Safety Instructions

Cubemass DCI

NEPSI Zone 1, Zone 21

This document is an integral part of the following Operating Instructions:
- BA00139D, Cubemass DCI
- BA00141D, Cubemass DCI Modbus RS485

Contents

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General warnings

- For installation, use and maintenance of the flow meter, the instruction manual and the following standards shall be observed:
  - GB50257-1996 "Code for construction and acceptance of electric device for explosive atmospheres and fire hazard electrical equipment installation engineering"
  - GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres – Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres"
  - GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres – Part 15: Electrical installations in hazardous area (other than mines)"
  - GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres – Part 16: Inspection and maintenance of electrical installation (other than mines)"
  - GB15577-2007: "Safety regulations for dust explosion prevention and protection" (Only if installed in dust hazardous areas.)
  - GB12476.2-2006 "Electrical apparatus for use in the presence combustible dust – Part 1-2: Electrical apparatus protected by enclosures and surface temperature limitation – Section. Installation and maintenance" (Only if installed in dust hazardous areas.)
- Any maintenance shall be done after power off or the area known to be non-hazardous.
- The flow meter shall not be modified in order to ensure the explosion protection performance of the equipment. Any change may impair safety.
- 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.
- Compliance with all of the technical data of the device (see nameplate) is mandatory.
- Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply) or in non-hazardous (classified) locations.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Opening the transmitter housing and the connection housing of the remote version is only permitted for a brief time. During this time, ensure that no dust or water enters the housing.
- To guarantee resistance to dust and water, the transmitter housing, the connection housing of the remote version and the cable entries must be tightly sealed.
- Use of the devices is restricted to mediums against which the process-wetted materials are adequately resistant.
- The suitability of the device in the event of simultaneous occurrence of gas-air and dust-air mixtures requires an additional assessment.

Special conditions

The device must be integrated into the potential equalization system. Potential must be equalized along the intrinsically safe sensor circuits.
Further information is provided in the "Potential equalization" section: → 8.

Installation instructions

- For terminals No. 20 to No. 27 of the transmitter, only devices with ratings $U_m \leq 260$ V and $I_m \leq 500$ mA are allowed to be connected (does not apply to intrinsically safe circuits).
- The measuring device must only be used in the permitted temperature class.
  The values of the individual temperature classes can be found in the temperature tables: → 6.
- The following applies when using the terminal compartment in type of protection "flameproof/Ex d":
  Only cable entries and cable glands, which are approved by NEPSI in accordance with GB3836.1-2010 and GB3836.2-2010 and which are suitable for an operating temperature of up to 80 °C, they shall be used.
- The following applies when using the terminal compartment in type of protection "increased safety/Ex e":
  Only cable entries, cable glands and blanking plugs, which are approved by NEPSI in accordance with GB3836.1-2010 and GB3836.3-2010 and which are suitable for an operating temperature of up to 80 °C and for an ingress protection of IP 67, they shall be used. The cables must be installed in such a way, that they are fixed in place in order to ensure adequate strain relief.
- Suitable cables and suitable, certified cable glands, cable entries and blanking plugs must be used for measuring devices operated at temperatures below −20 °C.
- The cable entries and openings not used must be sealed tight with suitable components.

- If the active intrinsically safe communication circuits (input/output option F, G, R, S, T, U; terminals 26/27 resp. 24/25) are fed into areas that require 1D or 2D apparatus, the connected apparatus must be tested and certified accordingly.

Caution!
The explosion group for the measuring device can be IIC. However, it is reduced to IIB if the permitted, external capacitance/inductance for the intrinsically safe communication circuits is increased: → 10.

- Turning the local display:
  the screw cap has to be removed before the local display can be turned, and this must be done with the device de-energized (and after a delay of at least 10 minutes following shutdown of the power supply) or when the area is known to be non-hazardous.

Turning the transmitter housing

1. Unscrew the grub screw.
2. Rotate the transmitter housing cautiously clockwise until the end stop (end of the thread).
3. Rotate the transmitter housing counter-clockwise (max. 360°) in the wanted position.
4. Tighten the grub screw again.

