type transmitters are identical, regardless of product family. For the remote-type sensor the technical data are different, depending on the product family.

- *Integral type [▷ 31]*
- Remote type
  - *Nano [▷ 33]*
  - *Supreme, Intense and Giga sensor [▷ 34]*
  - *Prime and Hygienic sensor [▷ 35]*
  - *CNG sensor [▷ 33], [▷ 34]*
  - *LPG sensor [▷ 33], [▷ 34]*
  - *Transmitter [▷ 36]*
  - *Connecting cable [▷ 38]*
  - *Connection to Rotamass 3 sensor [▷ 39]*

8.1 Integral type

The Ex marking is determined via the Ex approval product properties as well as inputs and outputs.

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



Ex marking

Ex approval	MS code Position 11	Inputs and outputs	MS code Position 13	Ex marking
IECEx approval for explosion group IIC and IIIC	SF21	Not intrinsically safe	JA, JB, JC, JD, JE, JF, JG, JH, JJ, JK, JL, JM, JN M0, M2, M3, M4, M5, M6, M7 F␣[1]	Ex db ib IIC T6...T1 Gb or Ex db e ib IIC T6...T1 Gb Ex ib tb IIIC T150 °C Db
		Intrinsically safe	JP, JQ, JR, JS F␣[2]	Ex db ib [ia Ga] IIC T6...T1 Gb or Ex db e ib [ia Ga] IIC T6...T1 Gb Ex ib tb [ia Da] IIIC T150 °C Db
IECEx approval for explosion group IIB and IIIC	SF22	Not intrinsically safe	JA, JB, JC, JD, JE, JF, JG, JH, JJ, JK, JL, JM, JN M0, M2, M3, M4, M5, M6, M7 F␣[1]	Ex db ib IIB T6...T1 Gb or Ex db e ib IIB T6...T1 Gb Ex ib tb IIIC T150 °C Db
		Intrinsically safe	JP, JQ, JR, JS F␣[2]	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 [ia Da] IIIC T150 °C Db

␣[1] : even digit
␣[2] : odd digit

Allowed temperature ranges

Standard temperature range	
Medium temperature range	-50...+150 °C
Maximum surface temperature	+150 °C
Ambient temperature range	-40...+60 °C

Technical data

Electrical data	
Operating voltage V_{AC}	20.4...28.8 V_{AC} or 80...250 V_{AC}
Operating voltage V_{DC}	20.4...28.8 V_{DC} or 90...130 V_{DC}
Maximum output	10 W
Overvoltage category	II
Maximum r.m.s. a.c. or d.c. voltage not intrinsically safe circuits U_m	250 V

Maximum input values for intrinsically safe current and pulse outputs (HART communication)	
Voltage U_i	30 V
Current I_i	300 mA
Power P_i	1.25 W
Inductance L_i	12 µH
Electrical capacitance C_i, for current output	4.84 nF
Electrical capacitance C_i, for pulse output	14.6 nF

The dielectric strength of at least 500 V a.c. r.m.s. between the intrinsically safe circuits and the enclosure is limited only by the overvoltage protection.

Maximum input values for intrinsically safe outputs (Foundation Fieldbus communication)	
Voltage U_i	30 V
Current I_i	380 mA
Power P_i	5.32 W
Inductance L_i	10 µH
Electrical capacitance C_i	5 nF
FISCO field device	

The dielectric strength of at least 500 V a.c. r.m.s. between the intrinsically safe circuits and the enclosure is limited only by the overvoltage protection.

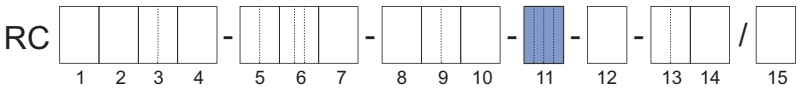
Ambient conditions	
IP code of housing	IP66/IP67
Relative humidity range	0...95 %
Allowed pollution degree according to EN 61010-1	4 (in operation)

8.2 Remote type

8.2.1 Nano, CNG, LPG sensor

The Ex marking is determined via the Ex approval product property.

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



Ex marking

Ex approval	MS code Position 11	Ex marking
IECEx approval for explosion group IIC and IIIC	SF21	Ex ib IIC T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db
IECEx approval for explosion group IIB and IIIC	SF22	Ex ib IIB T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db

[1] Maximum surface temperature according to the tables "Allowed temperatures"

Allowed temperature ranges

The allowed temperature ranges specified below are based on the technical performance parameters of Rotamass. In addition, *temperature classes [▷ 44]* are relevant and must be taken into account for Ex applications.

In case of CNG and LPG sensors with "Meter size" smaller than 34 these ranges are applicable.

Standard temperature range	
Medium temperature range	-50...+150 °C
Maximum surface temperature	+150 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C
Heat tracing temperature range	0...+150 °C

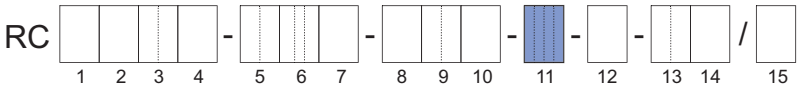
Mid-temperature range	
Medium temperature range	-50...+260 °C
Medium temperature range, with option Insulation T␣␣	-50...+260 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C
Maximum surface temperature	+260 °C
Maximum surface temperature, with option Insulation T␣␣	+260 °C
Heat tracing temperature range	0...+220 °C

Ambient conditions	
IP code of housing	IP66/IP67
Relative humidity range	0...95 %
Allowed pollution degree according to EN 61010-1	4 (in operation)

8.2.2 Supreme, CNG, LPG, Intense and Giga sensor

The Ex marking is determined via the Ex approval product property.

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



Ex marking

Ex approval	MS code Position 11	Ex marking
IECEx approval for explosion group IIC and IIIC	SF21	Ex ib IIC T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db
IECEx approval for explosion group IIB and IIIC	SF22	Ex ib IIB T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db

[1] Maximum surface temperature according to the tables "Allowed temperatures"

Allowed temperature ranges

The allowed temperature ranges specified below are based on the technical performance parameters of Rotamass. For Ex applications, the *Ex code [▸ 40]* and the *Temperature classes [▸ 44]* are also relevant and must be taken into account.

In case of CNG and LPG sensors with "Meter size" 34 these ranges are applicable.

