JUMO flowTRANS MAG S/H

Electromagnetic flowmeter
for the process industry and hygienic applications

Safety Manual Ex

for device versions 406012 - 406019

40601200T99Z001K000

V5.00/EN/00643289

Contents

Contents

1.1 Obligations of the operator

The operator must observe the national regulations, which apply in the country where the product is used, with regard to the installation, functional inspections, repairs and maintenance of electrical devices.

The following standards and directives must be observed for operation:

	Standards and directives
Operation with combustible dust	EN 60079 ff
Safety information for electrical equipment for potentially explosive areas	2014/34/EU (ATEX), IEC 60079-14
Safe operation (Minimum regulations for work protection)	1999/92/EC

1.2 Other applicable device documentation

For measuring systems used in potentially explosive areas, this document "JUMO flowTRANS MAG S/H - Ex Safety Manual for Devices 406012 - 406019" supplements the operating manual "JUMO flowTRANS MAG S/H for Devices 406012 - 406019".

The information and data contained in the document must also be strictly observed.

Document name	**Document type**	**For devices**
JUMO flowTRANS MAG S/H	Operating Manual	406012 - 406019
JUMO flowTRANS MAG S/H	SIL Safety Manual[a]	406012 - 406019

[a] Optional - depending on the device version

IMPORTANT (NOTE)!

The supplementary document "JUMO flowTRANS MAG S/H - SIL Safety Manual for Devices 406012 - 406019" is enclosed with measuring systems with an SIL-certified design (safety integrity level).

The information and data contained in the document must also be strictly observed.

IMPORTANT (NOTE)!

All the documentation, declarations of conformity and certificates are available in the download area at www.jumo.de.

1.3 Technical limit values

Particular attention must be paid to the limit values listed in the chapter 4 "Ex relevant data for operation in zones 1, 21 and 22", page 25 and chapter 5 "Ex-relevant data for operation in zones 2, 21 and 22", page 39:

- The data for the signal inputs and outputs of the transmitter
- The permissible temperature data and limit values

1.4 Safety information for the electrical installation

The electrical connection must be established when the voltage supply is switched off.

The sensor and the transmitter housing must be grounded. Make sure there is no risk of explosion.

1 Safety

1.5 Symbols and signal words

DANGER – Serious damage to health/risk to life!

This symbol in connection with the signal word "Danger" indicates an imminent threat of danger. Failure to observe the safety information results in death or serious injuries.

DANGER – Serious damage to health/risk to life!

This symbol in connection with the signal word "Danger" indicates an imminent threat of danger due to electric current. Failure to observe the safety information results in death or serious injuries.

WARNING – Personal injuries!

This symbol in connection with the signal word "Warning" indicates a potentially dangerous situation. Failure to observe the safety information may result in death or serious injuries.

WARNING – Personal injuries!

This symbol in connection with the signal word "Warning" indicates a potentially dangerous situation due to electric current. Failure to observe the safety information may result in death or serious injuries.

CAUTION – Minor injuries!

This symbol in connection with the signal word "Caution" indicates a potentially dangerous situation. Failure to observe the safety information may result in minor or moderate injuries. It may also be used for warnings against property damage.

CAUTION – Property damage!

This symbol indicates a potentially harmful situation. Failure to observe the safety information may damage or destroy the device and/or other system parts.

IMPORTANT (NOTE)!

This symbol indicates user tips, particularly useful or important information about the device; or its additional uses. This is not a signal word for a dangerous or harmful situation.

IMPORTANT (NOTE)!

This symbol is used in tables and indicates that further information is provided after the table.

DISPOSAL!

At the end of its service life, the device and any batteries present do not belong in the trash! Please ensure that they are **disposed of** properly and in an **environmentally friendly** manner.

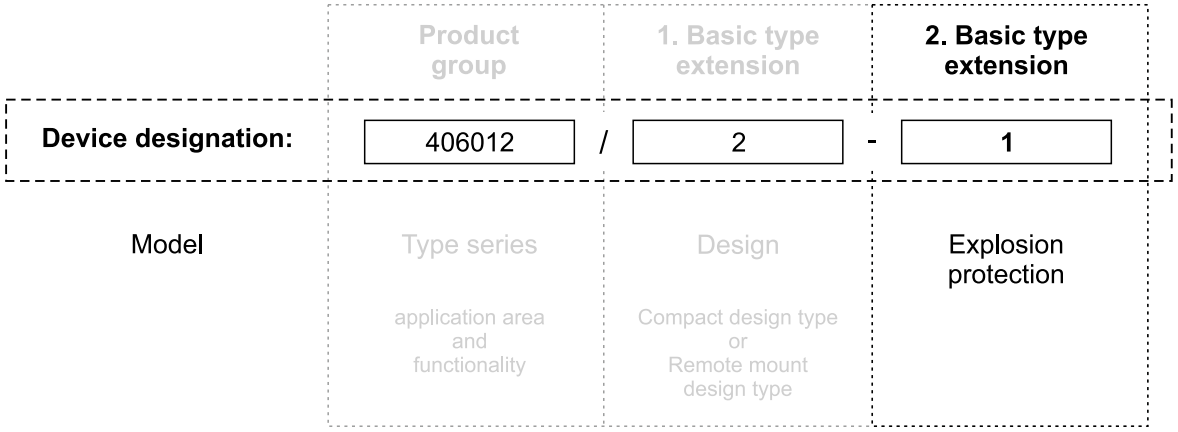
2.1 Device designation

The JUMO flowTRANS MAG devices use a device designation consisting of the six-digit product group number and the 1st and 2nd basic type supplements. Based on this device designation, the device versions can be distinguished.

The device designation is explained in full in the operating manual "JUMO flowTRANS MAG S/H“, chapter 2 "Layout and function", starting on page 22.

The 2nd basic type extension in the device designation relates to devices with Ex-protection.

Example:



See also: ⇨ Chapter 2.2

Additionally, the choice of housing design type is determined by the respective area of application in or outside of potentially explosive areas:⇨ see chapter 2.3 "Housing design type", page 8.

The device design type is not reflected in the device designation.

The devices suitable for use in potentially explosive areas have the corresponding Ex identification marking on the nameplate.⇨ see chapter 2.7 "Nameplate", page 14.

2 Device versions

2.2 Explosion protection

IMPORTANT (NOTE)!

For further information about the Ex-approval of the devices, refer to the Ex-inspection documents (available on the product CD or at www.jumo.de).

JUMO flowTRANS MAG electromagnetic flowmeters are available for use in potentially explosive areas.

The design type for potentially explosive areas is indicated by the digit "**1**" in the 2nd basic type supplement of the device designation.

Type series for process industry applications in potentially explosive areas:

Model	Type series	Design
406012/1-**1**	JUMO flowTRANS MAG S01	Compact design(sensor and transmitter)
406013/1-**1**	JUMO flowTRANS MAG S02	
406012/2-**1**	JUMO flowTRANS MAG S01	Remote mount design (sensor)
406013/2-**1**	JUMO flowTRANS MAG S02	
406018/2-**1**	JUMO flowTRANS MAG 01	Remote mount design (transmitter)
406019/2-**1**	JUMO flowTRANS MAG 02	

Type series for hygienic applications in potentially explosive areas:

Model	Type series	Design
406015/1-**1**	JUMO flowTRANS MAG H01	Compact design (sensor and transmitter)
406016/1-**1**	JUMO flowTRANS MAG H02	
406015/2-**1**	JUMO flowTRANS MAG H01	Remote mount design (sensor)
406016/2-**1**	JUMO flowTRANS MAG H02	
406018/2-**1**	JUMO flowTRANS MAG 01	Remote mount design (transmitter)
406019/2-**1**	JUMO flowTRANS MAG 02	

2.3 Housing design type

JUMO flowTRANS MAG electromagnetic flowmeters with compact or remote mount design types are deployed in a wide variety of areas of application. For devices with a remote mount design type, this distinction only relates to the transmitter housing.

Single-compartment housing

For single-compartment housings, the electronics compartment and the terminal compartment are not separated from each other in the transmitter.

Dual-compartment housing

In dual-compartment housings, the electronics compartment and the terminal compartment are separated from each other in the transmitter.

The choice of housing design type is determined by the respective area of application in or outside of potentially explosive areas:

Area of application	Housing design type
Ex-zone 2	Single-compartment housing
Ex-zone 1	Dual-compartment housing

The device design type is not reflected in the device designation.

2.4 JUMO flowTRANS MAG S/H - compact design

Sensor and transmitter form a mechanical unit.

2.4.1 ATEX/IECEx Zone 1

JUMO flowTRANS MAG S01/S02	JUMO flowTRANS MAG H01/H02
406012/1-1 (Ex-protection zone 1)	**406015/1-1 (Ex-protection zone 1)**
406013/1-1 (Ex-protection zone 1)	**406016/1-1 (Ex-protection zone 1)**
Transmitter: dual-compartment housing **Sensor:** aluminum housing 	**Transmitter:** dual-compartment housing 
ATEX certificate: FM15ATEX0025X DN 3 to 300: II 2G Ex d e ia ma IIC T6... T2 Gb > DN 300: II 2G Ex d e ia IIC T6…T2 Gb II 2 D Ex ia tb IIIC T70°C... T_{Medium} Db	**ATEX certificate:** FM15ATEX0025X II 2G Ex d e ia ma IIC T6... T2 Gb II 2 D Ex ia tb IIIC T70°C... T_{Medium} Db
IECEx certificate: FME 15.0006X DN 3 to 300: Ex d e ia ma IIC T6... T2 Gb > DN 300: Ex d e ia IIC T6... T2 Gb Ex ia tb IIIC T70°C... T_{Medium} Db	**IECEx certificate:** FME 15.0006X Ex d e ia ma IIC T6... T2 Gb Ex ia tb IIIC T70°C... T_{Medium} Db

2.4.2 ATEX/IECEx Zone 2

JUMO flowTRANS MAG S01/S02	JUMO flowTRANS MAG H01/H02
406012/1-1 (Ex-protection zone 2)	**406015/1-1 (Ex-protection zone 2)**
406013/1-1 (Ex-protection zone 2)	**406016/1-1 (Ex-protection zone 2)**
Transmitter: single-compartment housing **Sensor:** aluminum housing 	**Transmitter:** single-compartment housing 
ATEX certificate: FM15ATEX0024X: II 3 G Ex nA mc IIC T4... T3 Gc FM15ATEX0025X: II 2 D Ex tb IIIC T70° C... T_{Medium} Db	**ATEX certificate:** FM15ATEX0024X: II 3 G Ex nA mc IIC T4... T3 Gc FM15ATEX0025X: II 2 D Ex tb IIIC T70° C... T_{Medium} Db
IECEx certificate: FME 15.0006X Ex nA mc IIC T4... T3 Gc Ex tb IIIC T70° C... T_{Medium} Db	**IECEx certificate:** FME 15.0006X Ex nA mc IIC T4... T3 Gc Ex tb IIIC T70° C... T_{Medium} Db

2 Device versions

2.5 JUMO flowTRANS MAG S/H - remote mount design

The transmitter is mounted at a separate location from the sensor. The electrical connection between the transmitter and sensor may only be established using the signal cable included in the scope of delivery.⇨ see chapter 2.5.3 "Signal cable length and preamplifier", page 12.

2.5.1 ATEX/IECEx Zone 1

DANGER - Risk of explosion caused by incorrect transmitter installation!

The transmitters 406018/2-0 and 406019/2-0 are not Ex-approved.

The transmitters 406018/2-0 and 406019/2-0 must not be installed or operated in potentially explosive areas.

The electrical connection between the transmitter and sensor may only be established using the signal cable included in the scope of delivery.⇨ see chapter 2.5.3 "Signal cable length and preamplifier", page 12.

JUMO flowTRANS MAG S01/S02	JUMO flowTRANS MAG 01/02
406012/2-1 (Ex-protection zone 1)	**406018/2-1 (Ex-protection zone 1)**
406013/2-1 (Ex-protection zone 1)	**406019/2-1 (Ex-protection zone 1)**
Sensor: aluminum housing 	**Transmitter:** dual-compartment housing 
ATEX certificate: FM15ATEX0025X DN 3 to 300: II 2 G Ex d e ia ma IIC T6 ... T2 Gb > DN 300: II 2 G Ex d e ia IIC T6…T2 Gb II 2 D Ex ia tb IIIC T70° C ... T_{Medium}	**ATEX certificate:** FM15ATEX0025X II 2 (2) G Ex d e [ia Gb] IIC T6 II 2 (2) D Ex tb [ia Db] IIIC T70° C Db
IECEx certificate: FME 15.0006X DN 3 to 300: Ex e ia ma IIC T6 ... T2 Gb > DN 300: Ex e ia IIC T6 ... T2 Gb Ex tb IIIC T70° C ... T_{Medium}	**IECEx certificate:** FME 15.0006X Ex d e [ia Gb] IIC T6 Gb Ex tb [ia Db] IIIC T70° C Db

NOTE

The JUMO flowTRANS MAG H model series with a remote mount design is not available for ATEX/IECEx zone 1.