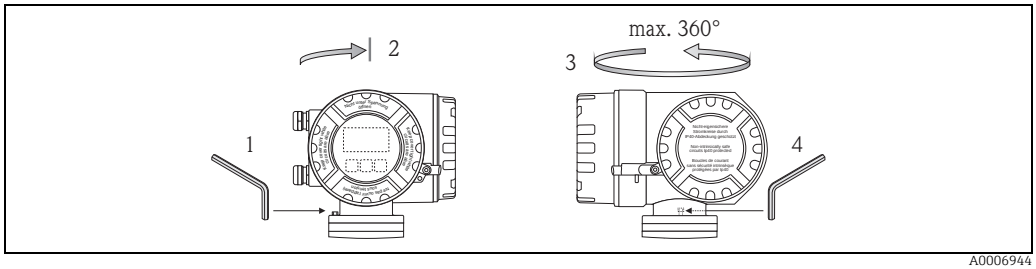

Fig. 1: Turning the transmitter housing

COC certificates of conformity

COC certificates of conformity

By affixing the certification number the product conforms with the following standards:

- GB3836.1~4 - 2010
- IEC60079-31: 2008
- IECEx61241-0: 2004
- GB12476 - 2010

Certification numbers:

- GYJ11.1569X

Inspection body

NEPSI, National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation

Description of measuring system

The measuring system consists of transmitters and sensors.

Two versions are available:

- Compact version: transmitters and sensors form a mechanical unit.
- Remote version: transmitters and sensors are installed separately and connected to each other via a connecting cable.

Nameplates

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.

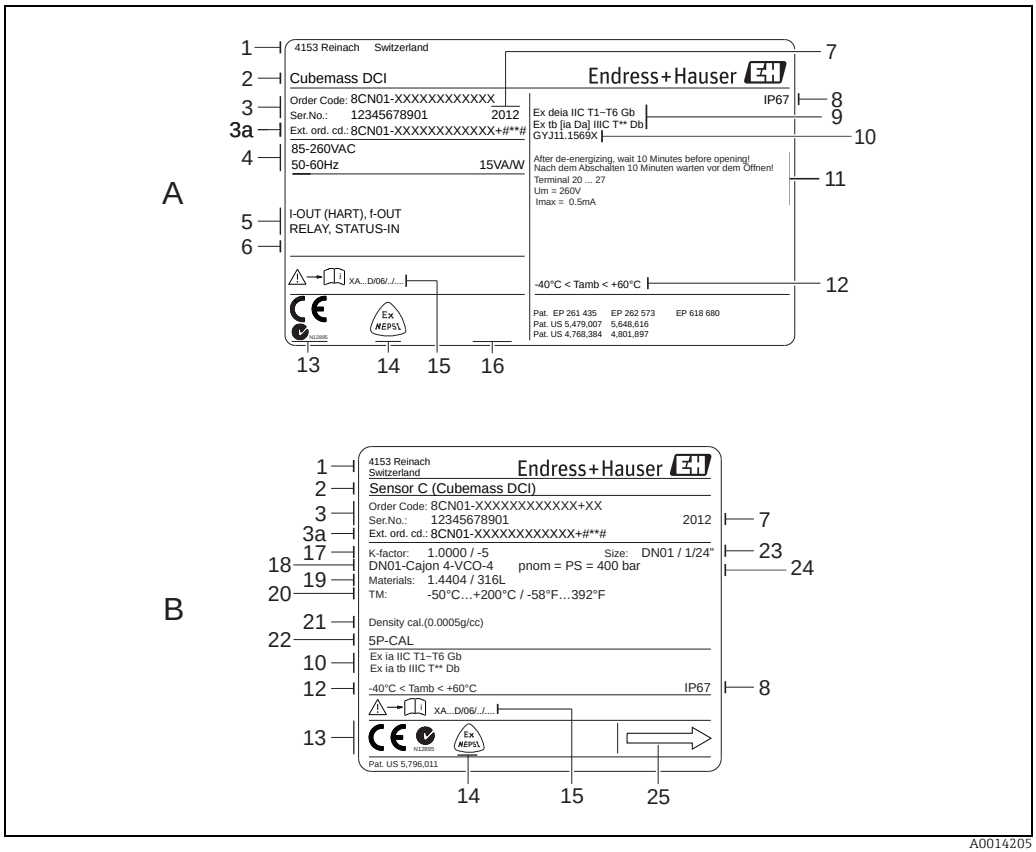

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Fig. 2: Example for nameplates of a transmitter and of a sensor compact version