Standard temperature range	
Medium temperature range	-50...+150 °C
Maximum surface temperature	+150 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C
Heat tracing temperature range	0...+150 °C

Low-temperature range	
Medium temperature	-200...+150 °C
Maximum surface temperature	+150 °C
Heat tracing temperature	0...+150 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C

Mid-temperature range	
Medium temperature	-50...+220 °C
Maximum surface temperature	+220 °C
Heat tracing temperature	0...+220 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C

High-temperature range	
Medium temperature	0...+350 °C
Maximum surface temperature	+350 °C
Heat tracing temperature	0...+350 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C

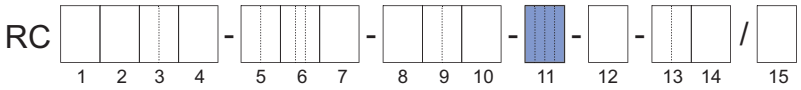
Technical data

Ambient conditions	
IP code of housing	IP66/IP67
Relative humidity range	0...95 %
Allowed pollution degree according to EN 61010-1	4 (in operation)

8.2.3 Prime and Hygienic sensor

The Ex marking is determined via the Ex approval product property.

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



Ex marking

Ex approval	MS code Position 11	Ex marking
IECEx approval for explosion group IIC and IIIC	SF21	Ex ib IIC T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db
IECEx approval for explosion group IIB and IIIC	SF22	Ex ib IIB T6...T1 Gb Ex ib IIIC T␣␣␣°C[1] Db

[1] Maximum surface temperature according to the tables "Allowed temperatures"

Allowed temperature ranges

The allowed temperature ranges specified below are based on the technical performance parameters of Rotamass. For Ex applications, the *Ex code [▸ 40]* and the *Temperature classes [▸ 44]* are also relevant and must be taken into account.

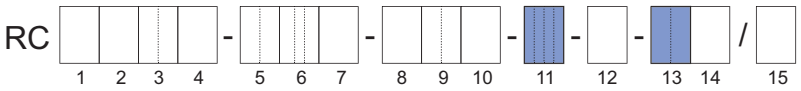
Standard temperature range	
Medium temperature range	-50...+200 °C
Maximum surface temperature	+200 °C
Ambient temperature range, with option L␣␣␣	-50...+80 °C
Ambient temperature range, with option Y␣␣␣	-30...+80 °C

Technical data

Ambient conditions	
IP code of housing	IP66/IP67
Relative humidity range	0...95 %
Allowed pollution degree according to EN 61010-1	4 (in operation)

8.2.4 Transmitter

The Ex marking is determined via the Ex approval product properties as well as inputs and outputs. The following figure shows the relevant positions of the MS code:



Ex marking

Tab. 1: Ex marking depending on the MS code for transmitters of remote types of all product families

Ex approval	MS code Position 11	Inputs and outputs	MS code Position 13	Ex marking
IECEx approval for explosion group IIC and IIIC	SF21	Not intrinsically safe	JA, JB, JC, JD, JE, JF, JG, JH, JJ, JK, JL, JM, JN M0, M2, M3, M4, M5, M6, M7 F␣[1]	Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb Ex tb [ia Da] IIIC T75 °C Db
		Intrinsically safe	JP, JQ, JR, JS F␣[2]	Ex db [ia Ga] IIC T6 Gb or Ex db e [ia Ga] IIC T6 Gb Ex tb [ia Da] IIIC T75 °C Db
IECEx approval for explosion group IIB and IIIC	SF22	Not intrinsically safe	JA, JB, JC, JD, JE, JF, JG, JH, JJ, JK, JL, JM, JN M0, M2, M3, M4, M5, M6, M7 F␣[1]	Ex db [ia Ga] IIB T6 Gb or Ex db e [ia Ga] IIB T6 Gb Ex tb [ia Da] IIIC T75 °C Db
		Intrinsically safe	JP, JQ, JR, JS F␣[2]	Ex db [ia Ga] [ia IIC Ga] IIB T6 Gb or Ex db e [ia Ga] [ia IIC Ga] IIB T6 Gb Ex tb [ia Da] IIIC T75 °C Db

␣[1] : even digit
␣[2] : odd digit

Technical data

Allowed temperatures	
Ambient temperature range	-40...+60 °C
Maximum surface temperature	+75 °C

Electrical data	
Operating voltage V_{AC}	20.4...28.8 V_{AC} or 80...250 V_{AC}
Operating voltage V_{DC}	20.4...28.8 V_{DC} or 90...130 V_{DC}
Maximum output	10 W
Overvoltage category	II
Maximum r.m.s. a.c. or d.c. voltage not intrinsically safe circuits U_m	250 V

Maximum input values for intrinsically safe current and pulse outputs (HART communication)	
Voltage U_i	30 V
Current I_i	300 mA
Power P_i	1.25 W
Inductance L_i	12 µH
Electrical capacitance C_i, for current output	4.84 nF
Electrical capacitance C_i, for pulse output	14.6 nF

The dielectric strength of at least 500 V a.c. r.m.s. between the intrinsically safe circuits and the enclosure is limited only by the overvoltage protection.

Maximum input values for intrinsically safe outputs (Foundation Fieldbus communication)	
Voltage U_i	30 V
Current I_i	380 mA
Power P_i	5.32 W
Inductance L_i	10 µH
Electrical capacitance C_i	5 nF
FISCO field device	

The dielectric strength of at least 500 V a.c. r.m.s. between the intrinsically safe circuits and the enclosure is limited only by the overvoltage protection.

Ambient conditions	
IP code of housing	IP66/IP67
Relative humidity range	0...95 %
Allowed pollution degree according to EN 61010-1	4 (in operation)

8.2.5 Connecting cable

To connect the sensor with the transmitter, the following specifications must be adhered to for Ex applications:

Complete cable	
Temperature range, with option L␣␣␣:	-50...+105 °C
Temperature range, with option Y␣␣␣:	-30...+80°C

Connection terminals/cable section	Maximum inductance	Maximum capacitance
D+/D-, S1+/ S1-, S2+/S2-	< 0.03 mH	< 90 nF
TP1, TP2, TP3	< 158 mH	< 11 µF

Calculation of maximum allowed cable length for option L␣␣␣

The supplied connecting cable has the following line constants:

Line type	Connection terminals	Capacitance in nF/km		Inductance in mH/km
		Core/core	Core/shield	
Coaxial	D+/D-, S1+/ S1-, S2+/S2-	120	132	0.175
AWG20	TP1, TP2, TP3	145	290	0.7

The resulting maximum allowed cable length is:

Connection terminals	Limitation	Calculation		Length limitation
D+/D-, S1+/ S1-, S2+/S2-	Inductance	0.03 mH / (0.175 mH/km)	=	171 m
D+/D-, S1+/ S1-, S2+/S2-	Capacitance	90 nF / (132 nF/km)	=	682 m
TP1, TP2, TP3	Inductance	158 mH / (0.7 mH/km)	=	226 km
TP1, TP2, TP3	Capacitance	11 µF / (290 nF/km)	=	38 km
	Maximum allowed cable length		=	**171 m**

See also installation diagrams, *Remote type with intrinsically safe I/O outputs [▷ 24]*.