2.5.2 ATEX/IECEx Zone 2

DANGER - Risk of explosion caused by incorrect transmitter installation

The transmitters 406018/2-0 and 406019/2-0 are not Ex-approved.

The transmitters 406018/2-0 and 406019/2-0 must not be installed or operated in potentially explosive areas.

The electrical connection between the transmitter and sensor may only be established using the signal cable included in the scope of delivery.⇨ see chapter 2.5.3 "Signal cable length and preamplifier", page 12.

JUMO flowTRANS MAG S01/S02	JUMO flowTRANS MAG H01/H02
406012/2-1 (Ex-protection zone 2)	**406015/2-1 (Ex-protection zone 2)**
406013/2-1 (Ex-protection zone 2)	**406016/2-1 (Ex-protection zone 2)**
Sensor: aluminum housing 	**Sensor:** 
ATEX certificate: FM15ATEX0024X: II 3 G Ex nA IIC T6... T3 Gc FM15ATEX0025X: II 2 D Ex tb IIIC T85° C... T_{Medium} Db	**ATEX certificate:** FM15ATEX0024X: II 3 G Ex nA IIC T6... T3 Gc FM15ATEX0025X: II 2 D Ex tb IIIC T85° C... T_{Medium} Db
IECEx certificate: FME 15.0006X Ex nA IIC T6... T3 Gc Ex tb IIIC T85° C... T_{Medium} Db	**IECEx certificate:** FME 15.0006X Ex nA IIC T6... T3 Gc Ex tb IIIC T85° C... T_{Medium} Db

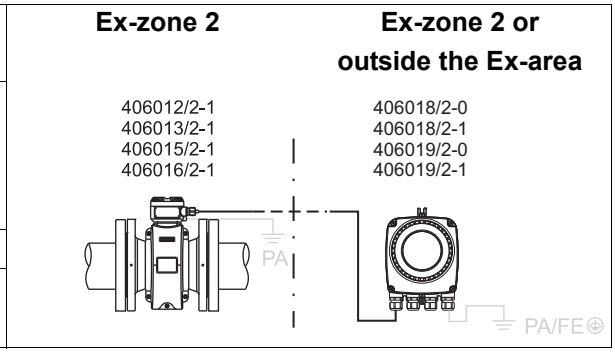
The sensors displayed above can be combined with the transmitters displayed below:

JUMO flowTRANS MAG 01/02
406018/2-1 (Ex-protection zone 2)
406019/2-1 (Ex-protection zone 2)
Transmitter: single-compartment housing 
ATEX certificate: FM15ATEX0024X: II 3 G Ex nA nC IIC T4 Gc FM15ATEX0025X: II 2 D Ex tb IIIC T70° C Db
IECEx certificate: FME 15.0006X Ex nA nC IIC T4 Gc Ex tb IIIC T70° C Db

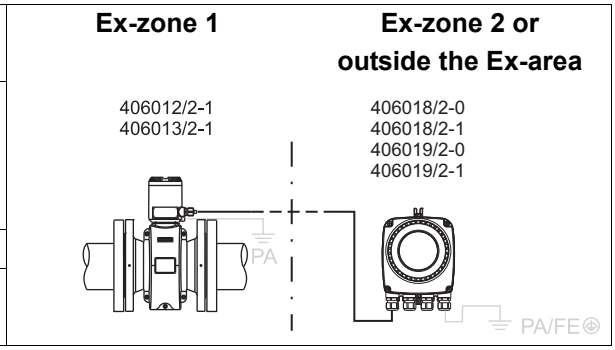
2.5.3 Signal cable length and preamplifier

For devices in the remote mount design, the electrical connection between the transmitter and sensor is made via a signal cable.

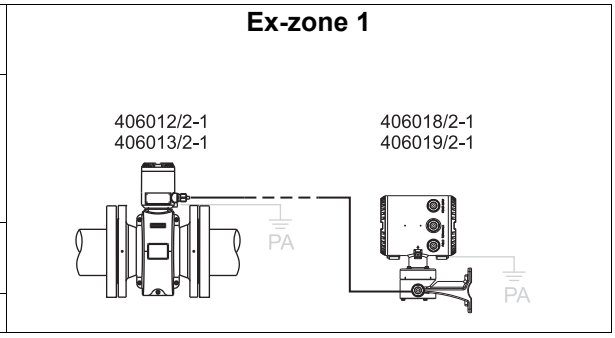
Transmitter housing design	Single-compartment housing
Maximum signal cable length[a]	
Without preamplifier	50 m (164 ft)
With preamplifier	200 m (656 ft)
Scope of delivery	5 m (16.4 ft) included
Signal cable, part no.	00648906



Transmitter housing design	Single-compartment housing
Maximum signal cable length[a]	
Without preamplifier	50 m (164 ft)
With preamplifier	-
Scope of delivery	5 m (16.4 ft) included
Signal cable, part no.	00648906



Transmitter housing design	Dual-compartment housing
Maximum signal cable length[a]	
Without preamplifier	10 m (164 ft)
With preamplifier	-
Scope of delivery	10 m (32.8 ft) fixed installation
Signal cable, part no.	00648907



[a] At a minimum conductivity for the measurement medium of ≥ 5 µS/cm

2.6 Overview: the fast way to the devices

This Ex-safety information applies in connection with the following inspection documents and certificates:

Scope of application	Inspection documents/certificates
ATEX	FM15ATEX0024X, FM15ATEX0025X
IECEx	FME 15.0006X

JUMO flowTRANS MAG S01/S02

Model in the Ex-area	Electrical Connection	Electrical Data	Temperature data
406012/1-1 in zone 1, 21	⇨ Chapter 4.1.1	⇨ Chapter 4.2	⇨ Chapter 4.3
406013/1-1 in zone 1, 21			
406012/1-1 in zone 2, 21, 22	⇨ Chapter 5.1.1	⇨ Chapter 5.2	⇨ Chapter 5.3
406013/1-1 in zone 2, 21, 22			
406012/2-1 with 406018/2-1 in zone 1, 21	⇨ Chapter 4.1.1	⇨ Chapter 4.2	⇨ Chapter 4.3
406013/2-1 with 406019/2-1 in zone 1, 21			
406012/2-1 with 406018/2-1 in zone 2, 21, 22	⇨ Chapter 5.1.1	⇨ Chapter 5.2	⇨ Chapter 5.3
406013/2-1 with 406019/2-1 in zone 2, 21, 22			
406012/2-1 in zone 1, 21 with 406018/2-1 in zone 2, 21, 22	⇨ Chapter 4.1.2	⇨ Chapter 4.2	⇨ Chapter 4.3
		⇨ Chapter 5.2	⇨ Chapter 5.3
406013/2-1 in zone 1, 21 with 406019/2-1 in zone 2, 21, 22	⇨ Chapter 4.1.2	⇨ Chapter 4.2	⇨ Chapter 4.3
		⇨ Chapter 5.2	⇨ Chapter 5.3

JUMO flowTRANS MAG H01/H02

Model in the Ex-area	Electrical Connection	Electrical Data	Temperature data
406015/1-1 in zone 1, 21	⇨ Chapter 4.1.1	⇨ Chapter 4.2	⇨ Chapter 4.3
406016/1-1 in zone 1, 21			
406015/1-1 in zone 2, 21, 22	⇨ Chapter 5.1.1	⇨ Chapter 5.2	⇨ Chapter 5.3
406016/1-1 in zone 2, 21, 22			
406015/2-1 with 406018/2-1 in zone 2, 21, 22	⇨ Chapter 5.1.1	⇨ Chapter 5.2	⇨ Chapter 5.3
406016/2-1 with 406019/2-1 in zone 2, 21, 22			

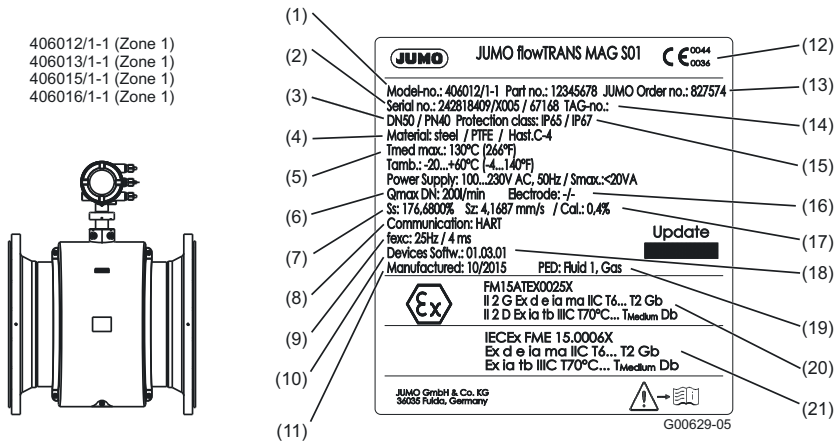
IMPORTANT (NOTE)!

All the documentation, declarations of conformity and certificates are available in the download area www.jumo.de.

2 Device versions

2.7 Nameplate

2.7.1 Nameplate for compact design (dual-compartment housing)



(1) Model number (for technical version details, see data sheet or order confirmation)

(2) Serial number for identification by the manufacturer

(3) Nominal width and nominal pressure levels

(4) Material: flange/lining/electrode

(5) T_{med} = Maximum admissible measurement medium temperature
T_{amb} = Maximum admissible ambient temperature

(6) Calibration value Qmax DN

(7) Calibration value Ss (range)
Calibration value Sz (zero point)

(8) Transmitter communication protocol

(9) Excitation frequency of the sensor coils

(10) Software version

(11) Year of construction

(12) CE mark

(13) Order number

(14) Customer-specific TAG number (if provided)

(15) Protection type according to DIN EN 60529

(16) Additional information: EE = Grounding electrodes, TFE = Partial filling electrode

(17) Accuracy with which the device was calibrated (e.g. 0.2 % of the measured value)

(18) Revision status (xx.xx.xx)

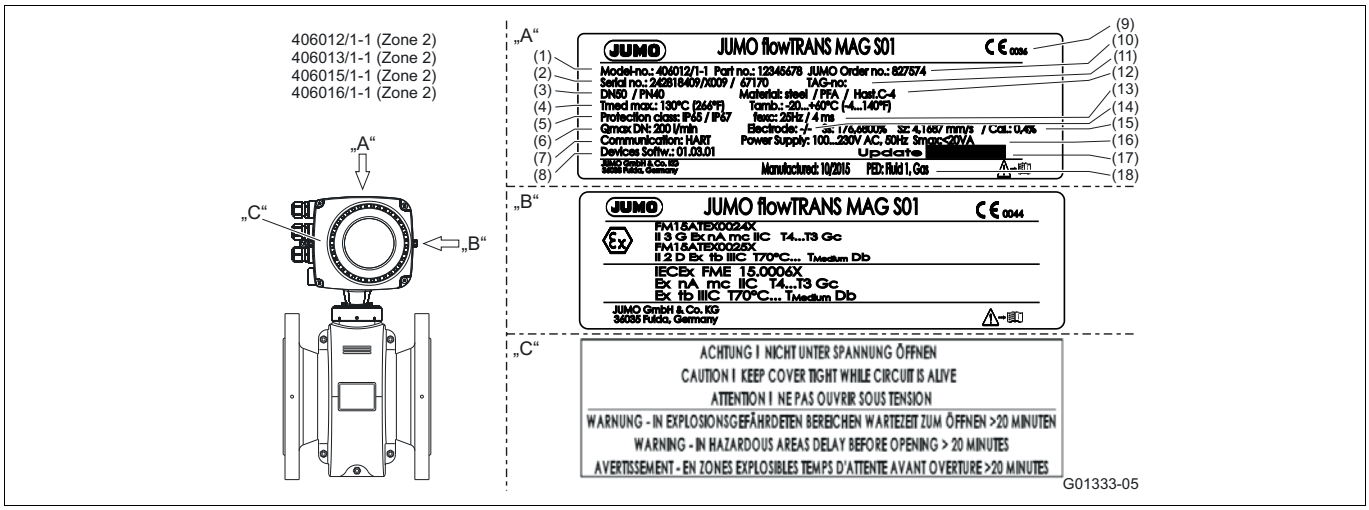
(19) Identification marking indicating whether the pressure device falls within the scope of the Pressure Equipment Directive.[a]Specification of the fluid group taken into consideration.
Fluid group 1 = Dangerous fluids, liquid, gaseous (Pressure Equipment Directive = PED)
If the pressure device is outside the scope of the Pressure Equipment Directive[a], the classification is carried out in the SEP (Sound Engineering Practice) category according to Art. 3 Para. 3 of the PED.
If the details are completely missing, then conformity with the requirements of the Pressure Equipment Directive[a] is not given. The exception for water networks and connection equipment parts according to guideline 1/16 to art. 1. para. 3.2 of the Pressure Equipment Directive applies.

