DR2000 Supplementary instructions

Guided Radar (TDR) Level Meter for 2-wire control systems

Supplementary Instructions for ATEX applications

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1 General safety information 4

1.1 Scope of the document ... 4
1.2 Device description ... 4
1.3 Standards and approvals ... 4
1.4 Device categories ... 5
1.4.1 Ex ia-approved devices ... 5
1.4.2 Ex d ia / Ex ia tb-approved devices ... 5
1.4.3 Ex ic-approved devices ... 5
1.5 ATEX nameplates ... 6

2 Installation 11

2.1 Precautions ... 11
2.1.1 General notes ... 11
2.1.2 Electrostatic discharge ... 11
2.2 Operating conditions ... 12
2.2.1 Ambient and flange temperature ... 12
2.2.2 Maximum surface temperature of the housing for dust applications ... 18
2.2.3 Process pressure ... 18

3 Electrical connections 19

3.1 General notes ... 19
3.2 Terminal compartment ... 19
3.2.1 How to open the terminal compartment ... 19
3.2.2 How to close the terminal compartment ... 20
3.3 Terminal tightening capacity ... 21
3.4 Equipotential bonding system ... 21
3.5 Ex ia equipment ... 22
3.5.1 How to connect the electrical cables ... 22
3.5.2 Maximum intrinsically-safe values for the electrical circuit ... 22
3.5.3 Supply voltage ... 22
3.5.4 Electrical schematic ... 23
3.6 Ex d ia / Ex ia tb equipment ... 24
3.6.1 General notes ... 24
3.6.2 How to connect the electrical cables ... 25
3.6.3 Supply voltage ... 25
3.6.4 Electrical schematic ... 25
3.7 Ex ic equipment ... 27
3.7.1 How to connect the electrical cables ... 27
3.7.2 Maximum intrinsically-safe values for the electrical circuit ... 27
3.7.3 Supply voltage ... 27
3.7.4 Electrical schematic ... 28

4 Start-up 29

5 Service 30

5.1 Periodic maintenance 30
5.2 Keep the device clean 30
5.3 Returning the device to the manufacturer 30
5.3.1 General information 30
5.3.2 Form (for copying) to accompany a returned device 31

1.1 Scope of the document

These instructions are applicable only to the explosion-protection version of the TDR level transmitter. For all other data, use the Quick Start and Handbook. If you do not have these documents, please contact the nearest office or download them from the manufacturer's internet site.

INFORMATION!
The information in these supplementary instructions only contains the data applicable to explosion protection. The technical data for the non-Ex version in the Handbook shall be valid in its current version, provided that it is not rendered invalid or replaced by these supplementary instructions.

WARNING!
Installation, commissioning and maintenance may only be carried out by "Personnel trained in explosion protection".

1.2 Device description

This device is a 2-wire level transmitter that uses TDR (Time Domain Reflectometry) / Guided Radar technology. It measures the level, distance, volume and mass of liquids, liquid gases, pastes, powders, slurries and granular products. Measurements are displayed via a DTM (device type manager) for remote communication or an optional integrated display screen with wizard-driven setup and online help functions.

The level transmitter is approved for use in potentially explosive atmospheres when equipped with the appropriate options.

1.3 Standards and approvals

DANGER!
In compliance with European Directive 94/9/EC (ATEX 100a), the ATEX version of the device described in these Supplementary Instructions agrees with European Standards EN 60079-0:2009, EN 60079-1:2007, EN 60079-11:2012, EN 60079-26:2007, EN 61241-11:2006 and EN 60079-31:2009. The Ex ia and Ex d ia / Ex ia tb versions are certified for use in hazardous areas by the DEKRA Certification B.V. under the EC-Type Examination Certificate DEKRA 13ATEX0175 X. The Ex ic version is certified for use in hazardous areas by the DEKRA Certification B.V. under the Type Examination Certificate DEKRA 13ATEX0177 X.

WARNING!
Carefully read the ATEX approval certificate. Obey the boundary conditions.

1.4 Device categories

1.4.1 Ex ia-approved devices

The Ex ia-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Gas Groups IIA, IIB and IIC. It is certified for applications requiring Category 1/2 G (gases, vapours or mists) and EPL Ga/Gb equipment or 2 G and EPL Gb equipment when fitted with the appropriate options.

The Ex ia-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Dust Groups IIIA, IIIB and IIIC. It is certified for applications requiring Category 1/2 D (dust) and EPL Da/Db equipment or 2 D and EPL Db equipment when fitted with the appropriate options.

1.4.2 Ex d ia / Ex ia tb-approved devices

The Ex d ia-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Gas Groups IIA, IIB and IIC. It is certified for applications requiring Category 1/2 G (gases, vapours or mists) and EPL Ga/Gb equipment or 2 G and EPL Gb equipment when fitted with the appropriate options.

The Ex ia tb-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Dust Group IIIA, IIIB and IIIC. It is certified for applications requiring Category 1/2 D (dust) and EPL Da/Db equipment or 2 D and EPL Db equipment when fitted with the appropriate options.