Calculation of maximum allowed cable length for option Y␣␣␣

The supplied marine cable has the following line constants:

Connection terminals	Capacitance in nF/km	Inductance in mH/km
D+/D-, S1+/ S1-, S2+/S2-,TP1, TP2, TP3	81	0.315

Inductance and capacitance at terminals D+/D-, S1+/S1-, S2+/S2- are limiting.

Limitation	Calculation		Length limitation
Inductance	0.03 mH / (0.315 mH/km)	=	95 m
Capacitance	90 nF / (81 nF/km)	=	1.1 km
Maximum allowed cable length		=	**95 m**

8.2.6 Connection to Rotamass 3 sensor

If a Rotamass Essential or Ultimate transmitter was configured for use at a remote type Rotamass 3 sensor via the MS code, the maximum input and output values of the Rotamass 3 sensor must be observed; see the corresponding operating instructions.

Tab. 2: Maximum output values, connection terminals Rotamass TI transmitter to Rotamass 3 sensor

Connection terminals	**Voltage U_o** in V		**Current I_o** in mA		**Power P_o** in mW		**Inductance L_o** in mH		**Electrical capacitance C_o** in µF	
	IIC	**IIB**	**IIC**	**IIB**	**IIC**	**IIB**	**IIC**	**IIB**	**IIC**	**IIB**
D+/D-	14.28		47	134.4	168	480	16	7.8	0.68	4.28
S1+/S1- or S2+/ S2-	7.14		36.1		64.4		27		13.5	
TP1, TP2, TP3	7.14		10.7		19.1		310		13.5	

The medium temperature ranges of the Rotamass 3 sensor must be observed.

The corresponding documentation of the Rotamass 3 is applicable to the respective sensor.

The medium temperature range specified in this document applies to the transmitter, see *Transmitter [▸ 36]*.

8.3 Ex code

The Ex code, in combination with the MS code positions 2 and 10, allows determining the maximum medium and ambient temperatures for every temperature class according to the Ex certificate. In each case, it is located on the *additional nameplate [▸ 5]* of the sensor, except for Rotamass Nano and all high-temperature versions. No Ex code is available for these devices so that the medium temperature ranges must be taken directly from the chapter *Temperature specification by temperature classes [▸ 44]*.

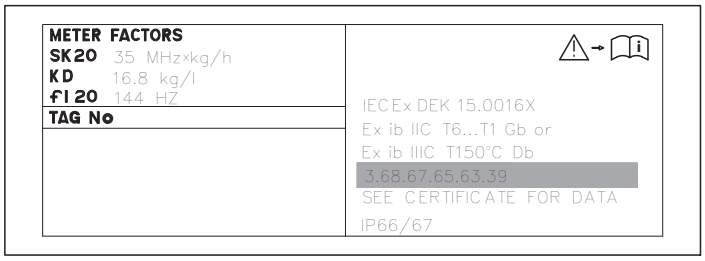


Fig. 7: Additional nameplate with Ex code

Ex code design

The Ex code is a 6-digit key with the following design:

3	.	68	.	67	.	65	.	63	.	39
a	.	p6	.	p5	.	p4	.	p3	.	p2

a	Ambient temperature column number
p6	Line number of maximum process temperature for temperature class T6
p5	Line number of maximum process temperature for temperature class T5
p4	Line number of maximum process temperature for temperature class T4
p3	Line number of maximum process temperature for temperature class T3
p2	Line number of maximum process temperature for temperature classes T2 and T1

8.3.1 Determining the maximum temperatures based on the Ex code

The specific example below is intended to explain how to determine the maximum medium and ambient temperatures based on the Ex code and the MS code.

The complete tables of the medium temperature range are listed in the "Annex 1" of the Ex certificate. Option (L␣␣␣ or Y␣␣␣) determines table a or b for remote variants. This example presents only excerpts thereof.

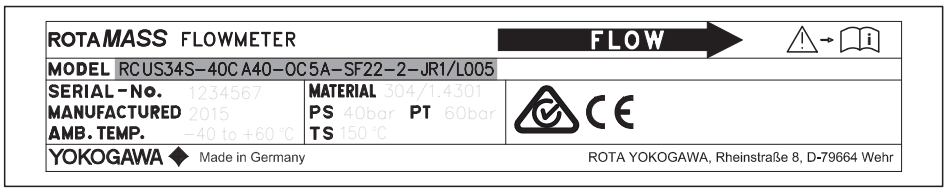
The following steps are performed to determine the maximum temperatures:

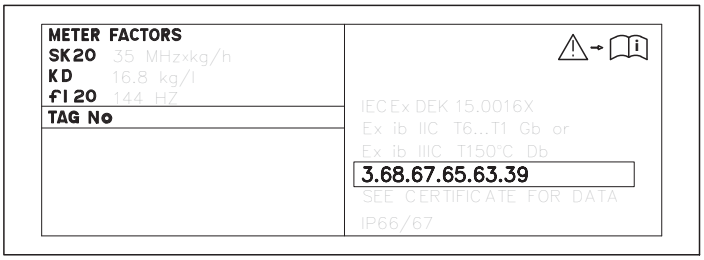
- Determining the maximum process temperature $T_{pro,max}$ based on the Ex code, positions p6...p2
- Determining the maximum ambient temperature $T_{amb\ pre}$ based on the following criteria:
  - MS code position 2 and 10
  - Ex code, position a
  - Determined maximum process temperatures $T_{pro,max}$

Problem definition:

The allowed medium and ambient temperatures for a Rotamass Supreme 34 are to be determined based on the Ex code and the MS code on the nameplates.

The following MS code and Ex code are given:





RC	U	S	34	S	-	40	CA4	0	-	0	C5	A	-	SF22	-	2	-	JR	1	/	L005
	1	2	3	4		5	6	7		8	9	10		11		12		13	14		15

Fig. 8: MS code based on nameplate

3	.	68	.	67	.	65	.	63	.	39
a	.	p6	.	p5	.	p4	.	p3	.	p2

Fig. 9: Ex code based on nameplate

Determining the maximum process temperature $T_{pro,max}$

The values of the Ex code on the nameplate p6...p2 are the line indexes that determine the maximum process temperatures $T_{pro,max}$ according to Table 6 in the Ex certificate. The temperature class determines the applicable column.