(20) Ex identification marking according to ATEX (example)

(21) Ex identification marking according to IECEx (example)

[a] Pressure Equipment Directive (PED) 2014/68/EU (Mod. B+D).

2.7.2 Nameplate for compact design (single-compartment housing)



A Nameplate

(1) Model number (for technical version details, see data sheet or order confirmation)

(2) Serial number for identification by the manufacturer

(3) Nominal width and nominal pressure levels

(4) T_{med} = Maximum admissible measurement medium temperature
T_{amb} = Maximum admissible ambient temperature

(5) Protection type according to DIN EN 60529

(6) Calibration value Qmax DN

(7) Transmitter communication protocol

(8) Software version

(9) CE mark

(10) Order number

(11) Customer-specific TAG number (if provided)

(12) Material: flange/lining/electrode

(13) Excitation frequency of the sensor coils

(14) Additional information: EE = Grounding electrodes, TFE = Partial filling electrode
Calibration value Ss (range)
Calibration value Sz (zero point)

(15) Accuracy with which the device was calibrated (e.g. 0.4 % of the measured value)

(16) Voltage supply

(17) Year of construction

(18) Identification marking indicating whether the pressure device falls within the scope of the Pressure Equipment Directive.[a]Specification of the fluid group taken into consideration.
Fluid group 1 = Dangerous fluids, liquid, gaseous (Pressure Equipment Directive = PED)
If the pressure device is outside the scope of the Pressure Equipment Directive[a], the classification is carried out in the SEP (Sound Engineering Practice) category according to Art. 3 Para. 3 of the PED.
If the details are completely missing, then conformity with the requirements of the Pressure Equipment Directive[a] is not given. The exception for water networks and connection equipment parts according to guideline 1/16 to art. 1. para. 3.2 of the Pressure Equipment Directive applies.

W Ex identification marking according to ATEX and IECEx (example)

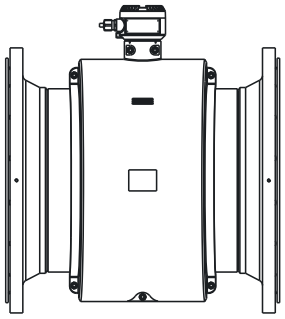
C Safety plate

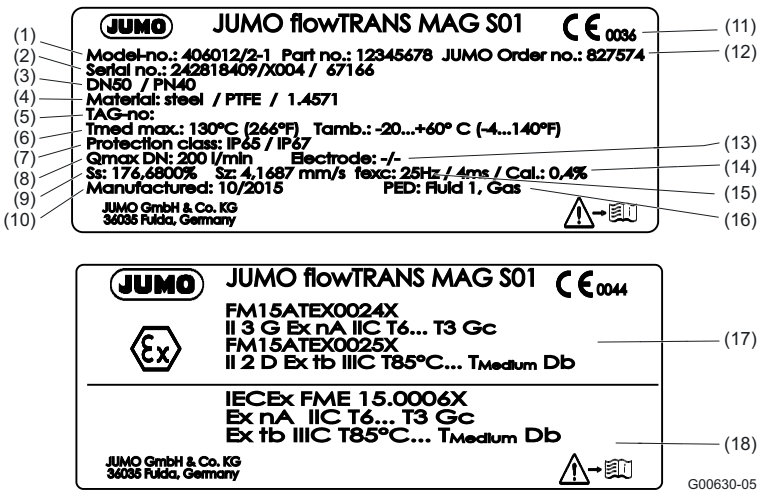
[a] Pressure Equipment Directive (PED) 2014/68/EU (Mod. B+D).

2 Device versions

2.7.3 Nameplate for remote mount design

406012/2-1 (Zone 1)
406012/2-1 (Zone 2)
406013/2-1 (Zone 1)
406013/2-1 (Zone 2)
406015/2-1 (Zone 2)
406016/2-1 (Zone 2)





(1) Model number (for technical version details, see data sheet or order confirmation)

(2) Serial number for identification by the manufacturer

(3) Nominal width and nominal pressure levels

(4) Material: flange/lining/electrode

(5) Customer-specific TAG number (if provided)

(6) T_{med} = Maximum admissible measurement medium temperature
T_{amb} = Maximum admissible ambient temperature

(7) Protection type according to DIN EN 60529

(8) Calibration value Qmax DN

(9) Calibration value Ss (range)
Calibration value Sz (zero point)

(10) Year of construction

(11) CE mark

(12) Order number

(13) Additional information: EE = Grounding electrodes, TFE = Partial filling electrode

(14) Accuracy with which the device was calibrated (e.g. 0.4 % of the measured value)

(15) Excitation frequency of the sensor coils

(16) Identification marking indicating whether the pressure device falls within the scope of the Pressure Equipment Directive.[a]Specification of the fluid group taken into consideration.

Fluid group 1 = Dangerous fluids, liquid, gaseous (Pressure Equipment Directive = PED)

If the pressure device is outside the scope of the Pressure Equipment Directive[a], the classification is carried out in the SEP (Sound Engineering Practice) category according to Art. 3 Para. 3 of the PED.

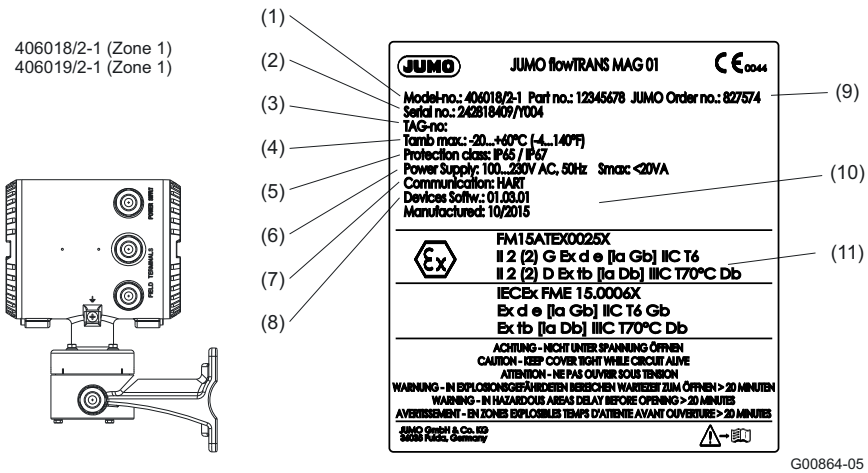
If the details are completely missing, then conformity with the requirements of the Pressure Equipment Directive[a] is not given. The exception for water networks and connection equipment parts according to guideline 1/16 to art. 1. para. 3.2 of the Pressure Equipment Directive applies.

(17) Ex identification marking according to ATEX (example)

(18) Ex identification marking according to IECEx (example)

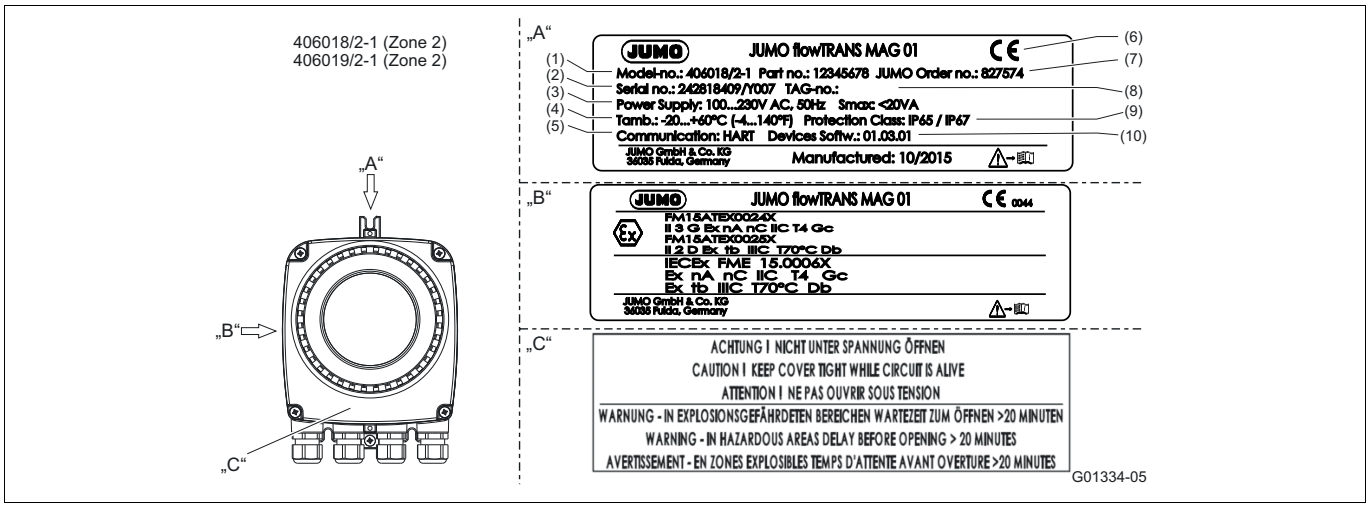
[a] Pressure Equipment Directive (PED) 2014/68/EU (Mod. B+D).

2.7.4 Nameplate of the transmitter (dual-compartment housing)



(1) Model number (for technical version details, see data sheet or order confirmation)
(2) Serial number for identification by the manufacturer
(3) Customer-specific TAG number (if provided)
(4) T_{amb} = Maximum admissible ambient temperature
(5) Protection type according to DIN EN 60529
(6) Voltage supply
(7) Transmitter communication protocol
(8) Software version
(9) Order number
(10) Revision status (xx.xx.xx)
(11) Ex identification marking according to ATEX (example)

2.7.5 Nameplate of the transmitter (single-compartment housing)



A Nameplate

(1) Model number (for technical version details, see data sheet or order confirmation)

(2) Serial number for identification by the manufacturer

(3) Voltage supply

(4) T_{amb} = Maximum admissible ambient temperature

(5) Transmitter communication protocol

(6) CE mark

(7) Order number

(8) Customer-specific TAG number (if provided)

(9) Protection type according to DIN EN 60529

(10) Software version

W Ex identification marking according to ATEX and IECEx (example)

C Safety plate

3.1 Notes on opening and closing the housing

To install, start up and maintain the JUMO flowTRANS MAG devices, it is necessary to open the housing of the sensor or transmitter.

Be sure to observe the following safety instructions before opening and after closing the housing for re-starting:

DANGER – Explosion hazard!

When the case lid is open, the Ex-protection becomes void.
Before opening the housing, de-energize all of the device's connecting cables and wait for at least 20 minutes.

DANGER – Explosion hazard!

Loosening the transmitter housing screws invalidates the Ex-protection. Before re-starting, tighten all screws on the transmitter housing.

WARNING – Personal injuries!

When the housing is open, the EMC protection is limited and the protection against contact becomes void.

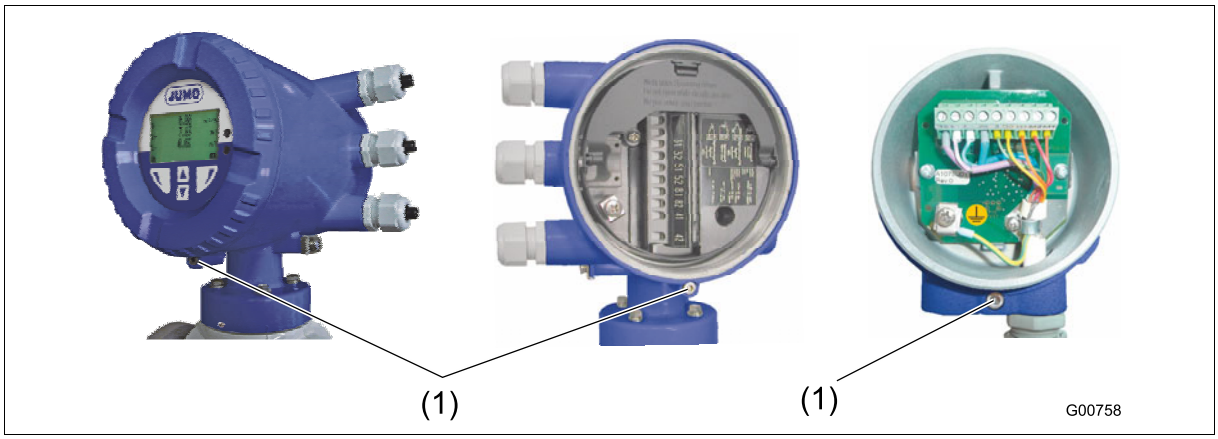
Before opening the housing switch off the voltage supply.