1.4.3 Ex ic-approved devices

The Ex ic-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Gas Groups IIA, IIB and IIC. It is certified for applications requiring Category 3 G (gases, vapours or mists) and EPL Gc equipment when fitted with the appropriate options.

The Ex ic-approved device is suitable for use in potentially explosive atmospheres of all flammable substances in Dust Group IIIA, IIIB and IIIC. It is certified for applications requiring Category 3 D (dust) and EPL Dc equipment when fitted with the appropriate options.

1.5 ATEX nameplates

Compact version

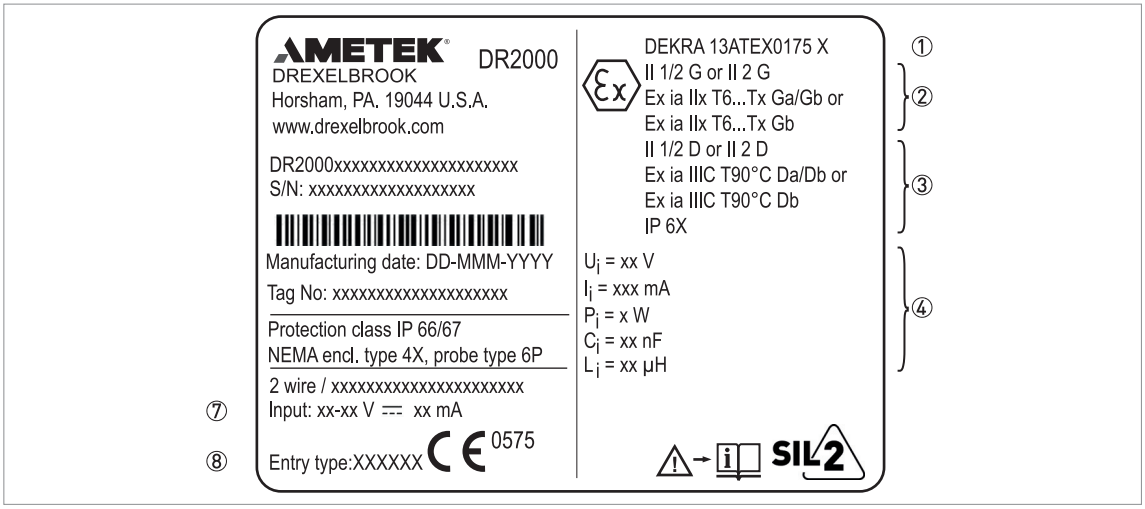

Figure 1-1: Compact version, Ex ia nameplate

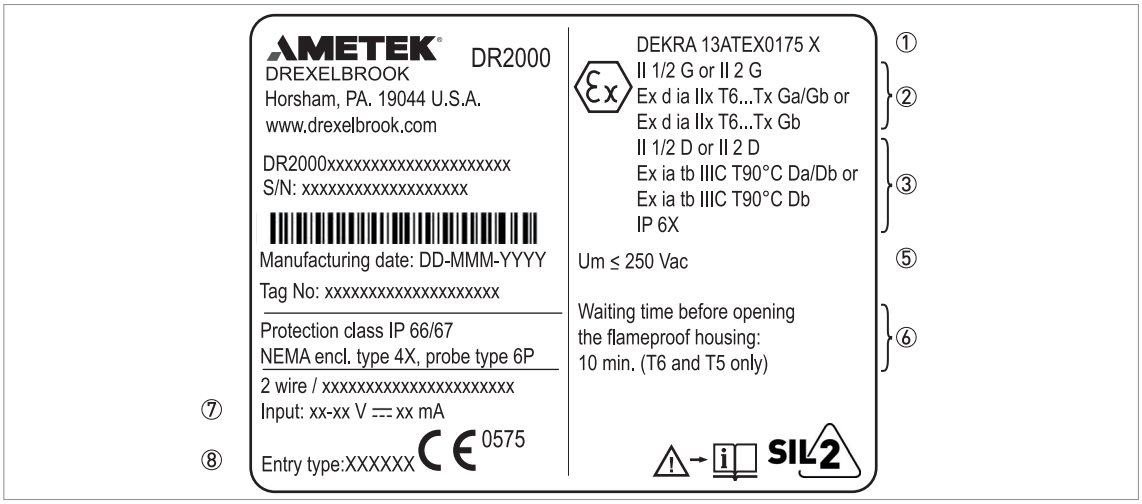

Figure 1-2: Compact version, Ex d ia / Ex ia tb nameplate

① ATEX certification agency code
② Equipment approval category (explosive atmosphere - gas), types of device protection including approved Gas Groups and temperature classes (type) and equipment protection level
③ Equipment category (explosive atmosphere - dust), types of device protection including approved Gas Groups, maximum surface temperature degree of ingress protection (if fitted with the appropriate cable glands) and equipment protection level
④ **4...20 mA passive - HART output option:** Intrinsically-safe circuit data
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑤ **4...20 mA passive - HART output option:** Maximum voltage in accordance with EN 60079-0. Refer to ⑦ for the input voltage range.
⑥ **4...20 mA passive - HART output option:** Minimum waiting time after power-off before it is safe to open the terminal compartment
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑦ Input voltage range and maximum current (4...20 mA passive - HART) / basic current (PROFIBUS PA)
⑧ Cable entry type and size (M20×1.5 or ½ NPT)