Tab. 3: Excerpt from the medium temperature table of the Ex certificate: "Table 6: Process temperatures according Ex-Code"

p2 to p6 Ex-Code values	$T_{pro,max}$ in °C: for temperature classes					
	T6	**T5**	**T4**	**T3**	**T2**	**T1**
...	...	...	...	...	...	...
39	20	35	70	135	**179**	**179**
...	...	...	...	...	...	...
63	44	59	94	**159**	203	203
...	...	...	...	...	...	...
65	46	61	**96**	161	205	205
...	...	...	...	...	...	...
67	48	**63**	98	163	107	107
68	**49**	64	99	164	208	208
...	...	...	...	...	...	...

For the temperature classes, this results in the following values for the maximum process temperature:

- Temperature class **T6** (column T6) and value of Ex code p6 (value = 68) define the intersection: $T_{pro, max}$ = **49 °C**
- Temperature class **T5** (column T5) and value of Ex code p5 (value = 67) define the intersection: $T_{pro, max}$ = **63 °C**
- Temperature class **T4** (column T4) and value of Ex code p4 (value = 65) define the intersection: $T_{pro, max}$ = **96 °C**
- Temperature class **T3** (column T3) and value of Ex code p3 (value = 63) define the intersection: $T_{pro, max}$ = **159 °C**
- Temperature class **T2** (column T2) and value of Ex code p2 (value = 39) define the intersection: $T_{pro, max}$ = **179 °C**
- Temperature class **T1** (column T1) and value of Ex code p2 (value = 39) define the intersection: $T_{pro, max}$ = **179 °C**

These maximum process temperatures established must be used for further determination of the ambient temperatures.

Determining the maximum ambient temperature $T_{amb\ pre}$

The following is required for determining the maximum ambient temperatures:

- MS code position 2, 10 and 15
- Ex code, position a
- Determined maximum process temperatures $T_{pro,max}$

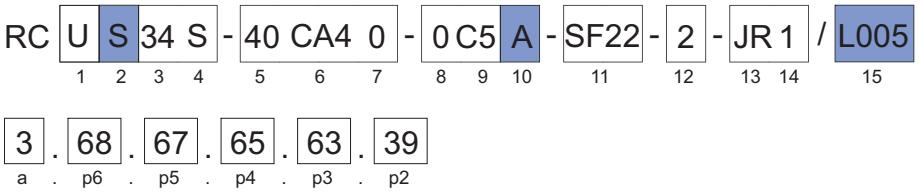


Fig. 10: Ex code

Temperature class	Maximum process temperature $T_{pro,max}$
T6	49 °C
T5	63 °C
T4	96 °C
T3	159 °C
T2	179 °C
T1	179 °C

First, the correct product-dependent table for the ambient temperature must be identified. To do so, the values of the positions 2 and 10 of the MS code on the nameplate are compared with the information of the table titles in Table 7...11 of the annex to the Ex certificate. A match determines the table to be applied.

In this case table 9a is valid, because no option Y⎵⎵⎵ is present in the MS-Code. The first digit of the Ex code, a = 3, defines the applicable columns T6...T1 within the located ambient temperature table.

The maximum process temperatures $T_{pro,max}$ established define the applicable lines within the located ambient temperature table. If a value of the maximum process temperature is not listed in the table, the next higher temperature value is used.

Determined maximum process temperature in °C	**Next higher process temperature** in °C
49	50
63	65
96	100
159	160
179	180
179	180

Tab. 4: Excerpt from the ambient temperature table of the Ex certificate: "Table 9a: Ambient temperature table for designs: RC□[2.]□□-□□□-□□[10.]-□-□□□/□
Applicable for Model Code part values: [2.] = S, G, C, L ,T; [10.] = A, C, E, J"

	$T_{amb\ pre}$ in °C																
a:	**...**	**a = 2**					**a = 3**					**a = 4**					**...**
T_{pro} in °C	**...**	**T6**	**T5**	**T4**	**T3**	**T2** T1	**T6**	**T5**	**T4**	**T3**	**T2** T1	**T6**	**T5**	**T4**	**T3**	**T2** T1	**...**
50	...	69	80	80	80	80	**62**	77	80	80	80	58	73	80	80	80	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
65	...	69	80	80	80	80	61	**77**	80	80	80	55	73	80	80	80	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
100	...			80	80	80			**80**	80	80			80	80	80	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
160	...				74	74				**74**	74				74	74	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
180					65	65				65	**65**				65	65	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

The value determined based on the ambient temperature table is a temporary value of the ambient temperature. Next, it must be compared with the determined maximum process temperature. The lower value determines the actual maximum ambient temperature.

Result

Determined maximum process temperature in °C	**Temperature class**	**Determined temporary value for the ambient temperature** in °C	**Maximum ambient temperature** in °C
49	T6	62	**49**
63	T5	77	**63**
96	T4	80	**80**
159	T3	74	**74**
179	T2	65	**65**
179	T1	65	**65**

8.4 Temperature specification by temperature classes

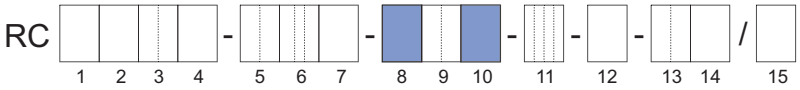
Maximum ambient and process temperatures depending on explosion groups and temperature classes can be determined via the MS code or via the MS code together with the Ex code.

8.4.1 Identification via MS code

The following tables provide an overview of where the tables of the temperature specifications are located based on MS code and explosion group.

Rotamass Nano, CNG, LPG

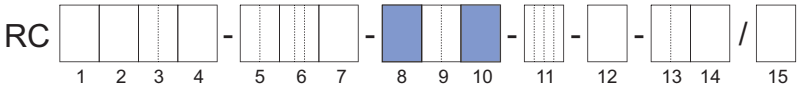
The following figure shows the relevant positions of the MS code:



Medium temperature range	MS code Position 8	Housing design	MS code Position 10	Temperature specification for the explosion groups	
Standard	0	Remote type, standard terminal box	A, C, E, J	IIC, IIB	*[▷ 48]*
Standard	0	Remote type, long neck	B, D, F, K	IIC, IIB	*[▷ 48]*
Mid-range	2	Remote type, long neck	B, D, F, K	IIC, IIB	*[▷ 48]*

Rotamass Supreme, CNG, LPG and Intense

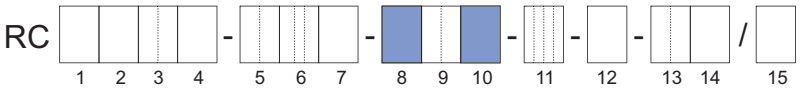
The following figure shows the relevant positions of the MS code:



Medium temperature range	MS code Position 8	Housing design	MS code Position 10	Temperature specification for the explosion groups	
Standard	0	Integral type	0, 1, 2	IIC IIB	*[▷ 49]* *[▷ 49]*
Standard	0	Remote type, standard terminal box	A, C, E, J	IIC IIB	*[▷ 49]* *[▷ 50]*
Standard	0	Remote type, long neck	B, D, F, K	IIC IIB	*[▷ 50]* *[▷ 50]*
Mid-range	2	Remote type, long neck	B, D, F, K	IIC IIB	*[▷ 51]* *[▷ 51]*
High	3	Remote type, long neck	B, D, F, K	IIC IIB	*[▷ 51]* *[▷ 51]*

Rotamass Giga

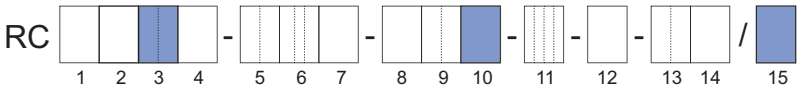
The following figure shows the relevant positions of the MS code:



Medium temperature range	MS code Position 8	Housing design	MS code Position 10	Temperature specification for the explosion groups	
Standard	0	Integral type	0, 1, 2	IIC IIB	*[52]* *[52]*
Standard	0	Remote type, standard terminal box	A, C, E, J	IIC IIB	*[52]* *[53]*
Standard	0	Remote type, long neck	B, D, F, K	IIC IIB	*[53]* *[53]*
Mid-range	2	Remote type, long neck	B, D, F, K	IIC IIB	*[54]* *[54]*
High	3	Remote type, long neck	B, D, F, K	IIC IIB	*[54]* *[54]*

Rotamass Prime and Hygienic

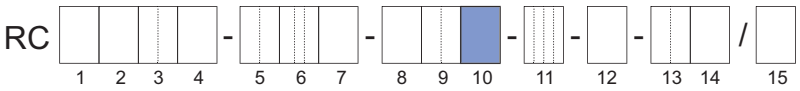
The following figure shows the relevant positions of the MS code:



MS code Position 3	Housing design	MS code Position 10	Device option	MS code Position 15	Temperature specification for the explosion groups	
25	Integral type	0, 1, 2	–		IIC, IIB	*[▷ 55]*
40						
25	Integral type	0, 1, 2	Expanded temperature range	/EPT	IIC, IIB	*[▷ 55]*
40						
50	Integral type	0, 1, 2	–		IIC, IIB	*[▷ 55]*
50	Integral type	0, 1, 2	Expanded temperature range	/EPT	IIC, IIB	*[▷ 56]*
80	Integral type	0, 1, 2	–		IIC IIB	*[▷ 56]* *[▷ 56]*
1H	Integral type	0, 1, 2	–		IIC, IIB	*[▷ 57]*
25	Remote type, standard terminal box	A, C, E, J	–		IIC, IIB	*[▷ 57]*
40						
25	Remote type, standard terminal box	A, C, E, J	Expanded temperature range	/EPT	IIC, IIB	*[▷ 57]*
40						
50	Remote type, standard terminal box	A, C, E, J	–		IIC, IIB	*[▷ 58]*
50	Remote type, standard terminal box	A, C, E, J	Expanded temperature range	/EPT	IIC, IIB	*[▷ 58]*
80	Remote type, standard terminal box	A, C, E, J	–		IIC IIB	*[▷ 58]* *[▷ 59]*
1H	Remote type, standard terminal box	A, C, E, J	–		IIC, IIB	*[▷ 59]*

8.4.2 Identification via MS code and Ex code

Using the MS code and Ex code, the following table can be used to identify the corresponding temperature classification table:



Product family	MS code Position 10	Ex code	See table
Rotamass Supreme CNG, LPG and Intense	0, 1, 2	6.85.86.87.54.10	*[49]*
	0, 1, 2	2.78.79.81.54.10	*[49]*
	A, C, E, J	6.85.86.87.54.10	*[49]*
	A, C, E, J	2.78.79.81.54.10	*[50]*
	B, D, F, K	6.85.86.87.54.10	*[50]*
	B, D, F, K	2.78.79.81.54.10	*[50]*
	B, D, F, K	6.85.86.87.89.80	*[51]*
	B, D, F, K	2.78.79.81.85.80	*[51]*
Rotamass Giga	0, 1, 2	7.89.89.90.54.10	*[52]*
	0, 1, 2	7.84.84.86.54.10	*[52]*
	A, C, E, J	7.89.89.90.54.10	*[52]*
	A, C, E, J	7.84.84.86.54.10	*[53]*
	B, D, F, K	7.89.89.90.54.10	*[53]*
	B, D, F, K	7.84.84.86.54.10	*[53]*
	B, D, F, K	7.89.89.90.90.80	*[54]*
	B, D, F, K	7.84.84.86.87.80	*[54]*
Rotamass Prime and Hygienic	0, 1, 2	7.66.66.68.54.10	*[55]*
	0, 1, 2	1.83.83.84.54.10	*[55]*
	0, 1, 2	2.73.72.76.54.10	*[55]*
	0, 1, 2	1.91.91.91.54.10	*[56]*
	0, 1, 2	7.83.84.86.54.10	*[56]*
	0, 1, 2	6.83.84.86.54.10	*[56]*
	0, 1, 2	7.87.87.88.54.10	*[57]*
	A, C, E, J	7.66.66.68.66.60	*[57]*
	A, C, E, J	1.83.83.84.82.60	*[57]*
	A, C, E, J	2.73.72.76.80.60	*[58]*
	A, C, E, J	1.91.91.91.91.60	*[58]*
	A, C, E, J	7.83.84.86.89.60	*[58]*
	A, C, E, J	6.83.84.86.89.60	*[59]*
	A, C, E, J	7.87.87.88.89.60	*[59]*

8.4.3 Rotamass Nano, CNG, LPG

In case of CNG and LPG sensors with "Meter size" smaller than 34 these temperatures are applicable.