A Transmitter nameplate
B Sensor nameplate

1 Production site
2 Transmitter or sensor type
3 Order code and serial number
3a Extended order code
4 Power supply, frequency and power consumption
5 Available inputs/outputs
6 Space for additional information on special products
7 Year of manufacture
8 Type of enclosure protection
9 Type of protection
10 Number of the NEPSI certificate of conformity
11 Space for notes, e.g. delays, etc. (only if necessary)
12 Ambient temperature range
13 C-Tick symbol
14 NEPSI Symbol
15 Associated Ex documentation
16 Space for other approval specifications and certificates, e.g. PROFIBUS, etc. (only if present)
17 Calibration factor/zero point
18 Nominal diameter of flange
19 Materials in contact with the medium
20 Fluid temperature range
21 Density accuracy
22 Additional information, e.g. 5P-CAL = 5-point calibration, 3.1B = 3.1 B certificate for wetted material
23 Device nominal diameter
24 Nominal pressure
25 Direction of flow

Order code

The order code is indicated on the nameplate, which is affixed to the device in such a way that it is clearly visible.
Additional information on the nameplate is provided in the associated Operating Instructions.

Structure of the order code

* * * * * _ * * * * * * * * * * * * + A B C D E F G H I J ...

Device type | Basic specifications | Optional specifications

* Placeholder: An option (number or letter) that depends on the device specification is displayed instead of the placeholders.

- Device type
  The device type section of the order code describes the device and the device construction.
- Basic specifications
  The features that are absolutely essential for the device (mandatory features) are specified in the basic specifications. The number of positions depends on the number of features available. The selected option of a feature can consist of several positions.
- Optional specifications
  The optional specifications describe additional features for the device (optional features). The number of positions depends on the number of features available. The features have a 2-digit structure to aid identification (e.g. JE). The first digit (ID) stands for the feature group (e.g. J = test, certificate) and consists of a number or a letter. The second digit constitutes the value that stands for the feature within the group (e.g. E = NACE).

More detailed information on the device is provided in the following tables. These tables describe the individual positions or IDs in the order code which are relevant to hazardous areas.

Device type

Position	Selected option	Description	
1 Instrument family	8	Coriolis flow measuring system	
2 Sensor	C	Sensor C	
3 Electronics	N	Cubemass DCI 8CN transmitter	▪ Transmitter electronics in: [Ex ia] IIC/IIB ▪ Ex d housing in Ex d IIC or Ex de IIC
4 Nominal 5 diameter	01 to 06	Nominal diameter of the sensor	

Basic specifications

Position		Selected option	Transmitter			Sensor
			Remote	Compact Ex ia	Compact non-intrinsically safe	
1 2	Approval	NH	Ex d[ia Ga] IIC T6 Gb Ex tb[ia Da] IIIC T** Db	Ex dia[ia Ga] IIC T1~T6 Gb Ex tb[ia Da] IIIC T** Db	Ex dia IIC T1~T6 Gb Ex tb IIIC T** Db	Ex ia IIC T1~T6 Gb Ex tb IIIC T** Db
		NI	Ex de[ia Ga] IIC T1~T6 Gb Ex tb[ia Da] IIIC T** Db	Ex deia[ia Ga] IIC T1~T6 Gb Ex tb[ia Da] IIIC T** Db	Ex deia IIC T1~T6 Gb Ex tb IIIC T** Db	Ex ia IIC T1~T6 Gb Ex tb IIIC T** Db

