Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Safety Instructions

CNGmass

MODBUS RS485

Division 1

Ex documentation

Safety instructions for electrical apparatus for explosion-hazardous areas according to FM APPROVALS standards → Page 3

Safety instructions for electrical apparatus for explosion-hazardous areas according to CANADIAN STANDARDS ASSOCIATION → Page 11

XA116D/06/en/04.10
71112171

Endress+Hauser
People for Process Automation

Examples for markings according to FM and CSA:

FM APPROVALS

Type of Protection

Example: **XP / I / 1 / ABCD**

XP	Explosionproof
IS	Intrinsically Safe Apparatus
AIS	Associated Apparatus with Intrinsically Safe Connections
ANI	Associated Nonincendive Field Wiring Apparatus
PX,PY,PZ	Pressurized
APX,APY,APZ	Associated Pressurization Systems/Components
NI	Nonincendive
DIP	Dust-Ignitionproof
S	Special Protection

Class

I	Class I (Gas)
II	Class II (Dust)
III	Class III (Fibre)

Division

1	Division 1
2	Division 2

Group

FM /NEC	Gases, vapours and dust examples	Min. ignition temperature [µJ]
A	Acetylene, carbon disulfide (Class I)	0.02
B	Hydrogen, ethyl nitrate (Class I)	0.02
C	Ethylene, isoprene (Class I)	0.06
D	Acetone, ethane, benzene, ethanoic acid, gasolines, diesel oil, aircraft fuel, methane, heating oil,crude oil, hexane, ether (Class I)	0.18
E	Metallic powder (Class II)	
F	Coal dust (Class II)	
G	Mill dust (Class II)	
	Textile fibres (Class III)	

Temperature Class

Maximum surface temperature		
T1	842 °F	450 °C
T2	572 °F	300 °C
T2A	536 °F	280 °C
T2B	500 °F	260 °C
T2C	446 °F	230 °C
T2D	419 °F	215 °C
T3	392 °F	200 °C
T3A	356 °F	180 °C
T3B	329 °F	165 °C
T3C	320 °F	160 °C
T4	275 °F	135 °C
T4A	248 °F	120 °C
T5	212 °F	100 °C
T6	185 °F	85 °C

Canadian Standards Association

Class

Example: **Class I, Division 1, Group ABCD**

I	Class I (Gas)
II	Class II (Dust)
III	Class III (Fibre)

Division

1	Division 1
2	Division 2

Group

CSC /NEC	Gases, vapours and dust examples	Min. ignition temperature [µJ]
A	Acetylene, carbon disulfide (Class I)	0.02
B	Hydrogen, ethyl nitrate (Class I)	0.02
C	Ethylene, isoprene (Class I)	0.06
D	Acetone, ethane, benzene (Class I)	0.18
E	Metallic powder (Class II)	
F	Coal dust (Class II)	
G	Mill dust (Class II)	
	Textile fibres (Class III)	

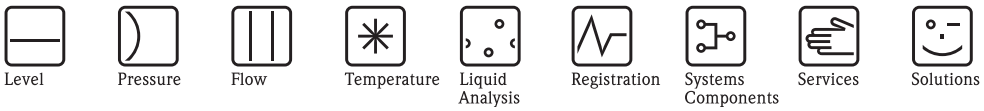
Type of Protection

Explosionproof
Intrinsically Safe Apparatus
Associated Apparatus with Intrinsically Safe Connections
Associated Nonincendive Field Wiring Apparatus
Pressurized
Associated Pressurization Systems/Components
Nonincendive
Dust-Ignitionproof
Special Protection

Temperature Class

Maximum surface temperature		
T1	450 °C	842 °F
T2	300 °C	572 °F
T2A	280 °C	536 °F
T2B	260 °C	500 °F
T2C	230 °C	446 °F
T2D	215 °C	419 °F
T3	200 °C	392 °F
T3A	180 °C	356 °F
T3B	165 °C	329 °F
T3C	160 °C	320 °F
T4	135 °C	275 °F
T4A	120 °C	248 °F
T5	100 °C	212 °F
T6	85 °C	185 °F

A0005630



Safety Instructions

CNGmass

MODBUS RS485

Division 1

FM Ex documentation

This document is an integral part of the following Operating Instructions:

- BA123D, CNGmass MODBUS RS485

Table of Contents FM

XA116D/06/en/04.10
71112171

Endress+Hauser
People for Process Automation

Special conditions

- Install per National Electrical Code NFPA 70. Install intrinsically safe circuits per National Electrical Code NFPA 70 and ISA RP 12.6 respecting the explosionproof integrity of the enclosure.
- Control room equipment shall not use or generate more than 250 V rms.
- The device must be integrated into the potential equalization system.
- For terminals No. 22 to No. 27 of the transmitter, only devices with ratings $U_m \leq 250$ V and $I_m \leq 1$ A are allowed to be connected.
- The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 7.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Use of the devices is restricted to mediums against which the process-wetted materials are adequately resistant.
- Class II Group G: The surface temperature of the apparatus cannot exceed 329 °F.
- Transmitter enclosure explosionproof for use in Class 1 Division 1 Groups A, B, C, D (factory sealed, conduit seal not required) and dust-ignition proof for Class II, III Division 1 Groups E, F, G.
- Sensor circuits are intrinsically safe for Cl. I, Div. 1, Group A, B, C, D. Sensor enclosure is dust ignition proof for Cl. II, III, Div. 1, Group E, F, G.
- Substitution of components may impair intrinsic safety.
- CNGmass is a dual seal related device.
- All ratings of the flow meter (see also nameplate) have to be respected.