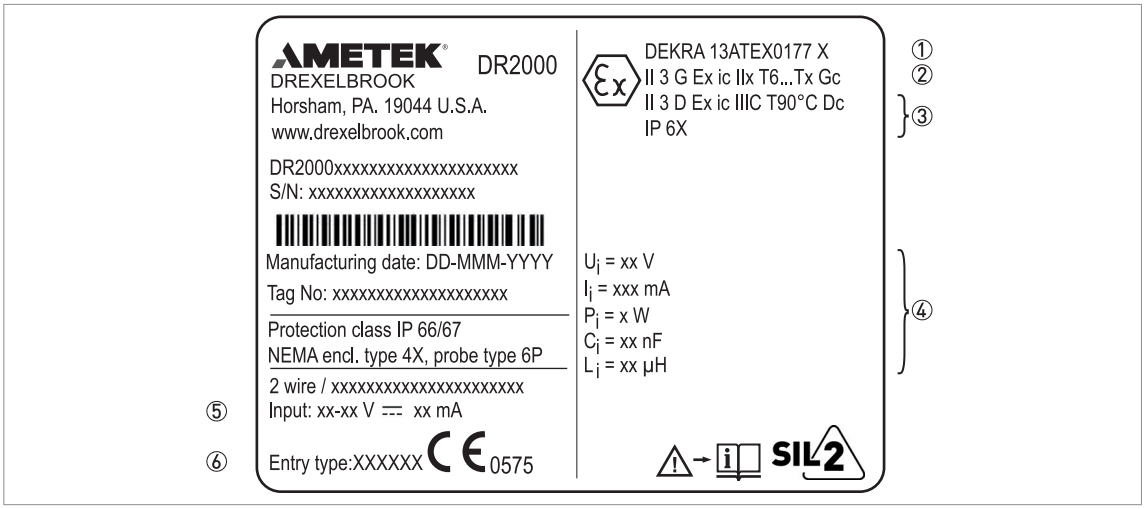

Figure 1-3: Compact version, Ex ic nameplate

① ATEX certification agency code
② Equipment approval category (explosive atmosphere - gas), types of device protection including approved Gas Groups and temperature classes (type) and equipment protection level
③ Equipment category (explosive atmosphere - dust), types of device protection including approved Gas Groups, maximum surface temperature degree of ingress protection (if fitted with the appropriate cable glands) and equipment protection level
④ **4...20 mA passive - HART output option:** Intrinsically-safe circuit data
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑤ Input voltage range and maximum current (4...20 mA passive - HART) / basic current (PROFIBUS PA)
⑥ Cable entry type and size (M20×1.5 or ½ NPT)