Position		Selected option	Description	
3	Inputs/ outputs	D, M, N, Q 1, 2, 7		Non-intrinsically safe outputs
		S, T		Ex ia
7	Housing	A	Compact version	Min. ambient temperature $T_{a\,min}$ = −20 °C
		1, 4		Min. ambient temperature $T_{a\,min}$ = −40 °C
		E, F	Remote version	Min. ambient temperature $T_{a\,min}$ = −20 °C
		7, 8		Min. ambient temperature $T_{a\,min}$ = −40 °C
8	Cable entry	A		Thread: M20x1.5
		B		Thread: NPT ½"
		C		Thread: G ½"

Temperature tables: Compact version

Ambient temperature

The minimum ambient temperature T_a is −20 °C.
A version for ambient temperatures T_a up to −40 °C is optionally available.

Medium temperature

The minimum medium temperature −50 °C.

Max. medium temperature [°C] for T1-T6 in relation to the maximum ambient temperature T_a

	DN [mm]	T_a [°C]	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Cubemass DCI 8CN**-...	1, 2, 4, 6	+50	50	95	130	150	200	200
		+60	–	95	130	150	200	200

Temperature table: Remote version

Ambient temperature

The remote version transmitter has a T6 temperature class rating when installed in the Ex d housing for operation at ambient temperatures up to T_a = 60 °C. The maximum ambient temperature range is −20 to +60 °C. A version for ambient temperatures T_a up to −40 °C is optionally available.

Medium temperature

The minimum medium temperature is −50 °C.

Max. medium temperature [°C] for T1-T6 in relation to the maximum ambient temperature T_a

	DN [mm]	T_a [°C]	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Cubemass DCI 8CN**-...	1, 2, 4, 6	+50	50	95	130	150	200	200
		+60	–	95	130	150	200	200

Gas and dust explosion protection

Determining the temperature class and surface temperature with the temperature table

In the case of gas: Determine the temperature class as a function of the ambient temperature T_a and the medium temperature T_m.
In the case of dust: Determine the maximum surface temperature as a function of the maximum ambient temperature T_a and the maximum medium temperature T_m.

Example of the maximum surface temperature for explosion hazards arising from dust

Device: Cubemass DCI, compact version, DN 4
Maximum ambient temperature: T_a = 60 °C
Maximum medium temperature: T_m = 98 °C

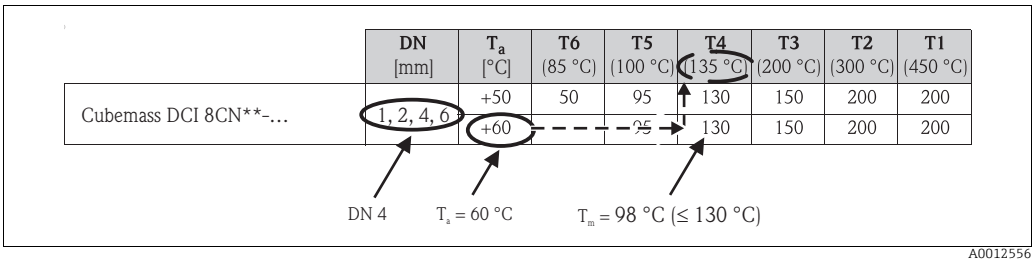

Fig. 3: Procedure for calculating the max. surface temperature

1. Select the device (Cubemass DCI), nominal diameter (DN 4) and ambient temperature T_a (60 °C) in the associated temperature table (compact version).

The row showing the maximum medium temperature is determined.

2. Select the maximum medium temperature T_m (98 °C), which is smaller than or equal to the maximum medium temperature of a cell.

The column with the temperature class for gas is determined (98 °C ≤ 130 °C → T4).

3. The maximum temperature of the temperature class determined corresponds to the maximum surface temperature: T4 = 135 °C = maximum surface temperature for dust.