☝ Caution!

- Use supply wires suitable for 9 °F above ambient temperature, but at least for 176 °F.

General warnings

- Installation, connection to the electricity supply, commissioning and maintenance of the devices must be carried out by qualified specialists trained to work on Ex-rated devices.
- Transmitter housing and cable entries have to be sealed tight.
- Open device only when disconnected or when atmosphere is known to be non-hazardous. Make sure, that no dust /humidity enters the enclosure when opened.
- A worm screw prevents undesired movement of the transmitter housing (please refer to the operating manual). When released the transmitter housing can be rotated contiously until an internal retaining ring comes to a stop. The worm screw has to be retightend once the housing has been rotated.
- If the transmitter and sensor have to be separated (e. g. for the purpose of repair), the retaining ring can be destroyed if considerable force is applied. In such a case, a new genuine Endress+Hauser retaining ring must be installed when reassembling. The worm screw has to be retightend.

Approvals

General

The system meets the fundamental health and safety requirements for the design and construction of devices and protective systems intended for use in potentially explosive atmospheres in accordance with the National Electrical Code.

No. / approval type

J.I. 3027806

Notified body

FM APPROVALS

Identification

The identification of the system must contain the following specifications:

- XP-IS-DIP / I, II, III / 1 / ABCDEFG / T5-T1

☝ Caution!

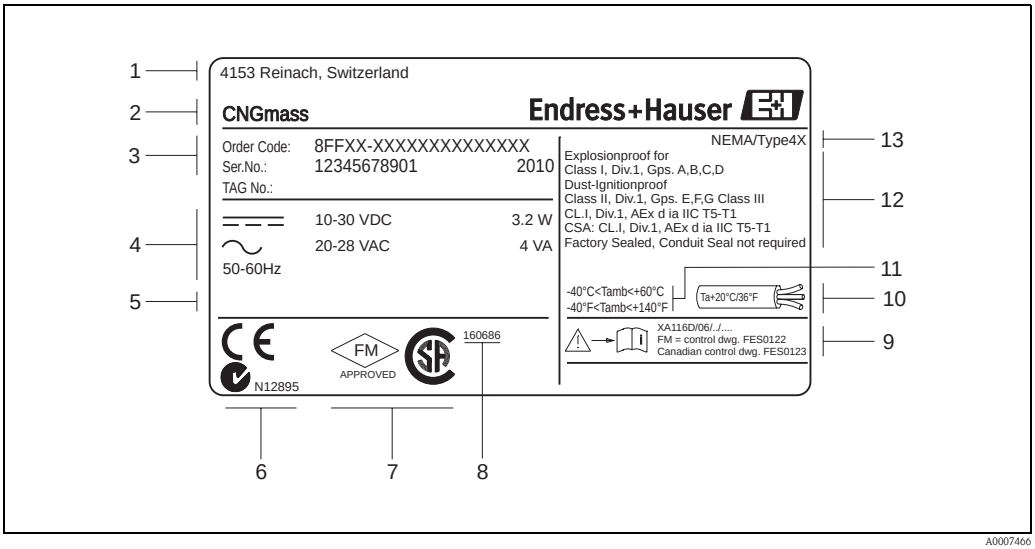
The installation instructions for the safe use of the system must be observed → Page 4 .

Description of measuring system

The measuring system consists of a compact version:
transmitters and sensors form a mechanical unit.

Nameplate

The nameplates, which are mounted in a clearly visible position on the transmitter and sensor, contain all of the relevant information about the measuring system.



A0007466

Fig. 1: Nameplate data for the transmitter (example)

1 *Production site*
2 *Type of device*
3 *Order code/ Serial number/ Year of manufacture: See the specifications on the order confirmation for the meanings of the individual letters and digits*
4 *Power supply / Frequency / Power consumption*
5 *Reserved for information on special products*
6 *C-Tick symbol*
7 *Label of the inspection authority: FM APPROVALS and CANADIAN STANDARDS ASSOCIATION*
8 *Approval number*
9 *Associated Ex documentation*
10 *Cable temperature*
11 *Permitted ambient temperature*
12 *Space for marking of class, division and group*
13 *Degree of protection*