WARNING – Impairment of the housing protection type!

If the seal (O-ring) is not connected properly or damaged, the housing protection type is impaired. Before closing the case lid, check the seal (O-ring) for damage and replace if necessary.

When closing the case lid, make sure the seal is connected properly.

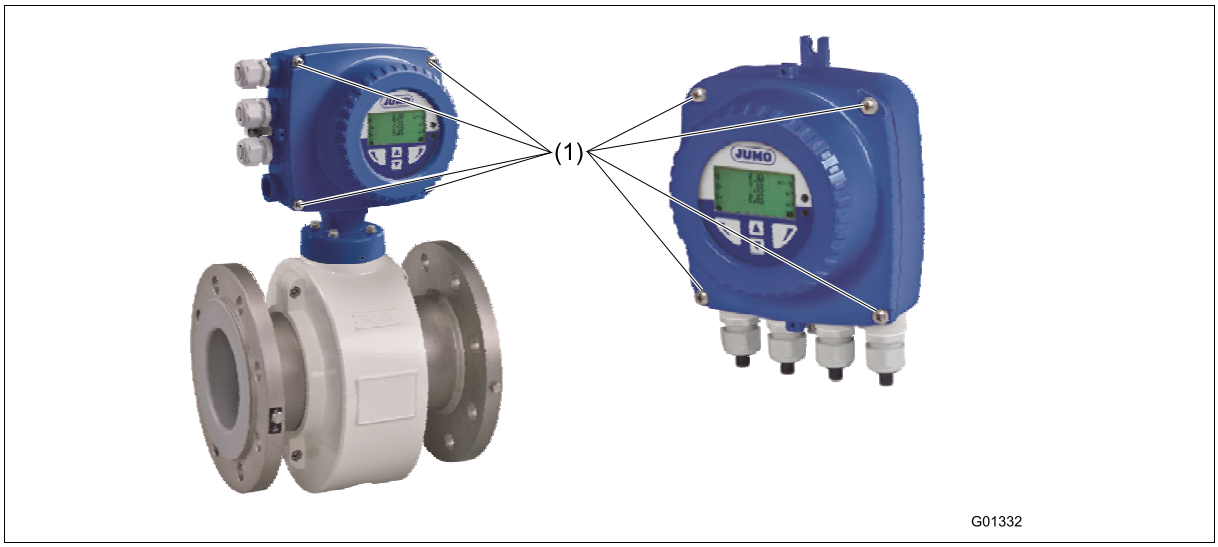
3.1.1 Opening the case lid (dual-compartment housing)



(1) Lid lock (Allen screw)

1. ⇨ Observe chapter 3.1 "Notes on opening and closing the housing", page 19!
2. To open the housing, loosen the lid lock (1) by screwing in the Allen screw.
3. Remove the case lid.
4. Before closing the housing, make sure the case lid (O-ring) is connected properly.
5. After closing the case, secure the case lid by unscrewing the Allen screw to prevent the case from being opened accidentally.

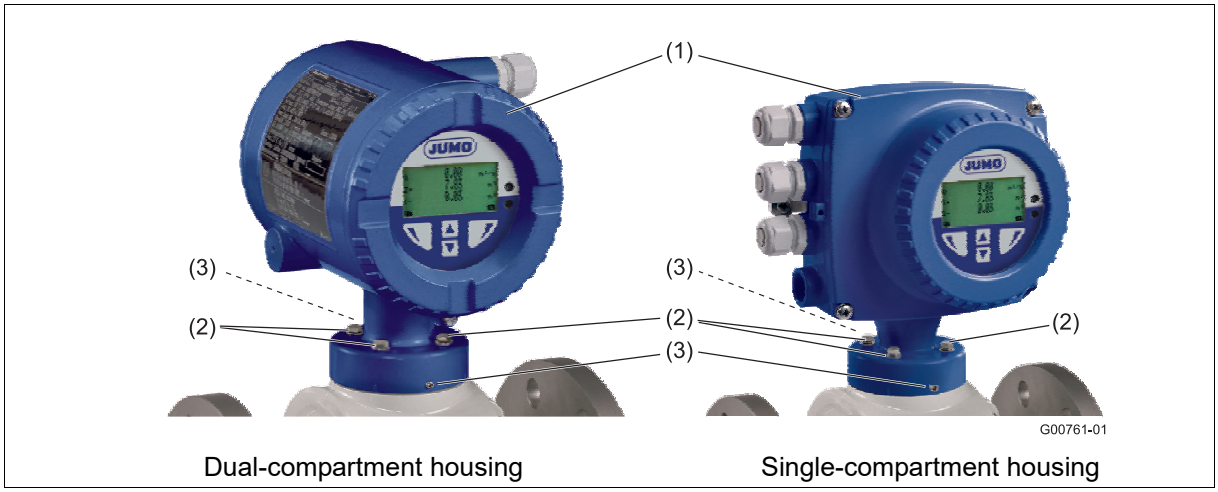
3.1.2 Opening the case lid (single-chamber housing)



(1) Recessed head screws

1. ⇨ Observe chapter 3.1 "Notes on opening and closing the housing", page 19!
2. Loosen the recessed head screws (1) and remove the case lid.
3. Relocate the case lid and screw down the recessed head screw (1) tightly before re-starting.

3.1.3 Rotation of the transmitter housing



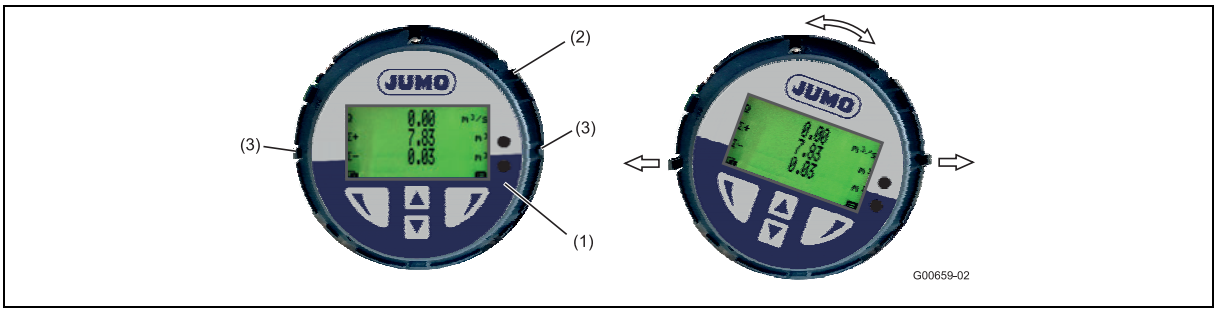
Dual-compartment housing Single-compartment housing

(1) Transmitter housing
(2) Screw
(3) Allen screw

1. ⇨ Observe chapter 3.1 "Notes on opening and closing the housing", page 19!
2. Loosen the Allen screws (3) on the front and rear, but do not remove them completely.
3. Loosen the screws (2) and rotate the transmitter housing to the left or right by 90°.
4. Before re-starting, tighten all screws (2) and Allen screws (3) on the transmitter housing.

3.1.4 Turning the LCD display

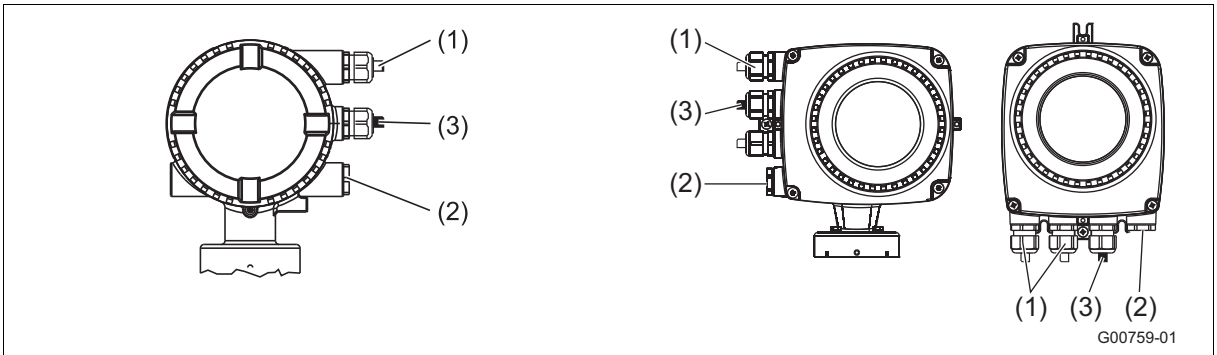
Depending on the installation position, the LCD display or transmitter housing can be rotated to allow for horizontal read-off.



(1) Transmitter with LCD display
(2) Housing for transmitter plug-in module
(3) Rotation lock

1. Switch off voltage supply.
2. Remove case lid⇨ see chapter 3.1 "Notes on opening and closing the housing", page 19.
3. Slightly pull back the rotation lock (3) and rotate the transmitter plug-in module with LCD display (1) to the left or right by 90° until the rotation lock (3) locks back into place.
4. Relocate the case lid and screw down tightly before re-starting.

3.2 Cable inlets



Dual-compartment housing | Single-compartment housing

(1) Cable fittings
(2) Closures in the terminal box
(3) Black plugs

The cable fittings supplied are ATEX or IECEx certified.

The black plugs in the cable fittings are intended to provide protection during transport.

All unused cable inlets must be sealed prior to startup, using the seals supplied that are provided in the terminal box.

Using standard cable fittings and seals is prohibited.

The outer diameter of the connecting cable must be between 6 mm (0.24") and 12 mm (0.47") to ensure the necessary leak-tightness.

Make sure that the cable fittings and seals are mounted correctly and are leak-tight.

Black cable fittings are installed at the factory. If signal outputs are connected to intrinsically safe electrical circuits, we recommend replacing the black caps on the respective cable fittings with the blue ones provided.

3.3 Protection type IP68

WARNING – Impairment of the IP68 protection type!

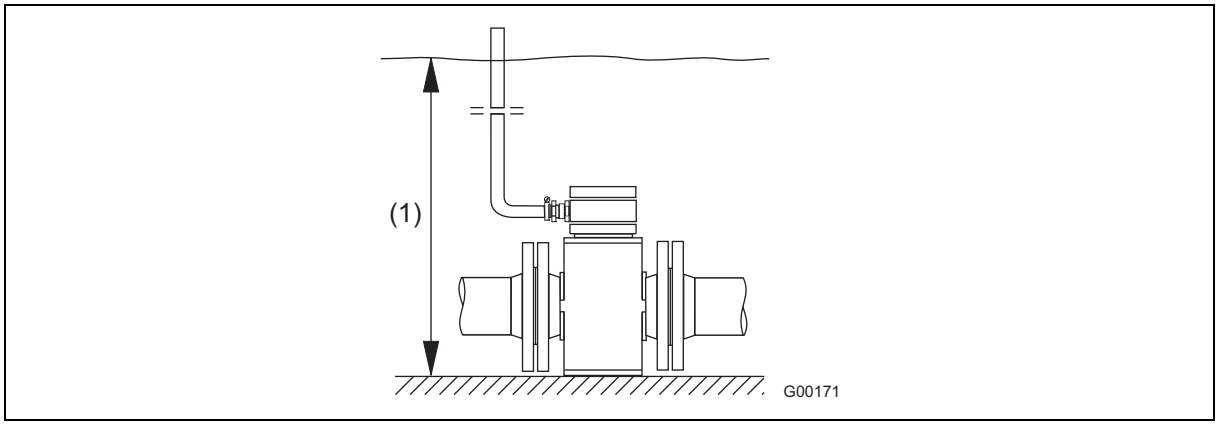
The IP68 protection type of the sensor is impaired by damage to the signal cable.

The sheath of the signal cable must not be damaged. Otherwise, the IP68 protection type for the sensor cannot be ensured.

For sensors with protection type IP68, the maximum flooding height is 5 m (16.4 ft). The cable (part no. 00648906 or 00648907) included in the scope of delivery meets all submersion capability requirements.

The sensor is type-tested according to EN 60529.

Test conditions: 14 days at a flooding height of 5 m (16.4 ft)



(1) Maximum flooding height 5 m (16.4 ft)

1. The signal cable included in the scope of delivery must be used to connect the sensor and the transmitter.
2. Connect the signal cable in the sensor terminal box.
3. Route the signal cable from the terminal box up to above the maximum flooding height of 5 m (16.4 ft).
4. Tighten the cable fitting.
   Optimum tightening torque: depends on the load of the used cable. (guide value: 4.5 Nm)
5. Carefully seal the terminal box. Make sure the housing seal is positioned correctly.