Design of measuring system

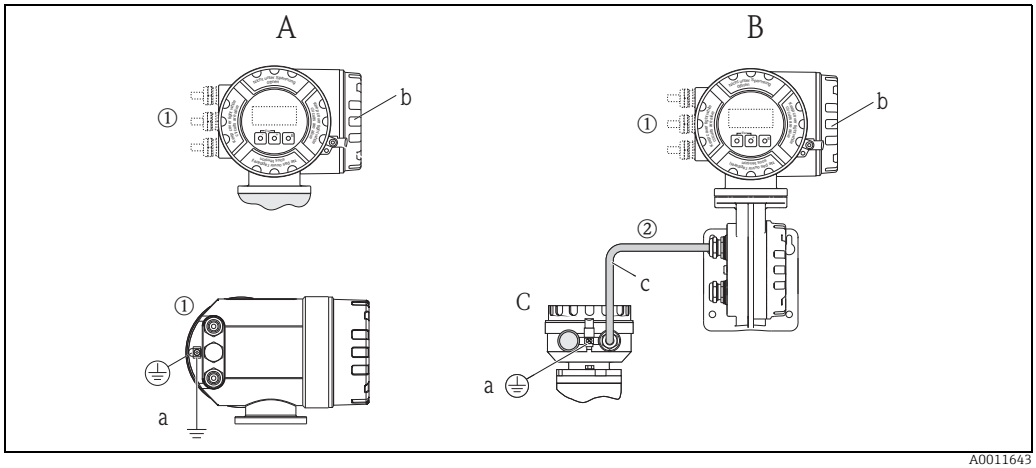

Fig. 4: Design of the measuring system, compact/ remote version

A Transmitter housing (compact version)
B Transmitter housing on connection housing, remote version
C Sensor connection housing, remote version

a Screw terminal for connecting to the potential equalization
b Connection compartment cover
c Connecting cable remote version
① and ② see following section "Cable entries"

✎ Note!
Connection of remote version connecting cable → 9

Cable entries

- ① for connection compartment (Ex d version): power supply cable and cable of the communication circuit → Choice of thread for cable entries M20 × 1.5, ½" NPT or G ½".

  Make sure that the Ex d cable glands/entries are secured to prevent working loose and that the seals are installed immediately adjacent to the housing.
- ① for connection compartment (Ex e version): power supply cable and cable of the communication circuit → Choice of cable gland M20 × 1.5 or thread for cable entries ½" NPT or G ½".
  The cables must be installed such that they are fixed in place. Adequate strain relief must be ensured.
- ② for remote version connecting cable:
  → Choice of cable gland M20 × 1.5 or thread for cable entries ½" NPT or G ½"

⚠ Warning!
The leak-tight of the cable glands and cable entries is to ensure.

Cable specification

You can find information about the cable specification in the associated Operating Instructions.

Potential equalization

- The transmitter (compact and remote version) is to be securely connected to the potential equalization system using the screw terminal on the outside of the transmitter housing. Alternatively, the transmitter of the compact version as of serial number 4Axxxxxx000 can be connected to the potential equalization system via the pipeline if a ground connection via the pipeline according to regulations can be assured.
- When using the remote version, the connection housing of the sensor must be grounded via the external screw terminal. Alternatively, the sensor 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, shielding and grounding can be found in the associated Operating Instructions.