Remote (Field) version

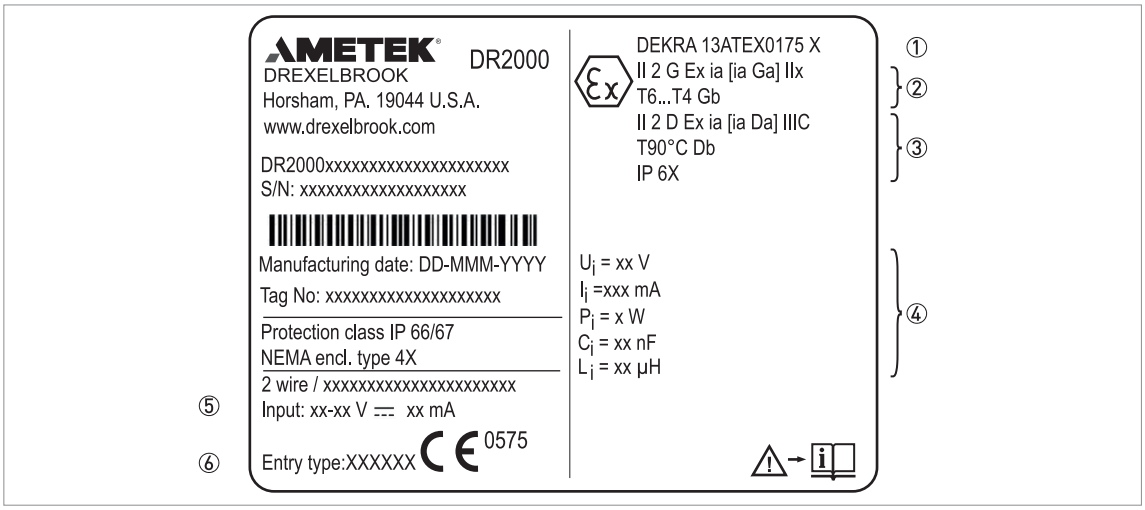

Figure 1-4: Remote version, Ex ia nameplate on the converter housing

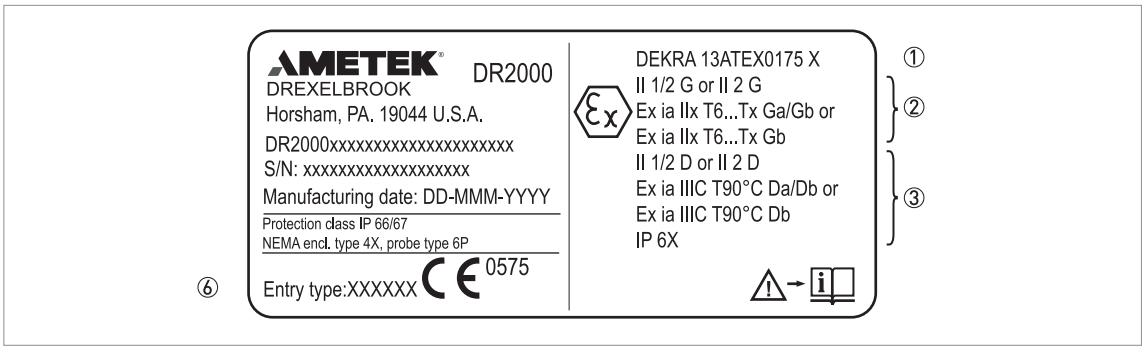

Figure 1-5: Remote version, Ex ia nameplate on the probe housing

① ATEX certification agency code
② Equipment approval category (explosive atmosphere - gas), types of device protection including approved Gas Groups, temperature classes (T6...T3 or T2 - depends on the probe type) and equipment protection level
③ Equipment category (explosive atmosphere - dust), types of device protection for explosive atmospheres with dust, zones, maximum surface temperature, equipment protection level and degree of ingress protection (if fitted with the appropriate cable glands)
④ **4...20 mA passive - HART output option:** Intrinsically-safe circuit data for the device
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑤ Input voltage range and maximum current (4...20 mA passive - HART) / basic current (PROFIBUS PA)
⑥ Cable entry type and size (M20×1.5 or ½NPT)