IMPORTANT (NOTE)!

The sensor can also be ordered with the signal cable already connected to the sensor and the terminal box already potted.

3.4 Notes on using the device in areas with combustible dust

DANGER – Explosion hazard!

Among other things, the dust explosion protection is ensured by the housing.

No changes may be made to the housing (e.g. removing or not using parts).

The device with dual-compartment transmitter housing is approved for use in potentially explosive areas (gas and dust).

The Ex mark is provided on the nameplate.

3.4.1 Maximum admissible surface temperature

IMPORTANT (NOTE)!

The maximum surface temperature is applicable to dust layers of up to 5 mm (0.20 inches) in thickness. This is to be used to determine the minimum admissible ignition and glow temperature for the dust atmosphere according to EN 60079.

The maximum admissible surface temperature must be reduced for thicker dust layers. The dust may be conductive or non-conductive. EN 60079 ff. must be observed.

Model	Surface temperature
406012/1-1 406013/1-1 406015/1-1 406016/1-1	70 °C (158 °F) to T_{Medium}
406012/2-1 406013/2-1 406015/2-1 406016/2-1	85 °C (185 °F) to T_{Medium}
406018/2-1 406019/2-1	70 °C (158 °F)

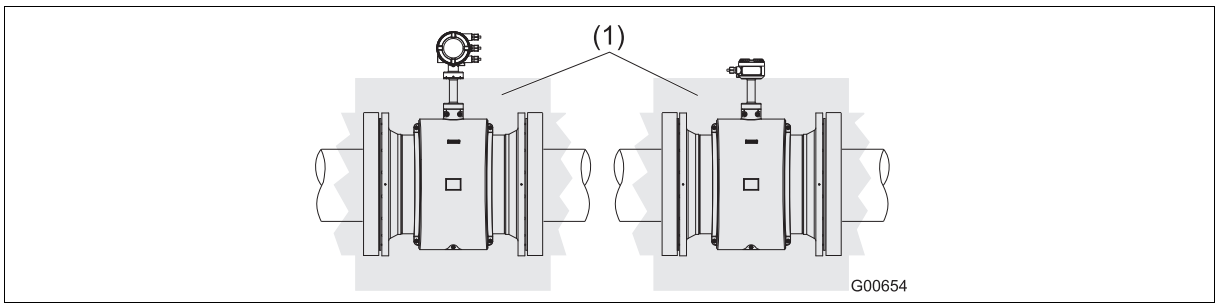
3.4.2 Minimum signal cable length

The signal cable in explosion protection areas may not be shorter than 5 m (16.4 ft).

3.5 Installation of the high-temperature version

Complete thermal insulation of the sensor part is required for the high-temperature version. The pipeline and sensor insulation (1) must be implemented as shown in the figure after installing the device.

The thermal resistance of the insulation must not exceed λ = 0.036 W/(mK); otherwise reduce the insulation thickness.



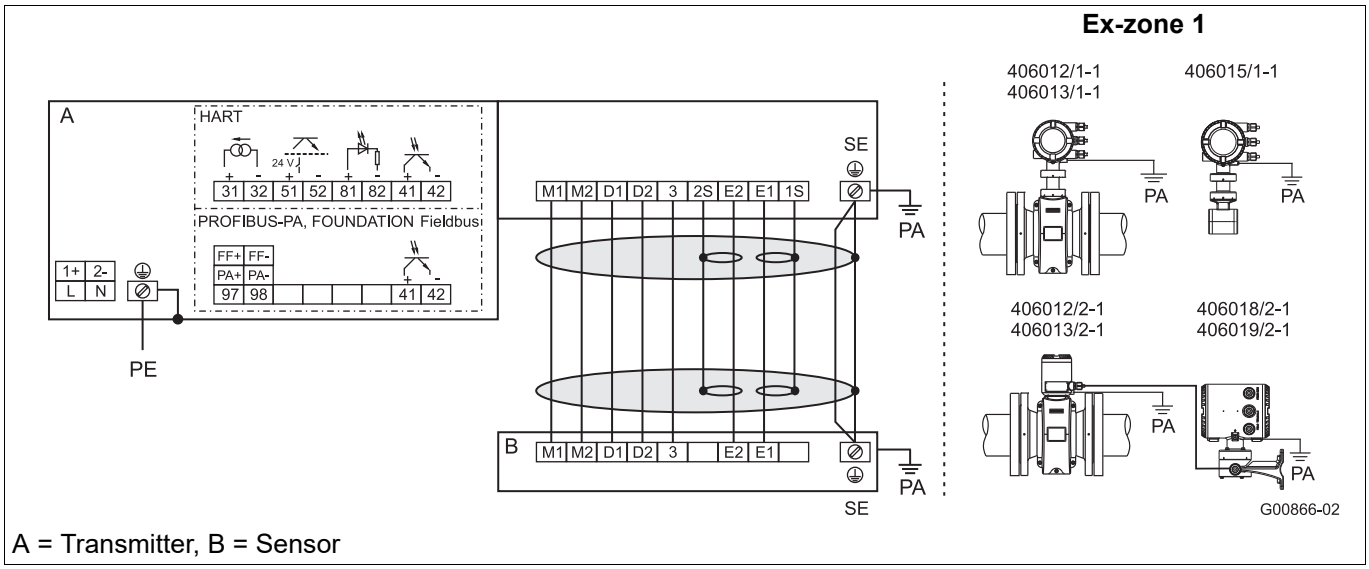
(1) Pipeline and container insulation

4 Ex relevant data for operation in zones 1, 21 and 22

4.1 Electrical connection

4.1.1 Sensor and transmitter in zone 1

Modell 406012/1-1, 406013/1-1, 406015/1-1, 406012/2-1 with 406018/2-1, 406013/2-1 with 406019/2-1
HART protocol, PROFIBUS-PA, FOUNDATION Fieldbus



A = Transmitter, B = Sensor

Voltage supply

Alternating voltage (AC)		**Direct voltage (DC)**	
Terminal	**Function**	**Terminal**	**Function**
L	Phase	1+	+
N	Neutral conductor	2-	-
PE	Protection conductor (PE)	PE	Protection conductor (PE)

Signal cable connection (for devices with remote mount design type only)

Terminal	**Function**	**Wire color**
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
SE	Shielding	-
E1	Signal line	Violet
1S	Shield of E1	-
E2	Signal line	blue
2S	Shield of E2	-
3	Measurement potential	Green

4 Ex relevant data for operation in zones 1, 21 and 22

Input and output connection

Terminal	Function
31/32	**Current/HART output** - The current output is available in "active" or "passive" mode. The configuration must be specified when ordering the unit, since the configuration cannot be changed on-site.
97/98	**PROFIBUS-PA (PA+/PA-)** or **FOUNDATION Fieldbus (FF+/FF-)** – according to IEC 61158-2
51/52	**Digital output DO1 active/passive** - Function can be configured locally as "Pulse output" or "Binary output". The default setting is "Pulse output".
81/82	**Digital input/contact input** - Function can be configured using software on-site as "External output switch-off", "External counter reset", "External counter stop", or "Other". Only available in conjunction with "passive" current output.
41/42	**Digital output DO2 passive** - Function can be configured using software on-site as "Pulse output" or "Binary output". The default setting is "Binary output", flow direction signaling.
PA	**Potential equalization (PA)**

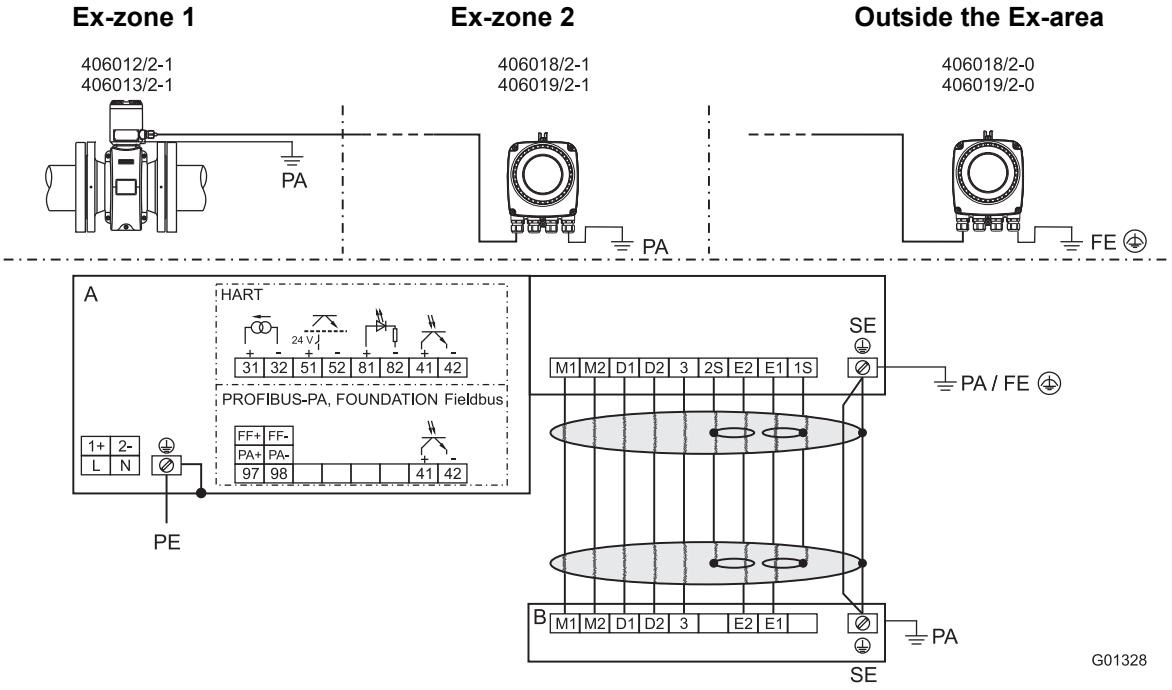
IMPORTANT (NOTE)!

The transmitter and sensor housing must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE), no potential differences can occur between the protective conductor (PE) and potential equalization (PA).

A temperature of 70 °C (158 °F) is assumed at the cable entry for the Ex calculations. The cables used for the voltage supply and the signal inputs and outputs must therefore have a minimum specification of 70 °C (158 °F).

4.1.2 Sensor in zone 1 and transmitter in zone 2 or outside of the Ex-area

Modell 406012/2-1 with 406018/2-1 or with 406018/2-0, 406013/2-1 with 406018/2-1 or with 406018/2-0 HART protocol, PROFIBUS-PA, FOUNDATION Fieldbus



A = Transmitter, B = Sensor

Voltage supply

Alternating voltage (AC)		**Direct voltage (DC)**	
Terminal	**Function**	**Terminal**	**Function**
L	Phase	1+	+
N	Neutral conductor	2-	-
PE	Protection conductor (PE)	PE	Protection conductor (PE)

Signal cable connection (for devices with remote mount design type only)

Terminal	**Function**	**Wire color**
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
SE	Shielding	-
E1	Signal line	Violet
1S	Shield of E1	-
E2	Signal line	blue
2S	Shield of E2	-
3	Measurement potential	Green

4 Ex relevant data for operation in zones 1, 21 and 22

Input and output connection

Terminal	Function
31/32	**Current/HART output** - The current output is available in "active" or "passive" mode.
97/98	**PROFIBUS-PA (PA+/PA-)** or **FOUNDATION Fieldbus (FF+/FF-)** – according to IEC 61158-2
51/52	**Digital output DO1 active/passive** - Function can be configured locally as "Pulse output" or "Binary output". The default setting is "Pulse output".
81/82	**Digital input/contact input** - Function can be configured using software on-site as "External output switch-off", "External counter reset", "External counter stop" or "Other".
41/42	**Digital output DO2 passive** - Function can be configured using software on-site as "Pulse output" or "Binary output". The default setting is "Binary output", flow direction signaling.
PA	**Potential equalization (PA)**
FE	**Functional ground** (only for transmitters outside potentially explosive area)

IMPORTANT (NOTE)!

The transmitter and sensor housing must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE), no potential differences can occur between the protective conductor (PE) and potential equalization (PA).

A temperature of 70 °C (158 °F) is assumed at the cable entry for the Ex calculations. The cables used for the voltage supply and the signal inputs and outputs must therefore have a minimum specification of 70 °C (158 °F).

4.2 Electrical data for operation in zones 1, 21, 22

4.2.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the transmitter signal inputs and outputs. For the current output version (active/passive), see the identification marking in the device's terminal box.