Potential equalization with shield grounded at both sides for fieldbus version

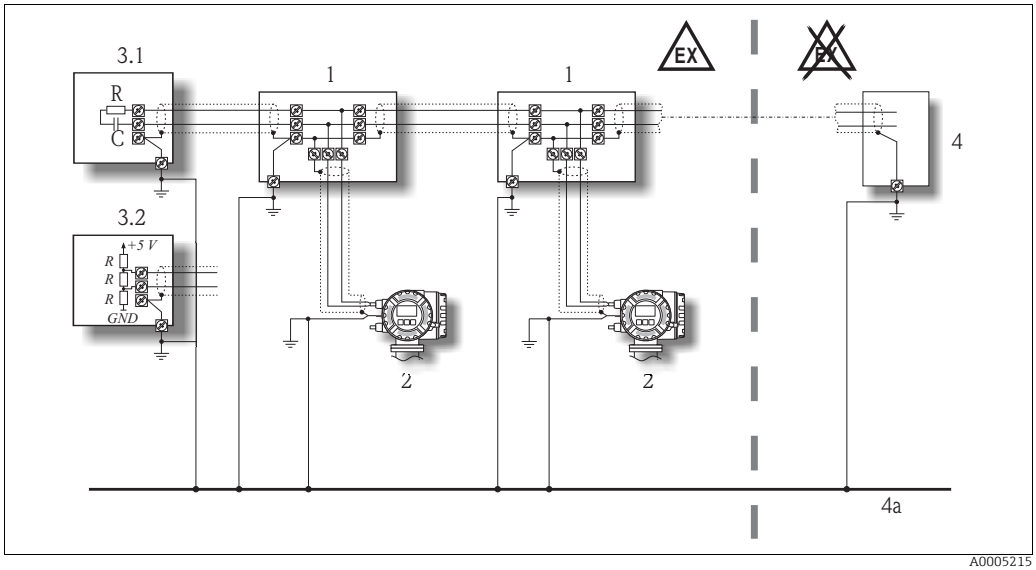

Fig. 5: Example for connecting potential equalization lines

1 Distributor/ T-Box
2 Bus devices for potentially explosive atmospheres
3.2 Bus terminator Modbus RS485
4 Bus supply unit or automation system
4 Potential equalization line is fed out into the safe area

✎ Note!
The length of the spur must be observed.

Connection of remote version connecting cable

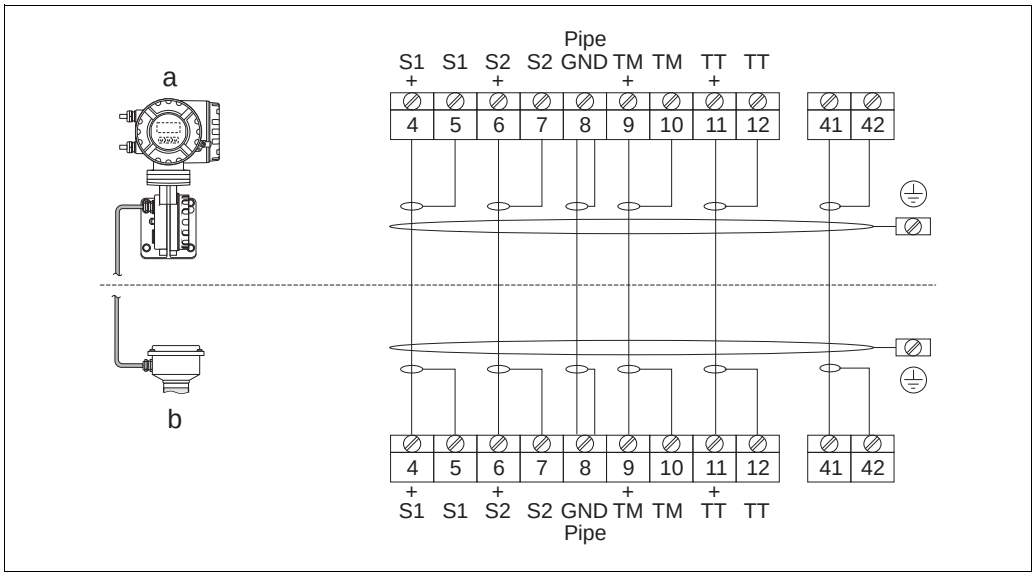

Fig. 6: Connection of remote version connecting cable

A Wall-mount housing: NEPSI Zone 1

B Remote version, flanged version

Wire colors (colour code according to DIN 47100):
Terminal No.: 4/5 = gray; 6/7 = green; 8 = yellow; 9/10 = pink; 11/12 = white; 41/42 = brown

Terminal assignment and connection data

The connection of the remote version, between the sensor and the transmitter, has Ex i explosion protection.
The maximum cable length between transmitter and sensor must not exceed 120 m.