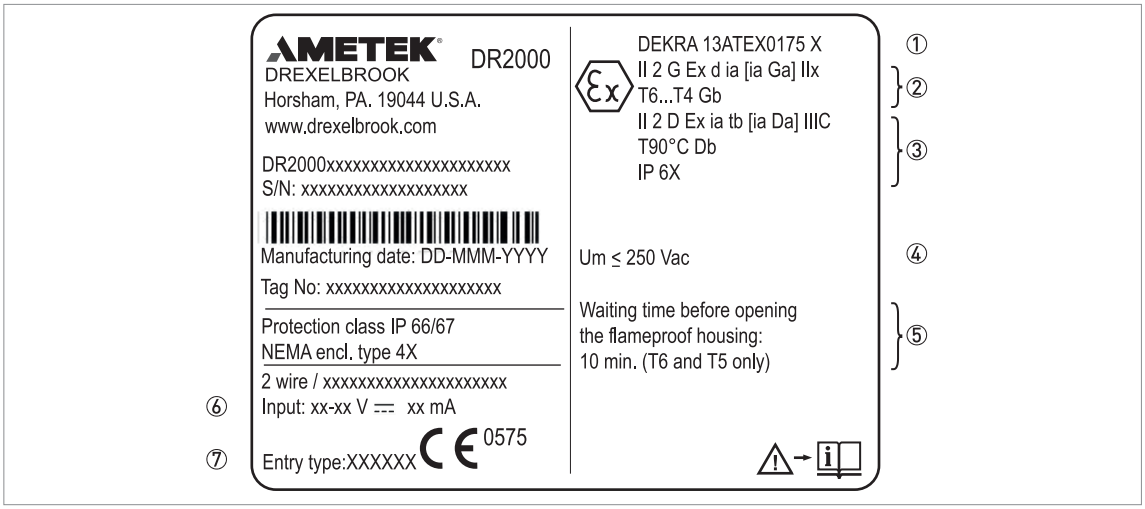

Figure 1-6: Remote version, Ex d / Ex ia tb nameplate on the converter housing

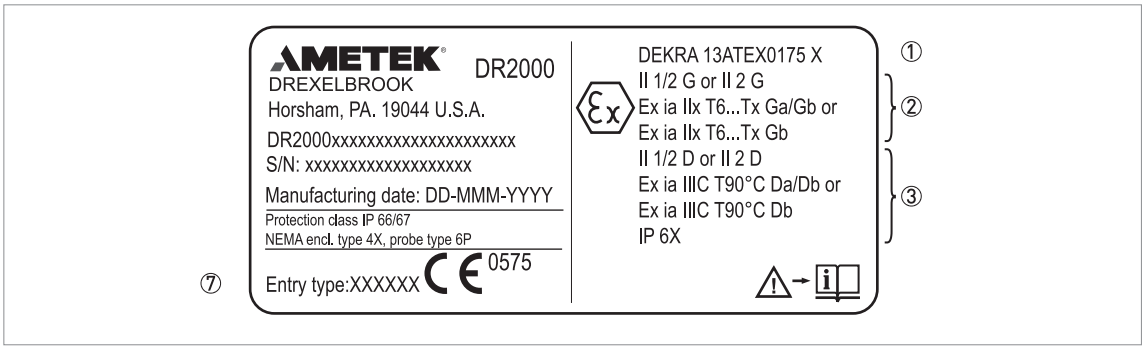

Figure 1-7: Remote version, Ex ia nameplate on the probe housing

① ATEX certification agency code
② Equipment approval category (explosive atmosphere - gas), types of device protection including approved Gas Groups, temperature classes (T6...T3 or T2 - depends on the probe type) and equipment protection level
③ Equipment category (explosive atmosphere - dust), types of device protection for explosive atmospheres with dust, zones, maximum surface temperature and degree of ingress protection (if fitted with the appropriate cable glands)
④ **4...20 mA passive - HART output option:** Maximum voltage in accordance with EN 60079-0. Refer to ⑦ for the input voltage range.
⑤ **4...20 mA passive - HART output option:** Minimum waiting time after power-off before it is safe to open the terminal compartment
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑥ Input voltage range and maximum current (4...20 mA passive - HART) / basic current (PROFIBUS PA)
⑦ Cable entry type and size (M20×1.5 or ½ NPT)