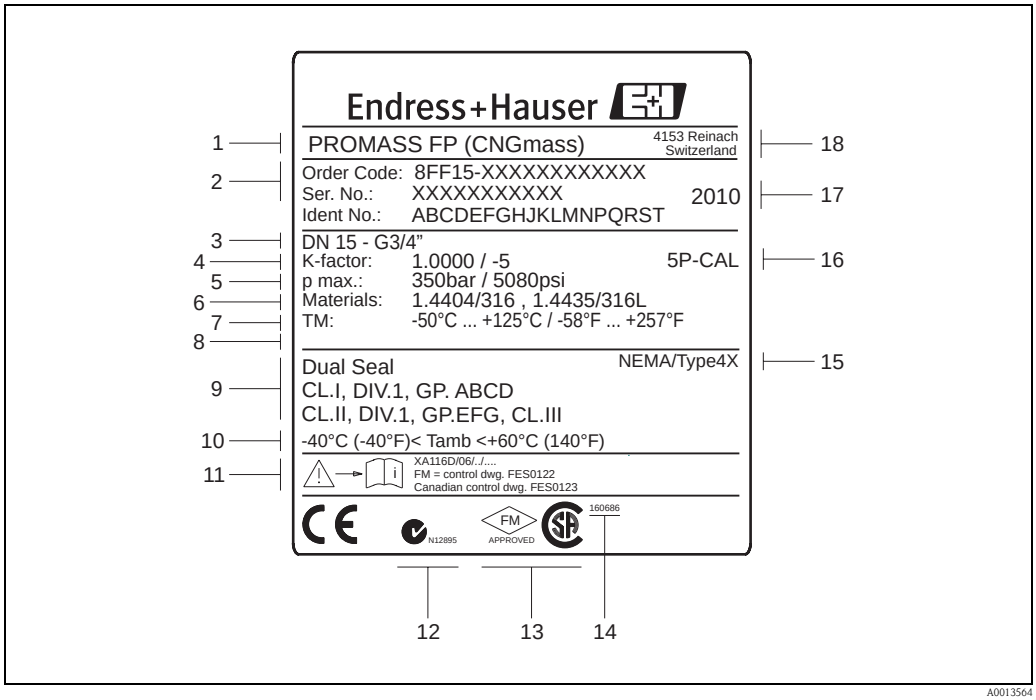
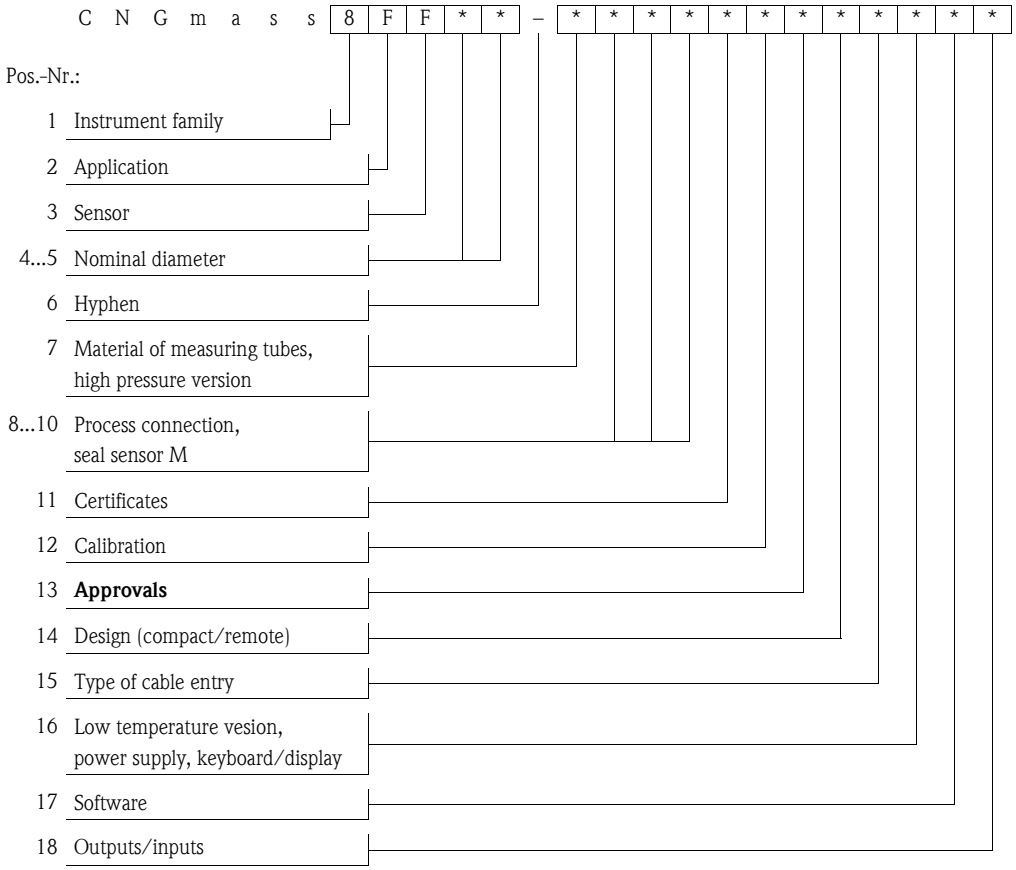


Fig. 2: Nameplate data for the sensor (example)

1 *Sensor type*
2 *Order code/ Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits*
3 *Process connection*
4 *Flow calibration factor*
5 *Maximum process pressure*
6 *Materials*
7 *Process temperature range*
8 *Reserved for information on special products*
9 *Space for marking of class, division and group*
10 *Permitted ambient temperature*
11 *Associated Ex documentation*
12 *C-Tick symbol*
13 *Label of the inspection authority: FM APPROVALS and CANADIAN STANDARDS ASSOCIATION*
14 *Approval number*
15 *Degree of protection*
16 *Additional information: with 5-point calibration*
17 *Year of manufacture*
18 *Production site*

Type code

The type code describes the exact design and the equipment of the measuring system.
It can be read on the nameplate of the transmitter and sensor and is structured as follows:



Approvals (Item No. 13 in type code)

*	Approval	Sensor	
N	Cl. I, Div. 1, Group ABCD	CNGmass	DN 08 (3/8"), DN 15 (½"), DN 25 (1")

✎ Note!
A detailed explanation of these values with regard to the outputs and inputs available, as well as a description of the associated terminal assignment and connection data can be found as of Page 10.

Temperature table

Max. medium temperature [°F] for T1-T5 in relation to the maximum ambient temperature T_a.

	DN	T_a (°F)	T6 (185 °F)	T5 (212 °F)	T4 (275 °F)	T3 (392 °F)	T2 (572 °F)	T1 (842 °F)
8FF**-***…	08 (3/8"), 15 (½"), 25 (1")	122	–	203	257	257	257	257
	08 (3/8"), 15 (½")	140	–	194	257	257	257	257
	25 (1")		–	203	257	257	257	257

The minimum **medium temperature** is –58 °F for CNGmass.