Model: 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1, 406018/2-1 (dual-compartment housing), 406019/2-1 (dual-compartment housing)

	Operating data		**Ex-data – ignition protection type Ex i, IS**											
Inputs and Outputs	**U_N [V]**	**I_N [mA]**	**U_O [V]**	**U_I [V]**	**I_O [mA]**	**I_I[a] [mA]**	**P_O [mW]**	**P_I[a] [mW]**	**C_O [nF]**	**C_I [nF]**	**C_{OPA} [nF]**	**C_{IPA} [nF]**	**L_O [mH]**	**L_I [mH]**
Current output Active Terminal 31/32	30	30	20	60	100	425	500	2000	210	8.4	195	24	6	0.065
Current output passive Terminal 31/32	30	30		60		500		2000		8.4		24		170
Digital output DO2 passive Terminal 41/42	30	220		60		425[b] 500[c]		2000		3.6		3.6		170
Digital output DO1 passive Terminal 51/52	30	220		60		425[b] 500[c]		2000		3.6		3.6		170
Digital input DI[d] passive Terminal 81/82	30	10		60		500		2000		3.6		3.6		170

[a] Intrinsically safe single-channel or multichannel barriers (supply isolators) with resistance characteristic curve must be used.

[b] For "active" current output.

[c] For "passive" current output.

[d] Only available in conjunction with passive current output.

All inputs and outputs are galvanically isolated from each other and from the voltage supply.

4 Ex relevant data for operation in zones 1, 21 and 22

IMPORTANT (NOTE)!

Special connection conditions:

The output circuits are designed so that they can be connected to intrinsically safe and non-intrinsically safe electrical circuits. Intrinsically safe and non-intrinsically safe electrical circuits may not be combined. Potential equalization must be implemented for intrinsically safe circuits. If the rated voltage U_M = 60 V is not exceeded when non-intrinsically safe electrical circuits are connected, the intrinsic safety is maintained.

4.2.2 Devices with PROFIBUS PA or FOUNDATION Fieldbus

Operation in zone 1 – Devices with PROFIBUS PA or **FOUNDATION Fieldbus**

When operating in potentially explosive areas, observe the following electrical data for the transmitter signal inputs and outputs. For the (PROFIBUS-PA or FOUNDATION Fieldbus) version, see the identification marking in the device's terminal box.

IMPORTANT (NOTE)!

For devices in zone 1, the bus termination must comply with the FISCO model (Fieldbus Intrinsically Safe COncept) or the explosion protection regulations. For devices in zone 2, the bus termination must comply with the FNICO model (Fieldbus NonIncendive COncept) or the explosion protection regulations.

Model: 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1, 406018/2-1 (dual-compartment housing), 406019/2-1 (dual-compartment housing)

The fieldbus and the digital output can be connected in zone 1 in three different variants.

Variant 1: Intrinsically safe fieldbus connection according to FISCO, intrinsically safe digital output connection

	Operating data		Ex-data – Ex i, IS, and FISCO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Digital output DO2 passive Terminal 41/42	30	220	60	200[a]	5000[a]	3.6	3.6	0.17
Fieldbus Terminal 97/98	32	30	17	380	5320	1	1	5

[a] Single-channel or multichannel barriers (supply isolators) with resistance characteristic curve must be used.

Variant 2: Intrinsically safe fieldbus connection (not according to FISCO!), intrinsically safe digital output connection

	Operating data		Ex-data – Ex i, IS, and FISCO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Digital output DO2 passive Terminal 41/42	30	220	60	200[a]	5000[a]	3.6	3.6	0.17
Fieldbus Terminal 97/98	32	30	60	500	5000	1	1	5

[a] Single-channel or multichannel barriers (supply isolators) with resistance characteristic curve must be used.

Variant 3: Fieldbus connection according to FNICO (zone 2), digital output connection (zone 2)

	Operating data		Ex-data – Ex n, NI, and FNICO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Digital output DO2 passive Terminal 41/42	30	220	-		-	-	-	-
Fieldbus Terminal 97/98	32	30	60	500[a]	5000[a]	1	1	5

[a] Single-channel or multichannel barriers (supply isolators) with resistance characteristic curve must be used.

All inputs and outputs are galvanically isolated from each other and from the voltage supply.

4 Ex relevant data for operation in zones 1, 21 and 22

IMPORTANT (NOTE)!

Special connection conditions:

The output circuits are designed so that they can be connected to intrinsically safe and non-intrinsically safe electrical circuits. Intrinsically safe and non-intrinsically safe electrical circuits may not be combined. Potential equalization must be implemented for intrinsically safe circuits. If the rated voltage U_M = 60 V is not exceeded when non-intrinsically safe electrical circuits are connected, the intrinsic safety is maintained.

4.3 Temperature data for operation in zone 1

Operation in zone 1

Model	Surface temperature
406012/1-1 406013/1-1 406015/1-1 406016/1-1	70 °C (158 °F)
406012/2-1 406013/2-1	85 °C (185 °F)
406018/2-1 (dual-compartment housing) 406019/2-1 (dual-compartment housing)	70 °C (158 °F)

The surface temperature depends on the medium temperature. With an increasing medium temperature > 70 °C (158 °F) or > 85 °C (185 °F), the surface temperature also increases to the level of the medium temperature.

IMPORTANT (NOTE)!

The maximum admissible measurement medium temperature depends on the lining and flange material and is limited by the operating data in table 1 and the explosion-relevant technical data in tables 2 and 3.

Table 1: Medium temperature depending on the lining and flange material

Model 406012/1-1, 406012/2-1, 406013/1-1, 406013/2-1

Materials		Medium temperature (operating data)	
Lining	**Flange**	**Minimum**	**Maximum**
Hard rubber	Steel	-10 °C (14 °F)	90 °C (194 °F)
	Stainless steel	-15 °C (5 °F)	
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
	Stainless steel	-15 °C (5 °F)	
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
	Stainless steel	-25 °C (-13 °F)	
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
	Stainless steel	-25 °C (-13 °F)	
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
	Stainless steel	-25 °C (-13 °F)	
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
	Stainless steel	-25 °C (-13 °F)	

Model 406015/1-1, 406016/1-1

			Medium temperature (operating data)	
Lining	**Process connection**	**Material**	**Minimum**	**Maximum**
PFA	Flange	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
PFA	Connection flange	-	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Variable process connection	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

4 Ex relevant data for operation in zones 1, 21 and 22

Table 2: Medium temperature (Ex data) for model 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1

IMPORTANT (NOTE)!

If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.

If the installation location for the device is only classified as a potentially explosive area for gases, the temperature data in the "Gas" column in the table must be taken into consideration.

IMPORTANT (NOTE)!

Not thermally insulated: the sensor is not surrounded by pipe insulating material.
Thermally insulated: the sensor is surrounded by pipe insulating material.

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 100	DN 3 to DN 100	T1	130 °C								90 °C	30 °C	80 °C	40 °C
		T2	130 °								90 °C	30 °C	80 °C	40 °C
		T3	130 °C								90 °C	30 °C	80 °C	40 °C
		T4	120 °C								90 °C	30 °C	80 °C	40 °C
		T5	85 °C								70 °C	30 °C	80 °C	40 °C
		T6	70 °C								70 °C	30 °C	80 °C	40 °C
DN 125 to DN 2000	Not available	T1	130 °C								90 °C	30 °C	70 °C	40 °C
		T2	130 °C								90 °C	30 °C	80 °C	40 °C
		T3	130 °C								90 °C	30 °C	80 °C	40 °C
		T4	125 °C								90 °C	30 °C	80 °C	40 °C
		T5	90 °C								90 °C	30 °C	80 °C	40 °C
		T6	75 °C								75 °C	30 °C	75 °C	40 °C

[a] Applies for model 406012/1-1, 406013/1-1

[b] Applies for model 406015/1-1, 406016/1-1

[c] Low temperature version (optional)

High-temperature version

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 100	DN 3 to DN 100	T1	180 °C								120 °C	20 °C	120 °C	20 °C
		T2	180 °								120 °C	20 °C	120 °C	20 °C
		T3	180 °								120 °C	20 °C	120 °C	20 °C
		T4	120 °								120 °C	20 °C	120 °C	20 °C
		T5	85 °C								85 °C	20 °C	85 °C	20 °C
		T6	70 °C								70 °C	20 °C	70 °C	20 °C
DN 125 to DN 2000	Not available	T1	180 °C								120 °C	20 °C	120 °C	20 °C
		T2	180 °C								120 °C	20 °C	120 °C	20 °C
		T3	180 °C								120 °C	20 °C	120 °C	20 °C
		T4	125 °C								120 °C	20 °C	120 °C	20 °C
		T5	90 °C								90 °C	20 °C	90 °C	20 °C
		T6	75 °C								75 °C	20 °C	75 °C	20 °C

[a] Applies for model 406012/1-1, 406013/1-1

[b] Applies for model 406015/1-1, 406016/1-1

[c] Low temperature version (optional)

4 Ex relevant data for operation in zones 1, 21 and 22

Table 3: Medium temperature (Ex data) for model 406012/2-1, 406013/2-1

IMPORTANT (NOTE)!

The standard version includes Ex-protection for gases and dust.

If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.

If the installation location for the device is only classified as a potentially explosive area for gases, the temperature data in the "Gas" column in the table must be taken into consideration.

IMPORTANT (NOTE)!

Not thermally insulated: the sensor is not surrounded by pipe insulating material.
Thermally insulated: the sensor is surrounded by pipe insulating material.

Nominal width 406012[a]	Temperature class	Ambient temperature											
		(-40 °C)[b] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
		Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 10 to DN 100	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	T2	130 °								110 °C	110 °C	110 °C	110 °C
	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	T4	120 °C								110 °C	110 °C	110 °C	110 °C
	T5	85 °C								85 °C	85 °C	85 °C	85 °C
	T6	70 °C								70 °C	70 °C	70 °C	70 °C
DN 125 to DN 2000	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	T2	130 °C								110 °C	110 °C	110 °C	110 °C
	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	T4	125 °C								110 °C	110 °C	110 °C	110 °C
	T5	90 °C								90 °C	90 °C	90 °C	90 °C
	T6	75 °C								75 °C	75 °C	75 °C	75 °C

[a] Applies for model 406012/2-1, 406013/2-1

[b] Low temperature version (optional)

High-temperature version

Nominal width 406012[a]	Temperature class	Ambient temperature											
		(-40 °C)[b] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
		Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 10 to DN 100	T1	180 °C								160 °C	150 °C	160 °C	150 °C
	T2	180 °								160 °C	150 °C	160 °C	150 °C
	T3	180 °C								160 °C	150 °C	160 °C	150 °C
	T4	120 °C								120 °C	120 °C	120 °C	120 °C
	T5	85 °C								85 °C	85 °C	85 °C	85 °C
	T6	70 °C								70 °C	70 °C	70 °C	70 °C
DN 125 to DN 2000	T1	180 °C								160 °C	150 °C	160 °C	150 °C
	T2	180 °C								160 °C	150 °C	160 °C	150 °C
	T3	180 °C								160 °C	150 °C	160 °C	150 °C
	T4	125 °C								110 °C	110 °C	110 °C	110 °C
	T5	90 °C								90 °C	90 °C	90 °C	90 °C
	T6	75 °C								75 °C	75 °C	75 °C	75 °C

[a] Applies for model 406012/2-1, 406013/2-1

[b] Low temperature version (optional)