MS code:

Pos. 2: N, C, L

Pos. 8: 0

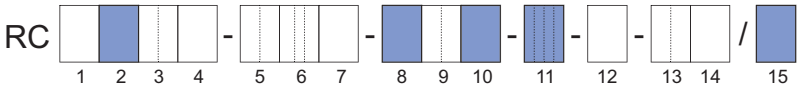
Pos. 10: A, C, E, J, B, D, F, K

Pos. 11: SF21, SF22

Ex code:

–

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



Tab. 5: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	65	65	65
T5	75	75	90
T4	80	74	130
T3	80	72	150
T2	80	72	150
T1	80	72	150

MS code:

Pos. 2: N, C, L

Pos. 8: 2

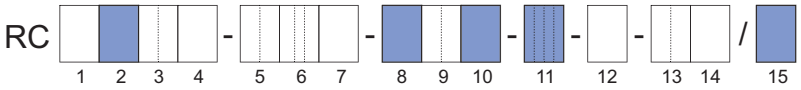
Pos. 10: B, D, F, K

Pos. 11: SF21, SF22

Ex code:

–

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



Tab. 6: Temperature classification

Temperature class	Maximum ambient temperature in °C			Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣ without option T␣␣	Option Y␣␣␣ with option T␣␣	
T6	65	65	65	65
T5	75	75	75	90
T4	80	76	75	130
T3	80	75	71	180
T2	80	73	64	260
T1	80	73	64	260

8.4.4 Rotamass Supreme, CNG, LPG and Intense

In case of CNG and LPG sensors with "Meter size" 34 these temperatures are applicable.

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

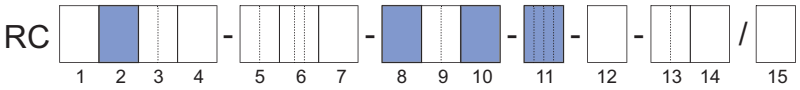
Pos. 10: 0, 1, 2

Pos. 11: SF21

Ex code:

6.85.86.87.54.10

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



Tab. 7: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	43	66
T5	58	82
T4	60	118
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

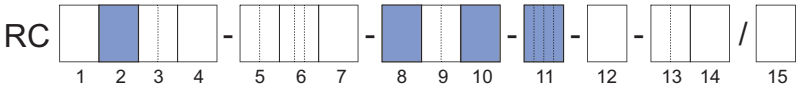
Pos. 10: 0, 1, 2

Pos. 11: SF22

Ex code:

2.78.79.81.54.10

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



Tab. 8: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	59	59
T5	60	75
T4	60	112
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

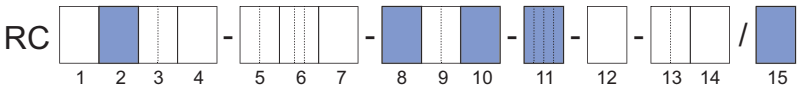
Pos. 10: A, C, E, J

Pos. 11: SF21

Ex code:

6.85.86.87.54.10

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



Tab. 9: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L□□□	Option Y□□□	
T6	41	41	66
T5	56	56	82
T4	80	62	118
T3	78	49	150
T2	78	49	150
T1	78	49	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

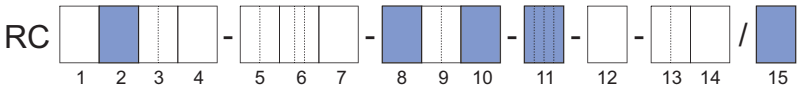
Pos. 10: A, C, E, J

Pos. 11: SF22

Ex code:

2.78.79.81.54.10

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



Tab. 10: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	59	59	59
T5	75	75	75
T4	80	65	112
T3	78	49	150
T2	78	49	150
T1	78	49	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

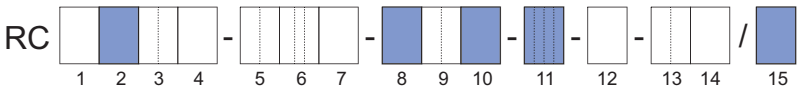
Pos. 10: B, D, F, K

Pos. 11: SF21

Ex code:

6.85.86.87.54.10

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



Tab. 11: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	47	47	66
T5	62	62	82
T4	80	74	118
T3	80	70	150
T2	80	70	150
T1	80	70	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 0

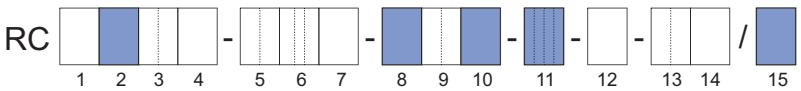
Pos. 10: B, D, F, K

Pos. 11: SF22

Ex code:

2.78.79.81.54.10

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



Tab. 12: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	59	59	59
T5	75	75	75
T4	80	74	112
T3	80	70	150
T2	80	70	150
T1	80	70	150

MS code:

Pos. 2: S, C, L, T

Pos. 8: 2

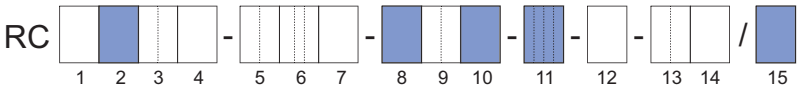
Pos. 10: B, D, F ,K

Pos. 11: SF21

Ex code:

6.85.86.87.89.80

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



Tab. 13: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	47	47	66
T5	62	62	82
T4	80	74	118
T3	80	64	185
T2	80	59	220
T1	80	59	220

MS code:

Pos. 2: S, C, L, T

Pos. 8: 2

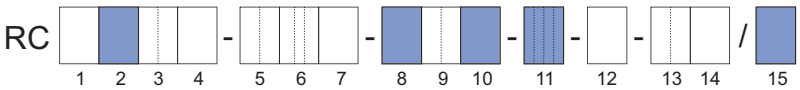
Pos. 10: B, D, F, K

Pos. 11: SF22

Ex code:

2.78.79.81.85.80

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



Tab. 14: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	59	59	59
T5	75	75	75
T4	80	74	112
T3	80	64	181
T2	80	59	220
T1	80	59	220

MS code:

Pos. 2: S, T

Pos. 8: 3

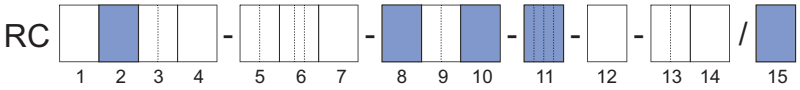
Pos. 10: B, D, F, K

Pos. 11: SF21, SF22

Ex code:

–

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



Tab. 15: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	62	62	65
T5	77	77	80
T4	80	74	115
T3	80	65	180
T2	73	50	275
T1	60	40	350

8.4.5 Rotamass Giga

MS code:

Pos. 2: G

Pos. 8: 0

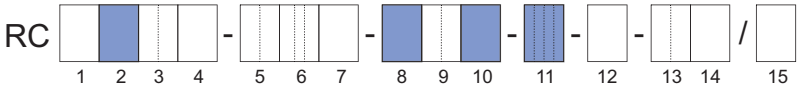
Pos. 10: 0, 1, 2

Pos. 11: SF21

Ex code:

7.89.89.90.54.10

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



Tab. 16: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	39	70
T5	54	85
T4	60	121
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: G

Pos. 8: 0

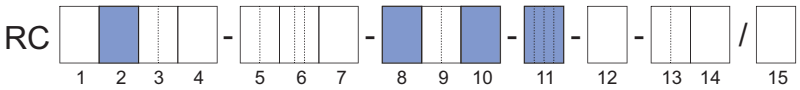
Pos. 10: 0, 1, 2

Pos. 11: SF22

Ex code:

7.84.84.86.54.10

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



Tab. 17: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	41	65
T5	56	80
T4	60	117
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: G

Pos. 8: 0

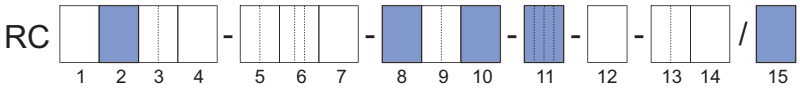
Pos. 10: A, C, E, J

Pos. 11: SF21

Ex code:

7.89.89.90.54.10

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



Tab. 18: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L□□□	Option Y□□□	
T6	37	37	70
T5	52	52	85
T4	80	60	121
T3	78	49	150
T2	78	49	150
T1	78	49	150

MS code:

Pos. 2: G

Pos. 8: 0

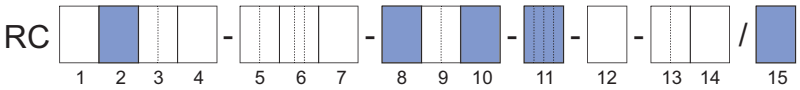
Pos. 10: A, C, E, J

Pos. 11: SF22

Ex code:

7.84.84.86.54.10

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



Tab. 19: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	39	39	65
T5	54	54	80
T4	80	62	117
T3	78	49	150
T2	78	49	150
T1	78	49	150

MS code:

Pos. 2: G

Pos. 8: 0

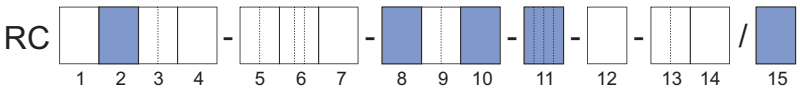
Pos. 10: B, D, F, K

Pos. 11: SF21

Ex code:

7.89.89.90.54.10

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



Tab. 20: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	44	44	70
T5	59	59	85
T4	80	73	121
T3	80	70	150
T2	80	70	150
T1	80	70	150

MS code:

Pos. 2: G

Pos. 8: 0

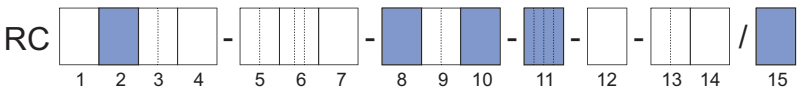
Pos. 10: B, D, F, K

Pos. 11: SF22

Ex code:

7.84.84.86.54.10

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



Tab. 21: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L___	Option Y___	
T6	44	44	65
T5	59	59	80
T4	80	74	117
T3	80	70	150
T2	80	70	150
T1	80	70	150

MS code:

Pos. 2: G

Pos. 8: 2

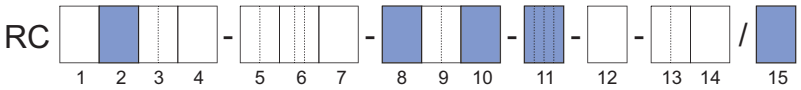
Pos. 10: B, D, F, K

Pos. 11: SF21

Ex code:

7.89.89.90.90.80

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



Tab. 22: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	44	44	70
T5	59	59	85
T4	80	73	121
T3	80	64	186
T2	80	59	220
T1	80	59	220

MS code:

Pos. 2: G

Pos. 8: 2

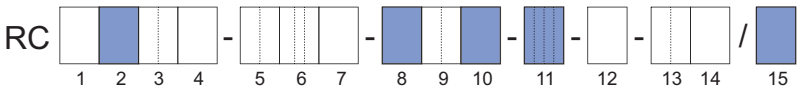
Pos. 10: B, D, F, K

Pos. 11: SF22

Ex code:

7.84.84.86.87.80

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



Tab. 23: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	44	44	65
T5	59	59	80
T4	80	74	117
T3	80	64	183
T2	80	59	220
T1	80	59	220

MS code:

Pos. 2: G

Pos. 8: 3

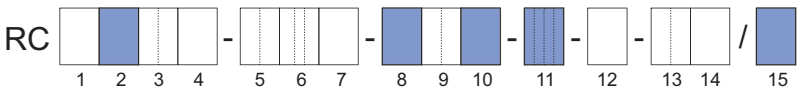
Pos. 10: B, D, F, K

Pos. 11: SF21, SF22

Ex code:

–

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



Tab. 24: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	62	62	65
T5	77	77	80
T4	80	74	115
T3	80	65	180
T2	73	50	275
T1	60	40	350

8.4.6 Rotamass Prime and Hygienic

MS code:

Pos. 2: P, H

Pos. 3: 25, 40

Pos. 10: 0, 1, 2

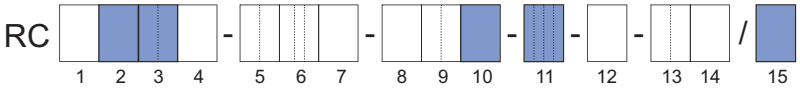
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

7.66.66.68.54.10

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



Tab. 25: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	43	47
T5	58	62
T4	60	99
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 25, 40

Pos. 10: 0, 1, 2

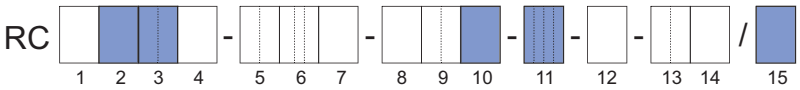
Pos. 11: SF21, SF22

Pos. 15: /EPT

Ex code:

1.83.83.84.54.10

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



Tab. 26: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	60	64
T5	60	79
T4	60	115
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 50

Pos. 10: 0, 1, 2

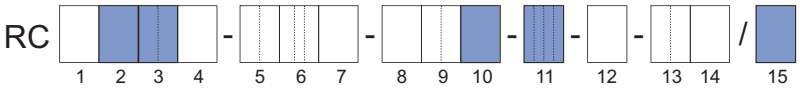
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