The minimum **ambient temperature** T_a for CNGmass is –40 °F.

Design of measuring system

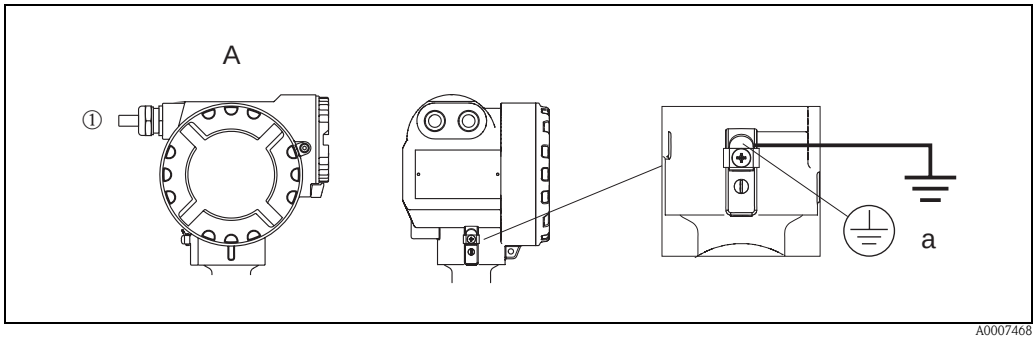


Fig. 3: Design of the measuring system

A Transmitter housing (compact version)
a Screw terminal for connecting to the potential equalization
① see following chapter "Cable entries"

Cable entries

① Cable entries for transmitter terminal compartment (XP version) power supply/communication cable. Choice of thread for cable entry: ½" NPT.

Make sure that the XP cable glands/entries are secured to prevent working loose.

Potential equalization

The transmitter must be safely integrated into the potential equalization via the screw terminal on the outside of the transmitter housing. Alternatively, the transmitter can be integrated into the potential equalization via the pipeline as long as the pipeline provides a ground connection conforming to regulations.

✎ Note!
Further information about potential equalization, screening and grounding can be found in the associated Operating Instructions.

Potential equalization for fieldbus versions, when both sides of the screen are grounded

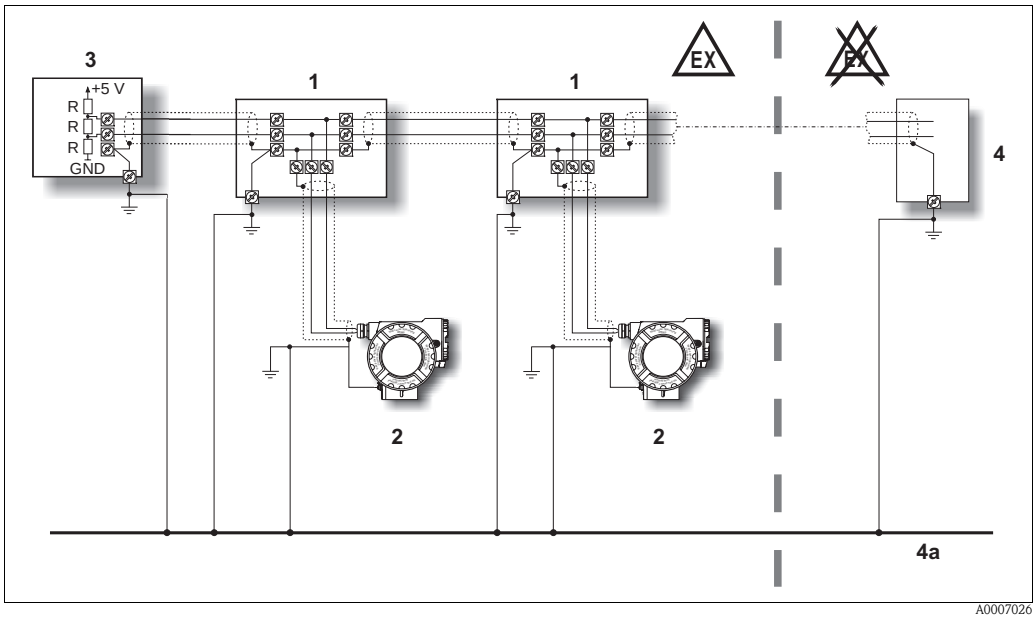


Fig. 4: Example for connecting potential equalization lines

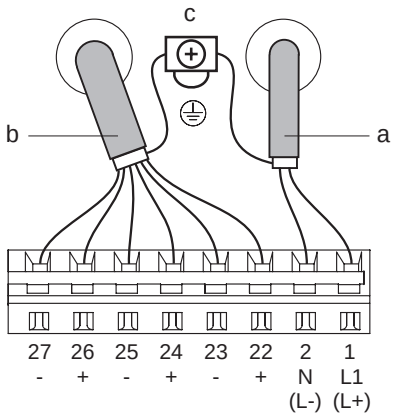
1 Distributor/T-Box
2 Bus devices for potentially explosive atmospheres
3 Bus termination MODBUS RS485
4 Bus power supply unit or automation system
4a Potential equalization line is fed out into the safe area

✎ Note!
The length of the spurs is to be considered.

Electrical connection

Connection compartment

Transmitter housing compact/remote version (terminal assignment, connection data → Page 9 ff.)