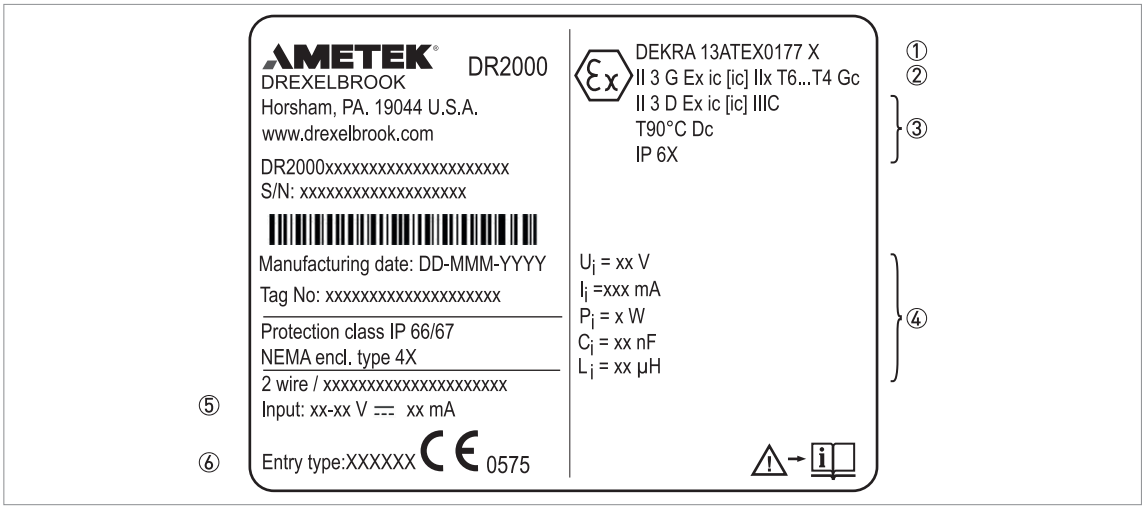

Figure 1-8: Remote version, Ex ic nameplate on the converter housing

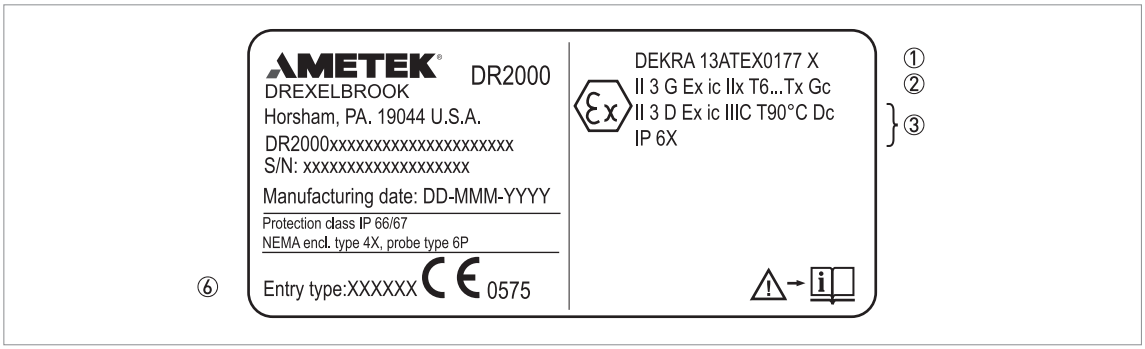

Figure 1-9: Remote version, Ex ic nameplate on the probe housing

① ATEX certification agency code
② Equipment approval category (explosive atmosphere - gas), types of device protection including approved Gas Groups, temperature classes (T6...T3 or T2 - depends on the probe type) and equipment protection level
③ Equipment category (explosive atmosphere - dust), types of device protection for explosive atmospheres with dust, zones, maximum surface temperature and degree of ingress protection (if fitted with the appropriate cable glands)
④ **4...20 mA passive - HART output option:** Intrinsically-safe circuit data
Fieldbus (PROFIBUS PA) option: Entity or FISCO power supply parameters
⑤ Input voltage range and maximum current (4...20 mA passive - HART) / basic current (PROFIBUS PA)
⑥ Cable entry type and size (M20×1.5 or ½ NPT)

2.1 Precautions

2.1.1 General notes

WARNING!
When you install the device, obey the conditions in the EC-Type Examination certificate. These conditions include:

- *The special conditions for safe use.*
- *The Essential Health and Safety Requirements.*

You can download the certificate from our internet site.

DANGER!
This installation must agree with EN 60079-14: Explosive atmospheres - Part 14: Electrical installations design, selection and erection and EN 61241-14: Electrical apparatus for use in the presence of combustible dust - Part 14: Selection and installation.

2.1.2 Electrostatic discharge

DANGER!

- *The apparatus shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.*
- *Risk of electrostatic discharge from plastic protective sheathes (PVC, PVDF or PP) on single rod probes.*
- *Make sure that all equipment is correctly grounded.*

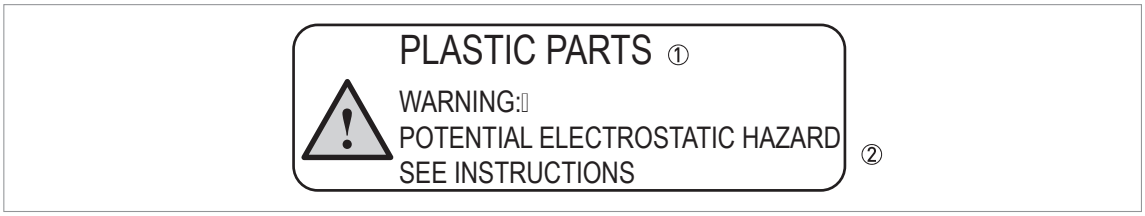

Figure 2-1: ESD warning sticker (below the device nameplate)

① Text: Plastic Parts
② Text: Warning! Potential electrostatic hazard - see instructions

Take the necessary antistatic precautions if you:

- handle,
- install or
- use

the device in potentially explosive atmospheres. Do not install in a location (near ventilation systems, for example) where the electrostatic charge can increase.

WARNING!
If there is a risk of electrostatic discharge, FEP-coated single cable probes and plastic protective sheathes cannot be used with Gas group IIC or in Zone 0.

2.2 Operating conditions

The allowable ambient temperature and corresponding flange temperature range for the device depends on the ATEX equipment category, IEC equipment protection level (EPL) and temperature classes marked on the nameplate.

2.2.1 Ambient and flange temperature

The ATEX equipment category, IEC equipment protection level and temperature class give the ambient temperature and related flange temperature ranges for the device.

WARNING!
The gasket temperature must be in the approved limits. For more data, refer to "Pressure and temperature ranges" in the Installation chapter of the handbook.

Definitions

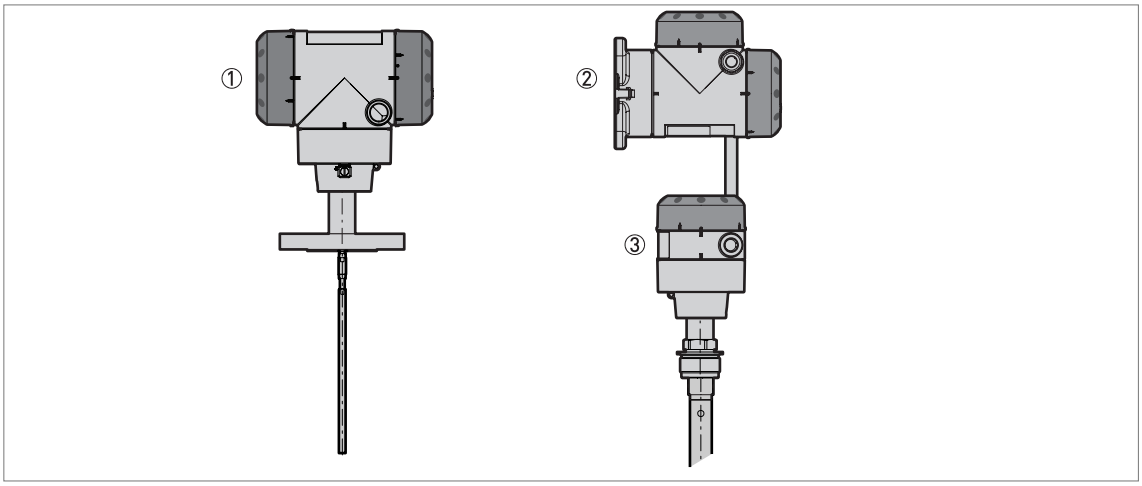

Figure 2-2: Definitions

① Compact version: Signal converter, process connection and probe
② Remote (Field) version: remote converter
③ Remote (Field) version: probe housing, process connection and probe