Caution!
Only preterminated connecting cables supplied by Endress+Hauser may be used.

Electrical connection

Connection compartment

Transmitter housing compact/ remote version (terminal assignment, connection data → 10 ff.)

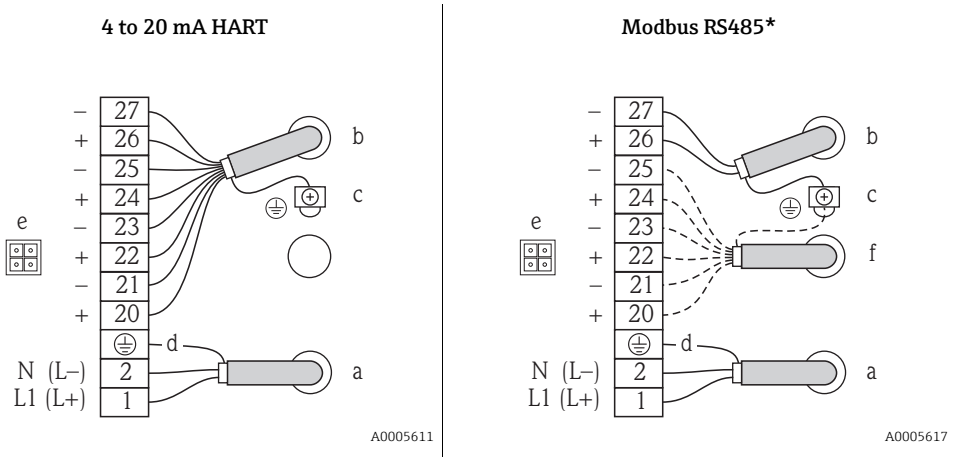

Fig. 7: Electrical connections

**) Flexible communication board*
a Power supply cable (terminal assignment and connection data → 10)
b Ground terminal for protective ground
c Signal cable/ fieldbus cable (terminal assignment and connection data → 10)
d Ground terminal for signal cable shield / fieldbus cable / RS485 line
e Service adapter for connecting service interface FXA 193 (Fieldcheck, FieldCare)
f Signal cable

Terminal assignment and connection data, power supply

All transmitters	1 L (+)	2 N (–)	⏚
Designation	Supply voltage		Protective earth
Functional values	AC: U = 85 to 260 V AC: U = 20 to 55 V DC: U = 16 to 62 V Power consumption: 15 VA / 15 W		Caution! Observe the grounding concepts of the system!
Intrinsically safe circuit	no		
U_m	260 V AC		

Terminal assignment and connection data for signal circuits (intrinsically safe 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. For a graphic representation of the electrical connections: → 🖹 9.

Terminal assignment for Cubemass DCI 8CN transmitter; basic specifications position 3 (inputs/outputs) = S+##**

Terminal assignment	Terminal No.							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		Pulse/frequency output, passive		Current output HART, active	
Electric circuit	–		–		Ex ia		Ex ia	
Safety-related values	–		–		U_i 30 V DC I_i 500 mA P_i 600 mW L_i negligible C_i 6 nF		U_o 21.8 V DC I_o 90 mA P_o 491 mW L_o IIC/IIB 4.1 mH/15 mH C_o IIC/IIB 160 nF/1160 nF [1] L_o IIC/IIB 2 mH/10 mH [1] C_o IIC/IIB 80 nF/300 nF U_i 30 V DC [2] I_i 10 mA [2] P_i 0.3 W [2] L_i negligible C_i 6 nF	
Functional values	–		–		galvanically isolated, passive: 30 V DC / 250 mA Open Collector Full scale frequency 2 to 5000 Hz		galvanically isolated, active: 0/4 to 20 mA R_L < 400 Ω R_L HART ≥ 250 Ω	

[1]) Permitted values in the event of simultaneous occurrence of concentrated inductances and capacitances.
[2]) The interconnection must be assessed according to the valid construction provisions.