A0007034

a Power supply cable, terminal assignment and connection data see below)
b Signal cable/fieldbus cable (terminal assignment and connection data → Page 10)
c Ground terminal, signal cable shield / RS485 line

Terminal assignment and connection data, power supply

Terminal assignment and connection data

all transmitters	**1 L (+)**	**2 N (–)**	⏚
Designation	Supply voltage		Protective earth
Functional values	AC: U = 20 to 28 V; DC: U = 10 to 30 V Power consumption: AC: < 4 VA DC: < 3.2 W		Caution! Observe the grounding plans of the system!
Intrinsically safe circuit	no		
U_m	253 V AC		

Terminal assignment and connection data for signal circuits

✎ Note!
The following tables contain values/specifications, which are dependent on the type code (type of measuring device). Please compare the following type code to the one shown on the nameplate of your measuring device. A graphic representation of the electrical connections can be found on Page 9.

Terminal assignment

Transmitter	Terminal no. (outputs)					
	22 (+)	**23 (–)**	**24 (+)**	**25 (–)**	**26 (+)**	**27 (–)**
Non-convertible communication boards (fixed assignment)						
8FF**- *…*N	Pulse / Frequency / Status output 2		Pulse / Frequency / Status output 1		MODBUS RS485[1)] B	MODBUS RS485[1)] A

[1)] *MODBUS RS485:*
– Terminal 26 (+) → B (RxD/TxD-P)
– Terminal 27 (–) → A (RxD/TxD-N)

Safety-related and functional values of signal circuits

Signal circuits	Functional values	Safety-related values
Pulse/frequency output	galvanically isolated passive 30 V DC / 250 mA Open Collector Full scale frequency 100 to 5000 Hz	intrinsically safe = no U_m = 253 V I_m = 1 A
Status output	galvanically isolated passive 30 V DC / 250 mA Open Collector	
MODBUS RS485	galvanically isolated, RS485 as per Standard EIA/TIA-485	

Service adapter

The service adapter is only used for connecting service interfaces approved by Endress+Hauser.

⚠ Warning!
It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.

Technical Data

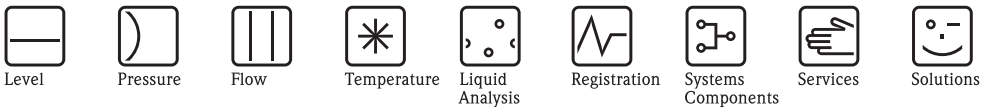
Dimensions

The dimensions of the instruments for the hazardous area correspond to those in the Technical Information documentation.

Weight

The weight of the Ex d version is equivalent to the weight in the Technical Information documentation.

✎ Note!
Technical Information for CNGmass → TI077D



Safety Instructions

CNGmass

MODBUS RS485

Division 1

Ex documentation

This document is an integral part of the following Operating Instructions:

- BA123D, CNGmass MODBUS RS485

Table of Contents CSA

XA116D/06/en/04.10
71112171

Endress+Hauser
People for Process Automation

Special conditions

- Install per Canadian Electrical Code.
- Control room equipment shall not use or generate more than 250 V rms.
- The device must be integrated into the potential equalization system.
- For terminals No. 22 to No. 27 of the transmitter, only devices with ratings $U_m \leq 250$ V and $I_m \leq 1$ A are allowed to be connected.
- The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 15.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Use of the devices is restricted to mediums against which the process-wetted materials are adequately resistant.
- Use supply wires suitable for 5 °C above ambient temperature, but least for 80 °C.
- Transmitter enclosure explosionproof for use in Class 1 Division 1 Groups A, B, C, D (factory sealed, conduit seal not required) and dust-ignition proof for Class II, III Division 1 Groups E, F, G.
- Sensor circuits are intrinsically safe for Cl. I, Div. 1, Group A, B, C, D.
  Sensor enclosure is dust ignition proof for Cl. II, III, Div. 1, Group E, F, G.
- Substitution of components may impair intrinsic safety.
- CNGmass is a dual seal related device.
- All ratings of the flow meter (see also nameplate) have to be respected.

☝ Caution!
- Use supply wires suitable for 5 °C above ambient temperature, but at least for 80 °C.

General warnings

- Installation, connection to the electricity supply, commissioning and maintenance of the devices must be carried out by qualified specialists trained to work on Ex-rated devices.
- Transmitter housing and cable entries have to be sealed tight.
- Open device only when disconnected or when atmosphere is known to be non-hazardous. Make sure, that no dust /humidity enters the enclosure when opened.
- A worm screw prevents undesired movement of the transmitter housing (please refer to the operating manual). When released the transmitter housing can be rotated contiously until an internal retaining ring comes to a stop. The worm screw has to be retightend once the housing has been rotated.
- If the transmitter and sensor have to be separated (e. g. for the purpose of repair), the retaining ring can be destroyed if considerable force is applied. In such a case, a new genuine Endress+Hauser retaining ring must be installed when reassembling. The worm screw has to be retightend.

Approvals

General

The system meets the fundamental health and safety requirements for the design and construction of devices and protective systems intended for use in potentially explosive atmospheres in accordance with the Canadian Electrical Code.

No. / approval type

160686

Notified body

CSA: Canadian Standard Association

Identification

The identification of the system must contain the following specifications:

- Class I, Groups ABCD
- Class I, Zone 1, Group IIC
- Class II, Groups EFG
- Class III

or

- Class I, Groups CD
- Class I, Zone 1, Group IIB
- Class II, Groups EFG
- Class III

☝ Caution!
The installation instructions for the safe use of the system must be observed → Page 12 .

Description of measuring system

The measuring system consists of a compact version:
transmitters and sensors form a mechanical unit.

Nameplate

The nameplates, which are mounted in a clearly visible position on the transmitter and sensor, contain all of the relevant information about the measuring system.