WARNING!
Compact version only: If the device is used in a potentially explosive atmosphere that contains dust, do not install the device on the side of the tank.

If the device must operate at a high process temperature, make sure that the maximum flange temperature and maximum ambient temperature are not more than the values given in the table.

INFORMATION!
If the device is equipped with the Metaglas® option, DR1000 adaptor, DR1200 adaptor or the Ø24/32 mm adaptor for the DR7100, use the values that follow.

The temperature data that follows is applicable to devices that have the 4...20 mA passive - HART or PROFIBUS PA output options.

Compact versions
Equipment category 1/2 G or EPL Ga/Gb: Ex ia and Ex d ia devices

Temperature class	Maximum ambient temperature						Max. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6	+54	+129	+52	+125	+53	+127	+60	+140
T5	+70	+158	+70	+158	+70	+158	+60	+140
T4	+80	+176	+80	+176	+80	+176	+60	+140

Temperature class	Minimum ambient temperature						Min. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6...T2	-40	-40	-40	-40	-40	-40	-20	-4

Compact version
Equipment category 2 G or EPL Gb: Ex ia and Ex d ia devices
Equipment category 3 G or EPL Gc: Ex ic devices

Temperature class	Maximum ambient temperature						Max. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6	+54	+129	+52	+125	+53	+127	+60	+140
	+51	+124	+42	+107	+45	+113	+85	+185
T5	+69	+156	+67	+152	+68	+154	+75	+167
	+66	+151	+57	+134	+60	+140	+100	+212
T4	+79	+174	+77	+170	+78	+176	+85	+185
	+76	+169	+67	+152	+70	+158	+110	+230
	+73	+163	+57	+134	+62	+143	+135	+275
T3	+71	+160	+51	+124	+57 ①	+134 ①	+150	+302
	+68	+154	-	-	-	-	+180 ②	+356 ②
	+65	+149	-	-	-	-	+200 ②	+392 ②
T2	+60	+140	-	-	-	-	+250 ②	+482 ②
	+54	+129	-	-	-	-	+300 ②	+572 ②

① If the device has an adaptor for DR1200 probes, this temperature is only permitted for devices that have an extension option
② Make sure that gasket temperature is in the specified limits. For more data, refer to the handbook.

Temperature class	Minimum ambient temperature						Min. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6...T2	-40	-40	-40	-40	-40	-40	-40 ①	-40 ①
	-39	-38	-36	-32	-37	-34	-50 ①	-58 ①

① Make sure that gasket temperature is in the specified limits. For more data, refer to the handbook.

Remote (Field) versions (probe housing only)
Equipment category 1/2 G or EPL Ga/Gb: Ex ia and Ex d ia devices

Temperature class	Maximum ambient temperature						Max. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6	+51	+123	+49	+120	+49	+120	+60	+140
T5	+70	+158	+70	+158	+70	+158	+60	+140
T4	+80	+176	+80	+176	+80	+176	+60	+140

Temperature class	Minimum ambient temperature						Min. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6...T2	-40	-40	-40	-40	-40	-40	-20	-4

INFORMATION!
Remote converter
The maximum ambient temperature, T_a, permitted depends on the temperature class:

- *T_a = +60° C for class T6*
- *T_a = +70° C for class T5*
- *T_a = +80° C for class T4*

Remote (Field) version (probe housing only)
Equipment category 2 G or EPL Gb: Ex ia and Ex d ia devices
Equipment category 3 G or EPL Gc: Ex ic devices

Temperature class	Maximum ambient temperature						Max. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6	+51	+123	+49	+120	+49	+120	+60	+140
	+48	+118	+39	+102	+43	+109	+85	+185
T5	+66	+150	+64	+147	+64	+147	+75	+167
	+65	+149	+54	+129	+58	+136	+100	+212
T4	+79	+174	+77	+170	+78	+176	+85	+185
	+75	+167	+64	+147	+68	+154	+110	+230
	+71	+160	+51	+124	+59	+138	+135	+275
T3	+69	+156	+43	+109	+54 ①	+129 ①	+150	+302
	+65	+149	-	-	-	-	+180 ②	+356 ②
	+62	+143	-	-	-	-	+200 ②	+392 ②
T2	+54	+129	-	-	-	-	+250 ②	+482 ②
	+47	+116	-	-	-	-	+300 ②	+572 ②

① If the device has an adaptor for DR1200 probes, this temperature is only permitted for devices that have an extension option
② Make sure that gasket temperature is in the specified limits. For more data, refer to the handbook.