2.73.72.76.54.10

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



Tab. 27: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	54	54
T5	60	68
T4	60	107
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 50

Pos. 10: 0, 1, 2

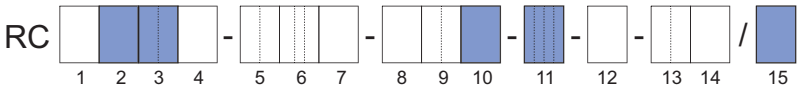
Pos. 11: SF21, SF22

Pos. 15: /EPT

Ex code:

1.91.91.91.54.10

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



Tab. 28: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	60	72
T5	60	87
T4	60	122
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 80

Pos. 10: 0, 1, 2

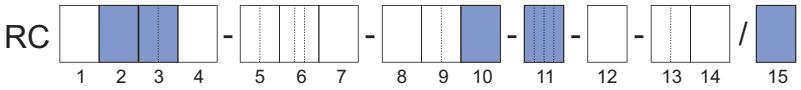
Pos. 11: SF21

Pos. 15: –

Ex code:

7.83.84.86.54.10

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



Tab. 29: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	40	64
T5	55	80
T4	60	117
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 80

Pos. 10: 0, 1, 2

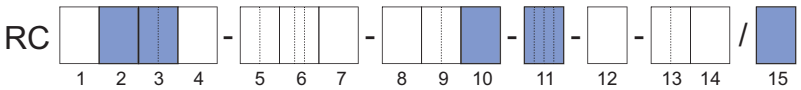
Pos. 11: SF22

Pos. 15: –

Ex code:

6.83.84.86.54.10

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



Tab. 30: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	44	64
T5	59	80
T4	60	117
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 1H

Pos. 10: 0, 1, 2

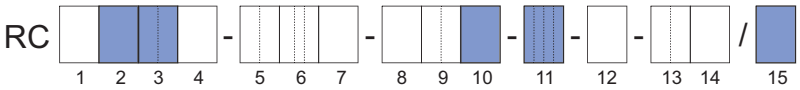
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

7.87.87.88.54.10

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



Tab. 31: Temperature classification

Temperature class	Maximum ambient temperature in °C	Maximum medium temperature in °C
T6	39	68
T5	54	83
T4	60	119
T3	60	150
T2	60	150
T1	60	150

MS code:

Pos. 2: P, H

Pos. 3: 25, 40

Pos. 10: A, C, E, J

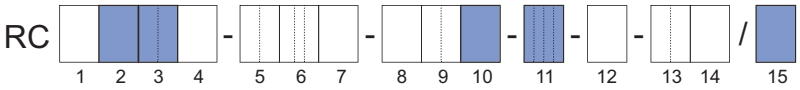
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

7.66.66.68.66.60

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



Tab. 32: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	46	46	47
T5	61	61	62
T4	80	74	99
T3	74	67	162
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 25, 40

Pos. 10: A, C, E, J

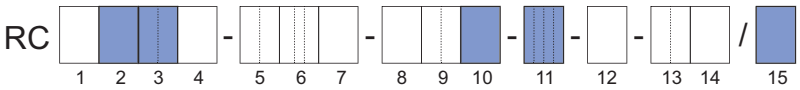
Pos. 11: SF21, SF22

Pos. 15: /EPT

Ex code:

1.83.83.84.82.60

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



Tab. 33: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	64	64	64
T5	79	79	79
T4	80	73	115
T3	68	63	178
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 50

Pos. 10: A, C, E, J

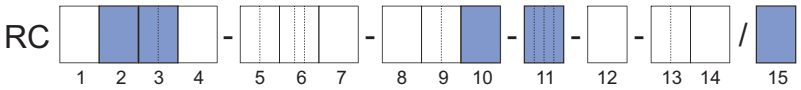
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

2.73.72.76.80.60

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



Tab. 34: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L____	Option Y____	
T6	54	54	54
T5	68	68	68
T4	80	73	107
T3	68	63	176
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 50

Pos. 10: A, C, E, J

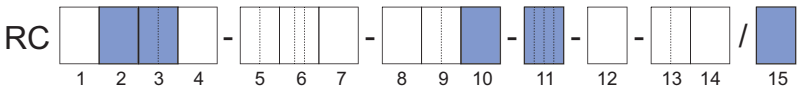
Pos. 11: SF21, SF22

Pos. 15: /EPT

Ex code:

1.91.91.91.91.60

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



Tab. 35: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L____	Option Y____	
T6	72	72	72
T5	80	77	87
T4	80	73	122
T3	64	60	187
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 80

Pos. 10: A, C, E, J

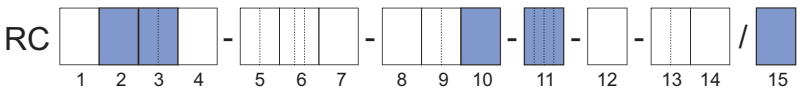
Pos. 11: SF21

Pos. 15: –

Ex code:

7.83.84.86.89.60

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



Tab. 36: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L____	Option Y____	
T6	42	42	64
T5	57	57	80
T4	80	73	117
T3	66	61	185
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 80

Pos. 10: A, C, E, J

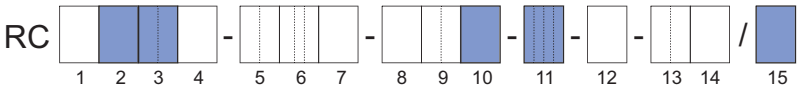
Pos. 11: SF22

Pos. 15: –

Ex code:

6.83.84.86.89.60

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



Tab. 37: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	46	46	64
T5	61	61	80
T4	80	73	117
T3	66	61	185
T2	60	57	200
T1	60	57	200

MS code:

Pos. 2: P, H

Pos. 3: 1H

Pos. 10: A, C, E, J

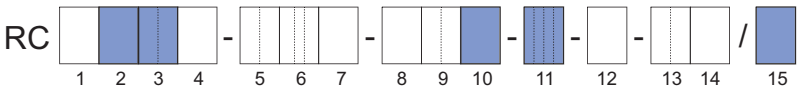
Pos. 11: SF21, SF22

Pos. 15: –

Ex code:

7.87.87.88.89.60

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



Tab. 38: Temperature classification

Temperature class	Maximum ambient temperature in °C		Maximum medium temperature in °C
	Option L␣␣␣	Option Y␣␣␣	
T6	40	40	68
T5	55	55	83
T4	80	73	119
T3	66	61	185
T2	60	57	200
T1	60	57	200

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