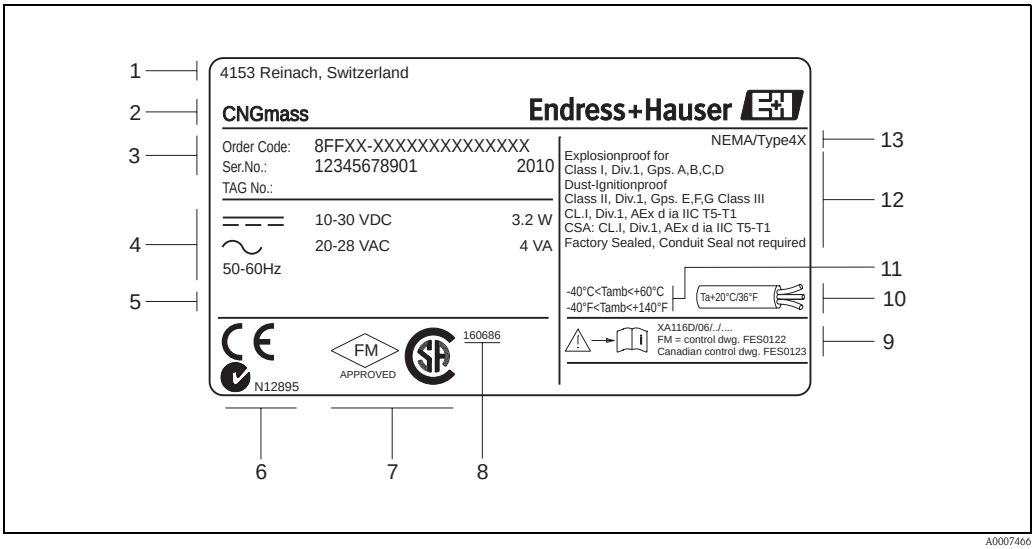


Fig. 1: Nameplate data for the transmitter (example)

1 *Production site*
2 *Type of device*
3 *Order code/ Serial number/ Year of manufacture: See the specifications on the order confirmation for the meanings of the individual letters and digits*
4 *Power supply / Frequency / Power consumption*
5 *Reserved for information on special products*
6 *C-Tick symbol*
7 *Label of the inspection authority: FM APPROVALS and CANADIAN STANDARDS ASSOCIATION*
8 *Approval number*
9 *Associated Ex documentation*
10 *Cable temperature*
11 *Permitted ambient temperature*
12 *Space for marking of class, division and group*
13 *Degree of protection*

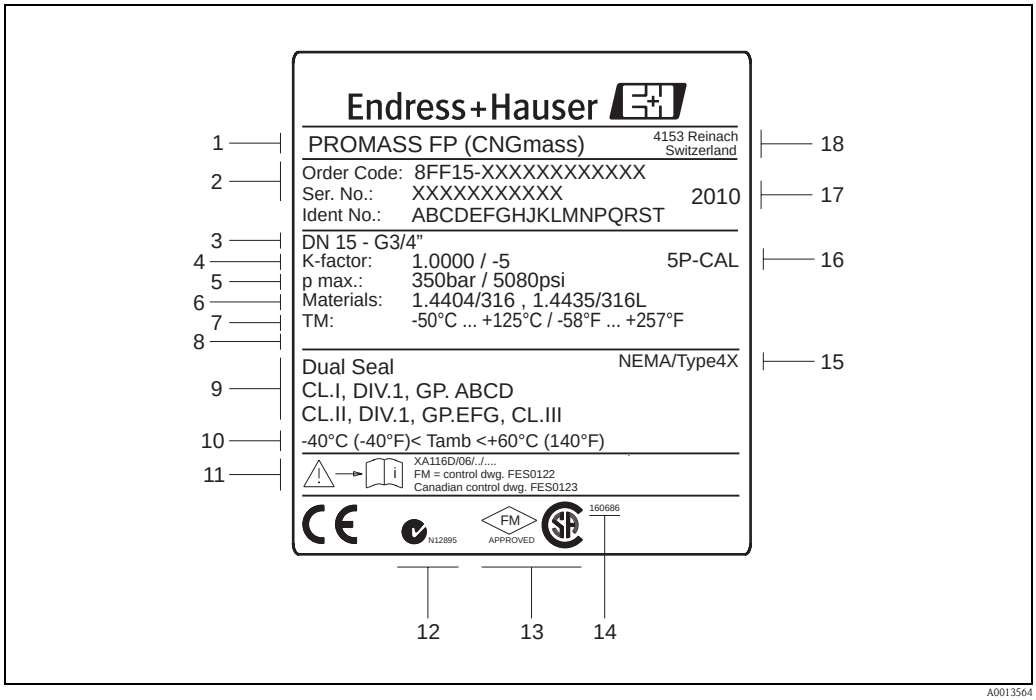
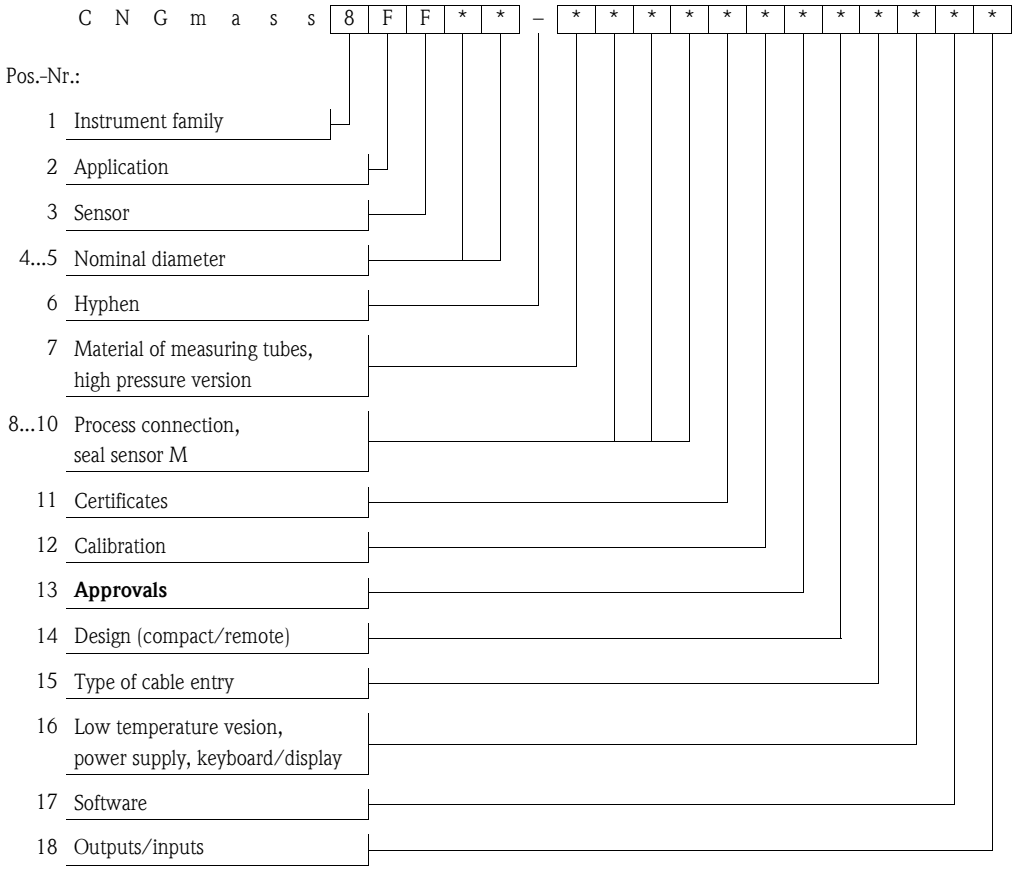