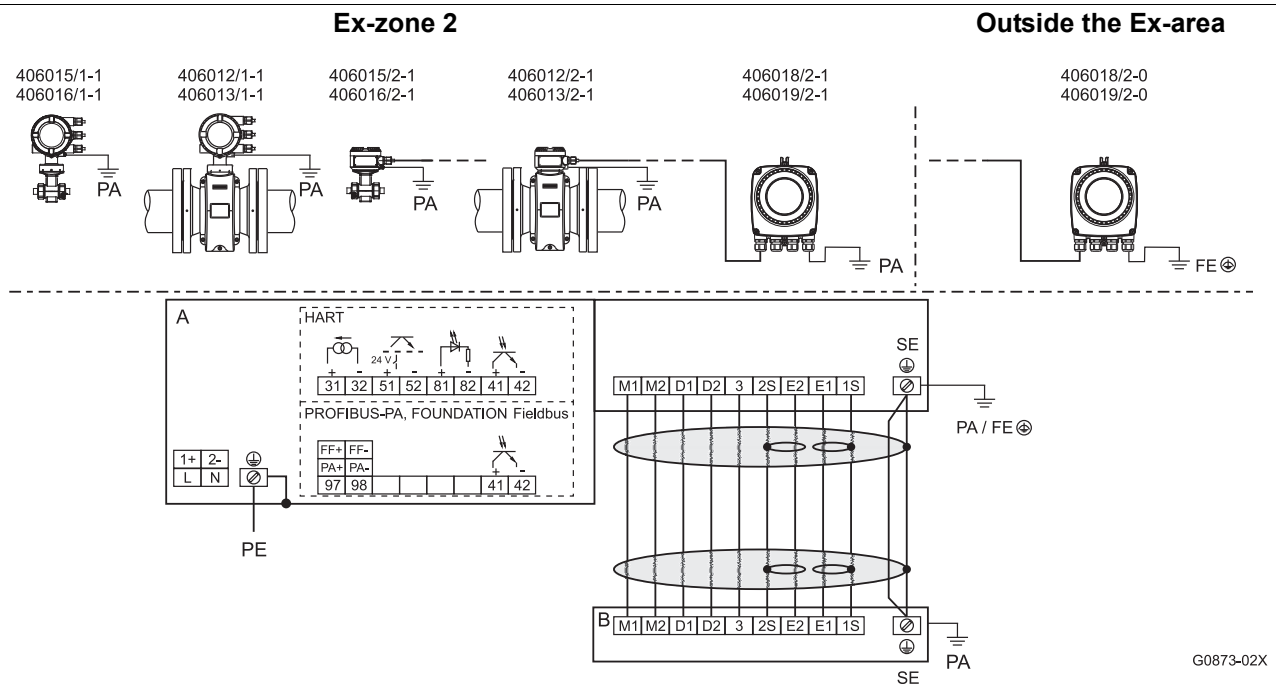
4 Ex relevant data for operation in zones 1, 21 and 22

5 Ex-relevant data for operation in zones 2, 21 and 22

5.1 Electrical connection

5.1.1 Sensor and transmitter in zone 2 or outside of the Ex-area

Models 406012/1-1, 406013/1-1, 406015/1-1. 406016/1-1, 406012/2-1 or 406015/2-1 with 406018/2-1 or with 406018/2-0, 406013/2-1 or 406016/2-1 with 406019/2-1 or with 406019/2-0
HART protocol, PROFIBUS-PA, FOUNDATION Fieldbus



A = Transmitter, B = Sensor

Voltage supply

Alternating voltage (AC)		**Direct voltage (DC)**	
Termi-nal	**Function**	**Termi-nal**	**Function**
L	Phase	1+	+
N	Neutral conductor	2-	-
PE	Protection conductor (PE)	PE	Protection conductor (PE)

Signal cable connection (for devices with remote mount design type only)

Termi-nal	**Function**	**Wire color**
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
SE	Shielding	-
E1	Signal line	Violet
1S	Shield of E1	-
E2	Signal line	blue
2S	Shield of E2	-
3	Measurement potential	Green

5 Ex-relevant data for operation in zones 2, 21 and 22

Input and output connection

Terminal	Function
31/32	**Current/HART output** - The current output is available in "active" or "passive" mode.
97/98	**PROFIBUS-PA (PA+/PA-)** or **FOUNDATION Fieldbus (FF+/FF-)** – according to IEC 61158-2
51/52	**Digital output DO1 active/passive** - Function can be configured locally as "Pulse output" or "Binary output". The default setting is "Pulse output".
81/82	**Digital input/contact input** - Function can be configured using software on-site as "External output switch-off", "External counter reset", "External counter stop", or "Other".
41/42	**Digital output DO2 passive** - Function can be configured using software on-site as "Pulse output" or "Binary output". The default setting is "Binary output", flow direction signaling.
PA	**Potential equalization (PA)**
FE	**Functional ground** (only for transmitters outside potentially explosive area)

IMPORTANT (NOTE)!

The transmitter and sensor housing must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE), no potential differences can occur between the protective conductor (PE) and potential equalization (PA).

A temperature of 70 °C (158 °F) is assumed at the cable entry for the Ex calculations. The cables used for the voltage supply and the signal inputs and outputs must therefore have a minimum specification of 70 °C (158 °F).

5.2 Electrical data for operation in zones 2, 21, 22

5.2.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the transmitter signal inputs and outputs. For the current output version (active/passive), see the identification marking in the device's terminal compartment..

Model: 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1, 406018/2-1 (single-compartment housing),
406019/2-1 (single-compartment housing)

	Operating data		Ex-data – Ex n/NI	
Inputs and outputs	**U_i [V]**	**I_i [mA]**	**U_i [V]**	**I_i [mA]**
Current output active/passive Terminal 31/32	30	30	30	30
Digital output DO1 active/passive Terminal 51/52	30	220	30	220
Digital output DO2 passive Terminal 41/42	30	220	30	220
Digital input DI Terminal 81/82	30	10	30	10

All inputs and outputs are galvanically isolated from each other and from the voltage supply. .

5.2.2 Devices with PROFIBUS PA or FOUNDATION Fieldbus

When operating in potentially explosive areas, observe the following electrical data for the transmitter signal inputs and outputs. For the (PROFIBUS-PA) version, see the identification marking in the device's terminal box.

IMPORTANT (NOTE)!

For devices in zone 2, the bus termination must comply with the FNICO model (Fieldbus NonIncendive COncept) or the explosion protection regulations.

Model: 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1, 406018/2-1 (single-compartment housing) 406016/2-1 (single-compartment housing)

	Operating data		Ex-data – Ex n/NI and FNICO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Digital output DO2 passive Terminal 41/42	30	220	30	-	-	-	-	-
Fieldbus Terminal 97/98	32	30	32	500[a]	7000[a]	1	1	5

[a] Single-channel or multichannel barriers (supply isolators) with resistance characteristic curve must be used.

5.3 Temperature data for operation in zone 2

Operation in zone 2

Model	Surface temperature
406012/1-1 406013/1-1 406015/1-1 406016/1-1	70 °C (158 °F)
406012/2-1 406013/2-1 406015/2-1 406016/2-1	85 °C (185 °F)
406018/2-1 (single-compartment housing) 406019/2-1 (single-compartment housing)	70 °C (158 °F)

The surface temperature depends on the medium temperature. With an increasing medium temperature > 70 °C (158 °F) or > 85 °C (185 °F), the surface temperature also increases to the level of the medium temperature.

IMPORTANT (NOTE)!

The maximum admissible measurement medium temperature depends on the lining and flange material and is limited by the operating data in table 1 and the explosion-relevant technical data in tables 2 and 3.

5 Ex-relevant data for operation in zones 2, 21 and 22

Table 1: Medium temperature depending on the lining and flange material

Model 406012/1-1, 406013/1-1, 406012/2-1, 406013/2-1

Materials		**Medium temperature (operating data)**	
Lining	**Flange**	**Minimum**	**Maximum**
Hard rubber	Steel	-10 °C (14 °F)	90 °C (194 °F)
	Stainless steel	-15 °C (5 °F)	
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
	Stainless steel	-15 °C (5 °F)	
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
	Stainless steel	-25 °C (-13 °F)	
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
	Stainless steel	-25 °C (-13 °F)	
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
	Stainless steel	-25 °C (-13 °F)	
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
	Stainless steel	-25 °C (-13 °F)	

Model 406015/1-1, 406016/1-1, 406015/2-1, 406016/2-1

			Medium temperature (operating data)	
Lining	**Process connection**	**Material**	**Minimum**	**Maximum**
PFA	Flange	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
PFA	Connection flange	-	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Variable process connection	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

Table 2: Medium temperature (Ex data) for model 406012/1-1, 406013/1-1, 406015/1-1, 406016/1-1

IMPORTANT (NOTE)!

If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.

If the installation location for the device is only classified as a potentially explosive area for gases, the temperature data in the "Gas" column in the table must be taken into consideration.

IMPORTANT (NOTE)!

Not thermally insulated: the sensor is not surrounded by pipe insulating material.
Thermally insulated: the sensor is surrounded by pipe insulating material.

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 2000	DN 3 to DN 100	T1	130 °C	130 °C	-	-	130 °C	100 °C[a] 110 °C[b]	-	-	80 °C	40 °C	-	-
		T2	130 °C	130 °C	-	-	130 °C	100 °C[a] 110 °C[b]	-	-	80 °C	40 °C	-	-
		T3	130 °C	130 °C	-	-	130 °C	100 °C[a] 110 °C[b]	-	-	80 °C	40 °C	-	-
		T4	130 °C	130 °C	-	-	130 °C	100 °C[a] 110 °C[b]	-	-	80 °C	40 °C	-	-

[a] Applies for model 406012/1-1, 406013/1-1

[b] Applies for model 406015/1-1, 406016/1-1

[c] Low temperature version (optional)

High-temperature version

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 2000	DN 3 to DN 100	T1	130 °C								180 °C	40 °C	180 °C	40 °C
		T2	130 °C								180 °C	40 °C	180 °C	40 °C
		T3	130 °C								180 °C	40 °C	180 °C	40 °C
		T4	130 °C								130 °C	40 °C	130 °C	40 °C

[a] Applies for model 406012/1-1, 406013/1-1

[b] Applies for model 406015/1-1, 406016/1-1

[c] Low temperature version (optional)

Table 3: Medium temperature (Ex data) for model 406012/2-1, 406013/2-1, 406015/2-1, 406016/2-1

IMPORTANT (NOTE)!

If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.

If the installation location for the device is only classified as a potentially explosive area for gases, the temperature data in the "Gas" column in the table must be taken into consideration.

IMPORTANT (NOTE)!

Not thermally insulated: the sensor is not surrounded by pipe insulating material.
Thermally insulated: the sensor is surrounded by pipe insulating material.

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 2000	DN 3 to DN 100	T1	130 °C	130 °C	-	-	130 °C	130 °C	-	-	110 °C[a] 120 °C[b]	110 °C	-	-
		T2	130 °C	130 °C	-	-	130 °C	130 °C	-	-	110 °C[a] 120 °C[b]	110 °C	-	-
		T3	130 °C	130 °C	-	-	130 °C	130 °C	-	-	110 °C[a] 120 °C[b]	110 °C	-	-
		T4	130 °C	130 °C	-	-	130 °C	130 °C	-	-	110 °C[a] 120 °C[b]	110 °C	-	-
		T5	95 °C	95 °C	-	-	95 °C	95 °C	-	-	95 °C	95 °C	-	-
		T6	80 °C	80 °C	-	-	80 °C	80 °C	-	-	80 °C	80 °C	-	-

[a] Applies for model 406012/2-1, 406013/2-1

[b] Applies for model 406015/2-1, 406016/2-1

[c] Low temperature version (optional)

High-temperature version

Nominal width 406012[a]	Nominal width 406015[b]	Temperature class	Ambient temperature											
			(-40 °C)[c] -20 °C to +40 °C				(-40 °C)[c] -20 °C to +50 °C				(-40 °C)[c] -20 °C to +60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust	Gas	Gas & Dust
DN 3 to DN 2000	DN 3 to DN 100	T1	130 °C											
		T2	130 °C											
		T3	130 °C											
		T4	130 °C											
		T5	95 °C											
		T6	80 °C											

[a] Applies for model 406012/2-1, 406013/2-1

[b] Applies for model 406015/2-1, 406016/2-1

[c] Low temperature version (optional)

6.1 Checks prior to start-up

IMPORTANT (NOTE)!

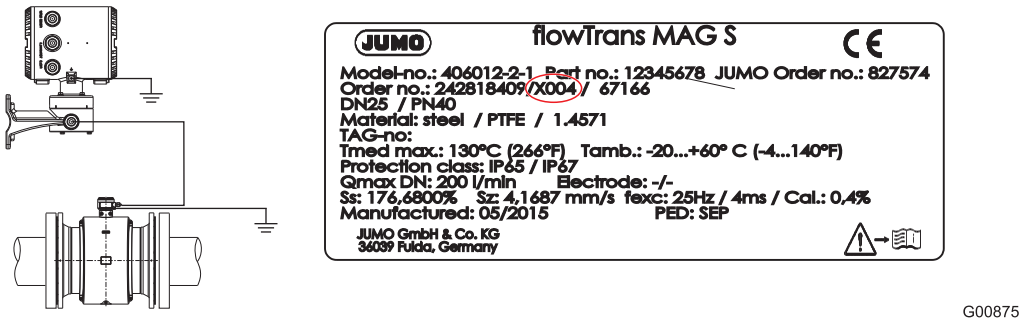
The following points must be checked before startup:

- The voltage supply must be switched off.
- The voltage supply must match the specification on the nameplate.
- The pin assignment must correspond to the connection diagram.
- The sensor and transmitter must be grounded properly.
- The temperature limit values must be observed.
- The transmitter must be mounted at a location that is largely free from vibrations.
- The case lid and its lock must be sealed before switching on the voltage supply.
- For devices with a remote mount design and an accuracy of 0.2 % of the measuring value, make sure that the sensor and the transmitter have the correct assignment: sensors have the last digits X1, X2, etc. printed on the nameplates: transmitters have the last digits Y1, Y2, etc. printed on the nameplates; devices with the last digits X1/Y1 or X2/Y2 belong together.
- Unused screw connections must be sealed with the provided plugs according to IEC 60079 prior to startup

6.2 Notes on combinations of sensors and transmitters

The correct assignment of the transmitter to the sensor must be ensured for the following combinations in Ex-zone 1.