Terminal assignment for Cubemass DCI 8CN transmitter; basic specifications position 3 (inputs/outputs) = T+##**

Terminal assignment	Terminal No.							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		Pulse/frequency output, passive		Current output HART, passive	
Electric circuit	–		–		Ex ia		Ex ia	
Safety-related values	–		–		U_i 30 V DC I_i 500 mA P_i 600 mW L_i negligible C_i 6 nF		U_i 30 V DC I_i 100 mA P_i 1.25 W L_i negligible C_i 6 nF	
Functional values	–		–		galvanically isolated, passive: 30 V DC / 250 mA Open Collector Full scale frequency 2 to 5000 Hz		galvanically isolated, passive: 4 to 20 mA voltage drop ≤ 9 V $R_L < [(V_{p.\ supply} - 9\ V) \div 25\ mA]$	

Terminal assignment and connection data for signal circuits (non-intrinsically safe 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. For a graphic representation of the electrical connections: → 9.

Terminal assignment for Cubemass DCI 8CN

Safety-related and functional values of signal circuits → 12

Order characteristic "Inputs/outputs" Basic specifications position 3	Terminal No. 20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Non-convertible communication boards (fixed assignment)								
Q	–		–		Status input		Modbus RS485 [1] B	A
Convertible communication boards								
D	Status input		Relay output		Pulse/frequency output		Current output HART	
M	Status input		Pulse/frequency output 2		Pulse/frequency output 1		Current output HART	
N	Current output		Pulse/frequency output		Status input		Modbus RS485 [1] B	A
1	Relay output		Pulse/frequency output 2		Pulse/frequency output 1		Current output HART	
2	Relay output		Current output 2		Pulse/frequency output		Current output 1 HART	
7	Relay output 2		Relay output 1		Status input		Modbus RS485 [1] B	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
Current output HART Current output	Galvanically isolated, active/passive can be selected: ▪ Active: 0/ 4 to 20 mA, R_L < 700 Ω, R_L HART ≥ 250 Ω ▪ Passive: 4 to 20 mA, V_s = 18 to 30 V DC, R_i ≥ 150 Ω	intrinsically safe = no U_m = 260 V I_m = 500 mA
	Galvanically isolated, active/passive can be selected: ▪ Active: 0/4 to 20 mA, R_L < 700 Ω ▪ Passive: 4 to 20 mA, V_s = 18 to 30 V DC, R_i ≥ 150 Ω	
Pulse/frequency output	Galvanically isolated, active/passive can be selected: ▪ Active: 24 V DC / 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω ▪ Passive: 30 V DC / 250 mA, open collector End frequency 2 to 10 000 Hz (f_{max} = 12 500 Hz)	
Relay output	galvanically isolated, max. 30 V AC / 500 mA max. 60 V DC / 100 mA	
Current input	Galvanically isolated, active/passive can be selected: ▪ Active: 4 to 20 mA, R_i ≤ 150 Ω, U_{out} = 24 V DC, short-circuit proof ▪ Passive: 0/4 to 20 mA, R_i < 150 Ω, U_{max} = 30 V DC	
Status input	*Basic specifications, position 10 (inputs/outputs) = D, M* Galvanically isolated, 3 to 30 V DC, R_i = 5 kΩ *Basic specifications, position 10 (inputs/outputs) = N, Q, 7* Galvanically isolated, polarity-independent, 3 to 30 V DC, R_i = 3 kΩ	
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.

Device fuse

⚠ Warning!
Use only fuses of the following types; the fuses are installed on the power supply board:

- Voltage 20 to 55 V AC / 16 to 62 V DC:
  fuse 2.0 A slow-blow, disconnect capacity 1500 A
  (Schurter, 0001.2503 or Wickmann, Standard Type 181 2.0 A)
- Voltage 85 to 260 V AC:
  fuse 0.8 A slow-blow, disconnect capacity 1500 A
  (Schurter, 0001.2507 or Wickmann, Standard Type 181 0.8 A)

Technical Data

Dimensions

Please refer to the respective Technical Information → TI00099D

Weight

The weight of the Ex d version is approx. 2 kg greater than that of the standard version.

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