Fig. 2: Nameplate data for the sensor (example)

1 *Sensor type*
2 *Order code/ Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits*
3 *Process connection*
4 *Flow calibration factor*
5 *Maximum process pressure*
6 *Materials*
7 *Process temperature range*
8 *Reserved for information on special products*
9 *Space for marking of class, division and group*
10 *Permitted ambient temperature*
11 *Associated Ex documentation*
12 *C-Tick symbol*
13 *Label of the inspection authority: FM APPROVALS and CANADIAN STANDARDS ASSOCIATION*
14 *Approval number*
15 *Degree of protection*
16 *Additional information: with 5-point calibration*
17 *Year of manufacture*
18 *Production site*

Type code

The type code describes the exact design and the equipment of the measuring system.
It can be read on the nameplate of the transmitter and sensor and is structured as follows:



Approvals (Item No. 13 in type code)

*	Approval	Sensor
N	Cl. I Div. 1 Group ABCD	CNGmass DN 08/15/25

✎ Note!
A detailed explanation of these values with regard to the outputs and inputs available, as well as a description of the associated terminal assignment and connection data can be found as of Page 18.

Temperature table compact version

Max. medium temperature [°C] for T1-T5 in relation to the maximum ambient temperature T_a.

	DN	T_a (°C)	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
8FF**-***…	08/15/25	+50	–	95	125	125	125	125
	08/15	+60	–	90	125	125	125	125
	25		–	95	125	125	125	125

The minimum **medium temperature** is –50 °C for CNGmass.

The minimum **ambient temperature** T_a for CNGmass is –40 °C.

Design of measuring system

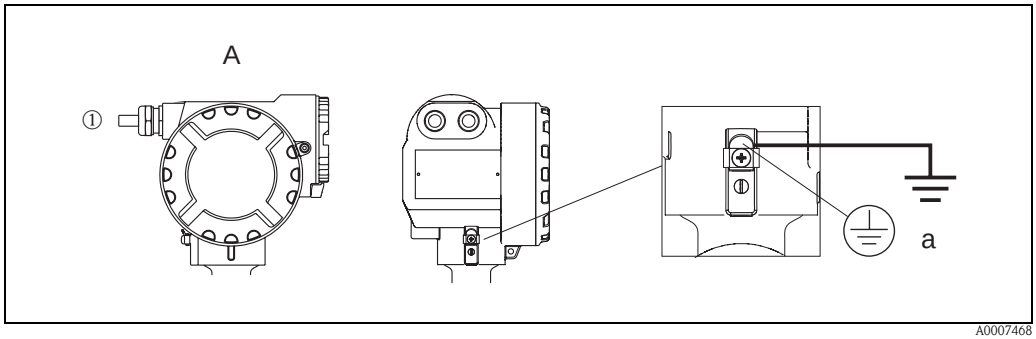


Fig. 3: Design of the measuring system

A Transmitter housing (compact version)
a Screw terminal for connecting to the potential equalization
① see following chapter "Cable entries"

Cable entries

① Cable entries for transmitter terminal compartment (XP version) power supply/communication cable. Choice of thread for cable entry: ½" NPT.

Make sure that the XP cable glands/entries are secured to prevent working loose.

Potential equalization

The transmitter must be safely integrated into the potential equalization via the screw terminal on the outside of the transmitter housing. Alternatively, the transmitter can be integrated into the potential equalization via the pipeline as long as the pipeline provides a ground connection conforming to regulations.