Combination	Identification marking
406012/2-1 with 406018/2-1 (dual-compartment housing)	X01, X02 etc.
406013/2-1 with 406019/2-1 (dual-compartment housing)	X01, X02 etc.



The sensor is marked with the ending X01, X02, etc. on the nameplate in the order number.

The corresponding transmitter is marked with the ending X01, X02, etc. on the nameplate in the order number.

6.3 Special features of device version for operation in Ex zone 1

6.3.1 Configuring the current output

For devices designed for use in Ex-zone 1, the current output configuration cannot be subsequently changed.

The desired configuration for the current output (active/passive) must be specified when the order is placed.

For the current output version (active/passive), see the identification marking in the device's terminal box.

If the signal is configured in "active" mode, no external power may be supplied to the current output.

If the signal is configured in "passive" mode, external power must be supplied to the current output, as with the pressure and temperature transmitters.

6.3.2 Configuring the digital output

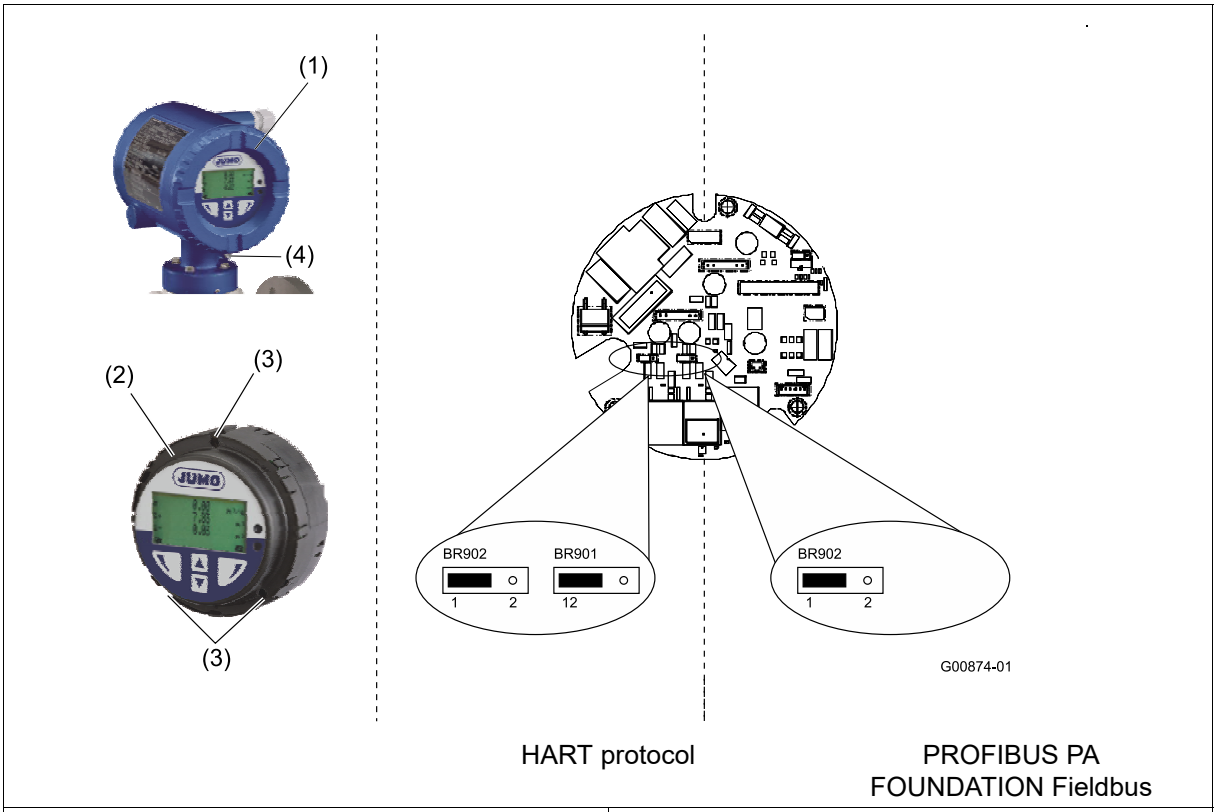
For the device version for operation in Ex zone 1, the digital outputs DO1 (51/52) and DO2 (41/42) can be configured for a connection to a NAMUR switching amplifier. In the default setting, the outputs are configured with the standard wiring (non-NAMUR).

Devices with PROFIBUS PA only feature the digital output DO2 (41/42).

IMPORTANT (NOTE)!

This does not affect the output ignition protection type. The devices connected to these outputs must comply with the applicable regulations for explosion protection.

The configuration jumpers are located on the backplane in the transmitter housing.



BR902 for digital output DO1	**BR901 for digital output DO2**
BR902 in position 1: standard (non-NAMUR)	BR901 in Position 1: Standard (non-NAMUR)
BR902 in position 2: NAMUR	BR901 in position 2: NAMUR

(1) Case lid
(2) Transmitter plug-in module
(3) Mounting screws
(4) Lid lock

Configuration of the digital outputs:

1. Switch off the voltage supply and wait at least 20 minutes before performing the next step.
2. Remove the case lid. (1) ⇨ see chapter 3.1 "Notes on opening and closing the housing", page 19.
3. Loosen the screws (3) and pull out the transmitter plug-in module (2).
4. Insert the jumpers at the required positions.
5. Re-insert the transmitter plug-in module (2) and retighten the screws (3).
6. Before restarting, close the housing and secure the case lid (1) by unscrewing the Allen screw (4) to prevent the case from being opened accidentally.

6 Startup

7.1 General information

All repair or maintenance work must only be carried out by qualified customer service personnel.

When replacing or repairing individual components, original spare parts must be used.

To install, start up and maintain the JUMO flowTRANS MAG devices, it is necessary to open the housing of the sensor or transmitter.

Be sure to observe the following safety instructions before opening and after closing the housing for re-starting:

DANGER – Explosion hazard!

When the case lid is open, the Ex-protection becomes void.
Before opening the housing, de-energize all of the device's connecting cables and wait for at least 20 minutes.

DANGER – Explosion hazard!

Loosening the transmitter housing screws invalidates the Ex-protection. Before re-starting, tighten all screws on the transmitter housing.

WARNING – Personal injuries!

When the housing is open, the EMC protection is limited and the protection against contact becomes void.

Before opening the housing switch off the voltage supply.

WARNING – Impairment of the housing protection type!

If the seal (O-ring) is not connected properly or damaged, the housing protection type is limited. Before closing the case lid, check the seal (O-ring) for damage and replace if necessary.

When closing the case lid, make sure the seal is connected properly.

CAUTION – Damage to components!

The electronic components of the circuit board may be damaged by static electricity (observe ESD guidelines).

Make sure that the static electricity in your body is discharged before touching electronic components.

7 Maintenance

7.2 Replacing the transmitter or sensor

DANGER – Explosion hazard!

When the case lid is open, Ex-protection and touch protection are voided. EMC protection is restricted. Before opening the housing, be sure to observe chapter 7.1 "General information", page 51!

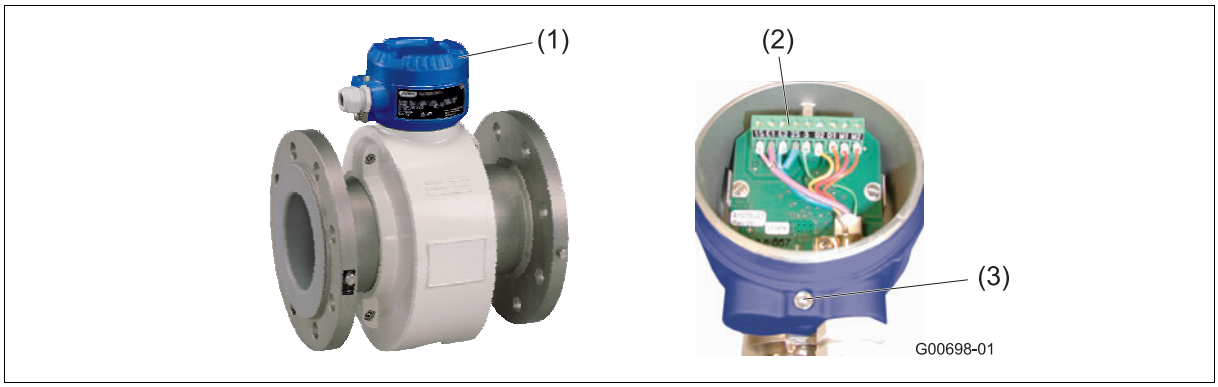
IMPORTANT (NOTE)!

When replacing the transmitter or sensor, the correct assignment must be ensured.

The respective series is specified on the nameplate of the transmitter or sensor (e.g. JUMO flowTRANS MAG S01 or JUMO flowTRANS MAG H02).

After the transmitter is replaced, the system data must be reloaded according to the specifications in chapter 7.5.1 "Loading the system data" of the „JUMO flowTRANS MAG S/H - Operating Manual for the devices 406012 - 406019".

7.2.1 Replacing the sensor

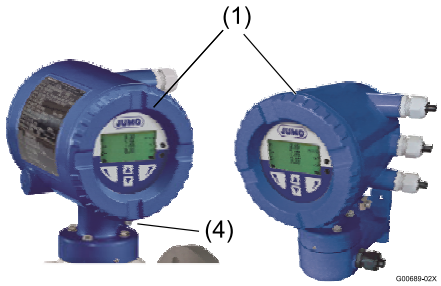


(1) Case lid
(2) Screw terminals
(3) Lid lock

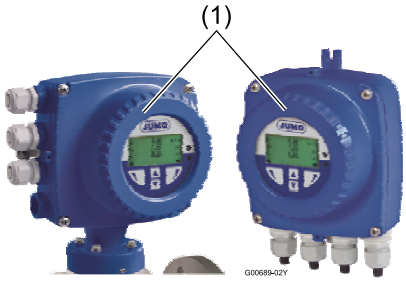
Replace the sensor as follows:

1. ⇨ Observe chapter 7.1 "General information", page 51!
2. Switch off the voltage supply and wait at least 20 minutes before performing the next step.
3. Screw in the lid lock (3) and unlock the case lid (1).
4. Open the case lid (1).
5. Loosen the screw terminals (2) and remove the cable.
6. Replace the sensor.
7. Before closing the housing, make sure the case lid (O-ring) is connected properly.
8. Mount it in reverse order. After mounting the lid, unscrew the lid lock (3) and secure the case lid (1) against twisting.
9. Reload the system data, ⇨ See operating manual "JUMO flowTRANS MAG S/H for the devices 406012 - 406019", chapter 7.5.1 "Loading the system data".

7.2.2 Replacing the transmitter



Transmitter in a dual-compartment housing



Transmitter in a single-compartment housing

(1) Case lid
(2) Transmitter plug-in module
(3) Screws
(4) Lid lock

Replace the transmitter plug-in as follows:

1. ⇨ Observe chapter 7.1 "General information", page 51!
2. Switch off the voltage supply and wait at least 20 minutes before performing the next step.
3. Screw in the lid lock (4) and unlock the case lid (1).
4. Open the case lid (1).
5. Loosen the screws (3) and pull out the transmitter plug-in module.
6. Insert the new transmitter plug-in module (2) and retighten the screws (3).
7. Before closing the housing, make sure the case lid (O-ring) is connected properly.
8. Close the case lid and secure the lid by unscrewing the lid lock (4).
9. Reload the system data, ⇨ See operating manual "JUMO flowTRANS MAG S/H for the devices 406012 - 406019", chapter 7.5.1 "Loading the system data".

7 Maintenance

8.1 Approvals and certifications

CE mark	CE	The device version that we market complies with the regulations of the following EU directives. • Pressure Equipment Directive (PED) 2014/68/EU (Article 13) • Pressure Equipment Directive (PED) 2014/68/EU (Mod. B+D) • EMC directive 2014/30/EC • Low-voltage directive 2014/35/EU • ATEX directive 2014/34/EC
Explosion protection	Ex IECEx	Identification marking for intended use in potentially explosive areas according to: • ATEX Directive (identification marking in addition to CE mark) • IECEx standards

IMPORTANT (NOTE)!

All the documentation, declarations of conformity and certificates are also available in the download area www.jumo.de.

8 Annex

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