✎ Note!
Further information about potential equalization, screening and grounding can be found in the associated Operating Instructions.

Potential equalization for fieldbus versions, when both sides of the screen are grounded

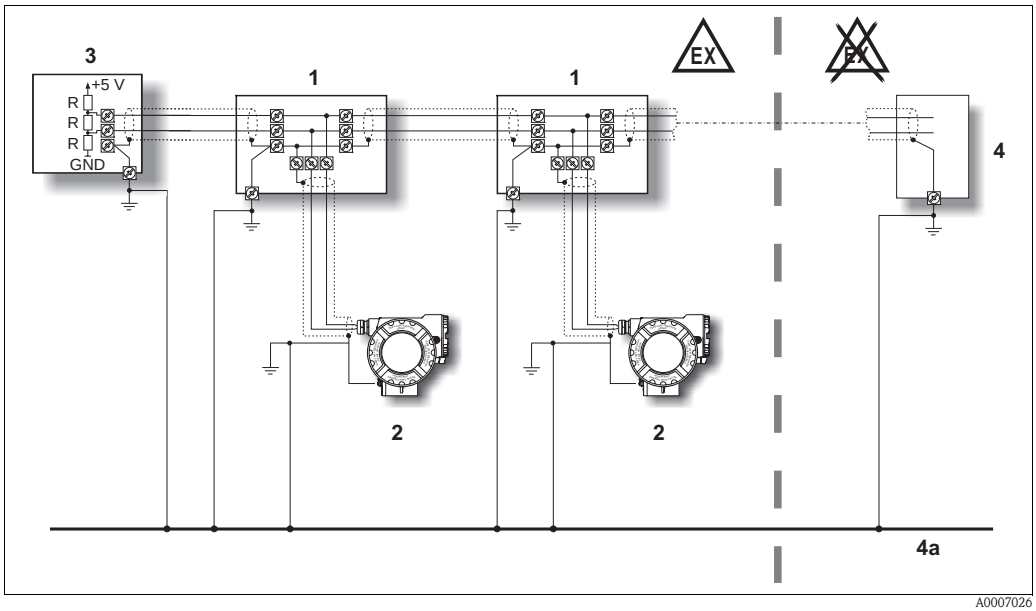


Fig. 4: Example for connecting potential equalization lines

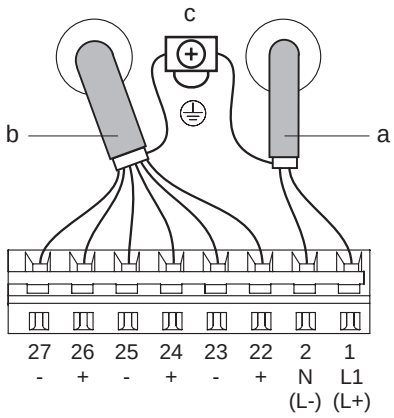
1 Distributor/T-Box
2 Bus devices for potentially explosive atmospheres
3 Bus termination MODBUS RS485
4 Bus power supply unit or automation system
4a Potential equalization line is fed out into the safe area

✎ Note!
The length of the spurs is to be considered.

Electrical connection

Connection compartment

Transmitter housing compact/remote version (terminal assignment, connection data → Page 17 ff.)



A0007034

a Power supply cable, terminal assignment and connection data see below)
b Signal cable/fieldbus cable (terminal assignment and connection data → Page 18)
c Ground terminal, signal cable shield / RS485 line

Terminal assignment and connection data, power supply

Terminal assignment and connection data

All transmitters	**1 L (+)**	**2 N (–)**	⏚
Designation	Supply voltage		Protective earth
Functional values	AC: U = 20 to 28 V; DC: U = 10 to 30 V Power consumption: AC: < 4 VA DC: < 3.2 W		Caution! Observe the grounding plans of the system!
Intrinsically safe circuit	no		
U_m	253 V AC		

Terminal assignment and connection data for signal circuits

✎ Note!
The following tables contain values/specifications, which are dependent on the type code (type of measuring device). Please compare the following type code to the one shown on the nameplate of your measuring device. A graphic representation of the electrical connections can be found on Page 17.

Terminal assignment

Transmitter	Terminal no. (outputs)					
	22 (+)	**23 (–)**	**24 (+)**	**25 (–)**	**26 (+)**	**27 (–)**
Non-convertible communication boards (fixed assignment)						
8FF**- *…*N	Pulse / Frequency / Status output 2		Pulse / Frequency / Status output 1		MODBUS RS485[1)] B	MODBUS RS485[1)] A

[1)] *MODBUS RS485:*
– Terminal 26 (+) → B (RxD/TxD-P)
– Terminal 27 (–) → A (RxD/TxD-N)

Safety-related and functional values of signal circuits

Signal circuits	Functional values	Safety-related values
Pulse/frequency output	galvanically isolated passive 30 V DC / 250 mA Open Collector Full scale frequency 100 to 5000 Hz	intrinsically safe = no U_m = 253 V I_m = 1 A
Status output	galvanically isolated passive 30 V DC / 250 mA Open Collector	
MODBUS RS485	galvanically isolated, RS485 as per Standard EIA/TIA-485	

Service adapter

The service adapter is only used for connecting service interfaces approved by Endress+Hauser.

⚠ Warning!
It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.

Technical Data

Dimensions

The dimensions of the instruments for the hazardous area correspond to those in the Technical Information documentation.

Weight

The weight of the Ex d version is equivalent to the weight in the Technical Information documentation.

✎ Note!
Technical Information for CNGmass → TI077D

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

XA116D/06/en/04.10
71112171
FM+SGML 6.0