Temperature class	Minimum ambient temperature						Min. flange temperature	
	Ø2 mm / Ø0.08¨ single cable probe (HT version)		Ø2 mm / Ø0.08¨ single cable probe (other versions)		All other probe types			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6...T2	-40	-40	-40	-40	-40	-40	-40 ①	-40 ①
	-39	-38	-35	-31	-36	-32	-50 ①	-58 ①

① Make sure that gasket temperature is in the specified limits. For more data, refer to the handbook.

INFORMATION!
Remote converter
The maximum ambient temperature, T_a, permitted depends on the temperature class:

- *T_a = +60° C for class T6*
- *T_a = +70° C for class T5*
- *T_a = +80° C for class T4*

Compact and Remote (Field) versions
Equipment category 1/2 D, 2 D or EPL Da/Db, Db: Ex ia and Ex ia tb devices
Equipment category 3 D or EPL Dc: Ex ic devices

Maximum flange temperature		Maximum ambient temperature											
		Ø2 mm / Ø0.08¨ single cable probe (HT version)				Ø2 mm / Ø0.08¨ single cable probe (other versions)				All other probe types			
		Compact version		Remote (Field) version		Compact version		Remote (Field) version		Compact version		Remote (Field) version	
[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
+80	+176	+80	+176	+80	+176	+80	+176	+80	+176	+80	+176	+80	+176
+90	+194	+79	+174	+79	+174	+76	+169	+75	+167	+77	+170	+76	+169
+100	+212	+78	+172	+77	+170	+72	+161	+70	+158	+74	+165	+73	+163
+110	+230	+76	+169	+76	+169	+68	+154	+64	+147	+70	+158	+69	+156
+120	+248	+75	+167	+74	+165	+64	+147	+59	+138	+67	+152	+65	+149
+130	+266	+74	+165	+73	+163	+59	+138	+54	+129	+64	+147	+61	+142
+140	+284	+73	+163	+71	+160	+55	+131	+49	+120	+61	+142	+58	+136
+150	+302	+72	+161	+70	+158	+51	+124	+43	+109	+57	+134	+54	+129
+160	+320	+71	+160	+68	+154	-	-	-	-	-	-	-	-
+170	+338	+69	+156	+67	+152	-	-	-	-	-	-	-	-
+180	+356	+68	+154	+65	+149	-	-	-	-	-	-	-	-
+190	+374	+67	+152	+64	+147	-	-	-	-	-	-	-	-
+200	+392	+66	+151	+62	+144	-	-	-	-	-	-	-	-
+210	+410	+65	+149	+61	+142	-	-	-	-	-	-	-	-
+220	+428	+64	+147	+59	+138	-	-	-	-	-	-	-	-
+230	+446	+62	+143	+58	+136	-	-	-	-	-	-	-	-
+240	+464	+61	+142	+56	+133	-	-	-	-	-	-	-	-
+250	+482	+60	+140	+55	+131	-	-	-	-	-	-	-	-
+260	+500	+59	+138	+53	+127	-	-	-	-	-	-	-	-
+270	+518	+58	+136	+52	+125	-	-	-	-	-	-	-	-
+280	+536	+57	+134	+50	+122	-	-	-	-	-	-	-	-
+290	+554	+55	+131	+49	+120	-	-	-	-	-	-	-	-
+300	+572	+54	+129	+47	+116	-	-	-	-	-	-	-	-

2.2.2 Maximum surface temperature of the housing for dust applications

WARNING!
Equipment category 1/2 D, 2 D, 3 D or EPL Da/Db, Db, Dc: Ex ia, Ex ia tb and Ex ic devices only
If the ambient and flange temperatures of the device are not more than values given in the table for Ex ia, Ex ia tb and Ex ic devices, the surface temperature of the housing will not be more than +90°C / +194°F.

For more data, refer to the table for Ex ia, Ex ia tb and Ex ic devices in the "Ambient and flange temperature" section.

2.2.3 Process pressure

Equipment category and Equipment protection level (EPL)	Allowable process pressure	
	[kPa]	[psi]
1/2 G or Ga/Gb	80...110 ①	11.6...16 ①
Others	As per non-Ex device	As per non-Ex device

① Atmospheric pressure

3.1 General notes

WARNING!

- *De-energize the circuit.*
- *Use the applicable cable glands for the cable entry openings in the housing (M20×1.5 or ½ NPT). For the cable entry size, refer to the device nameplate.*
- *If ambient temperature >65°C / >149°F, use heat-resistant cables, cable glands and cable entry plugs certified for continuous operation above +80°C / +176°F.*

3.2 Terminal compartment

3.2.1 How to open the terminal compartment

WARNING!
If dirt collects on the housing, clean the device before you remove the terminal compartment cover.

How to open the Ex i terminal compartment

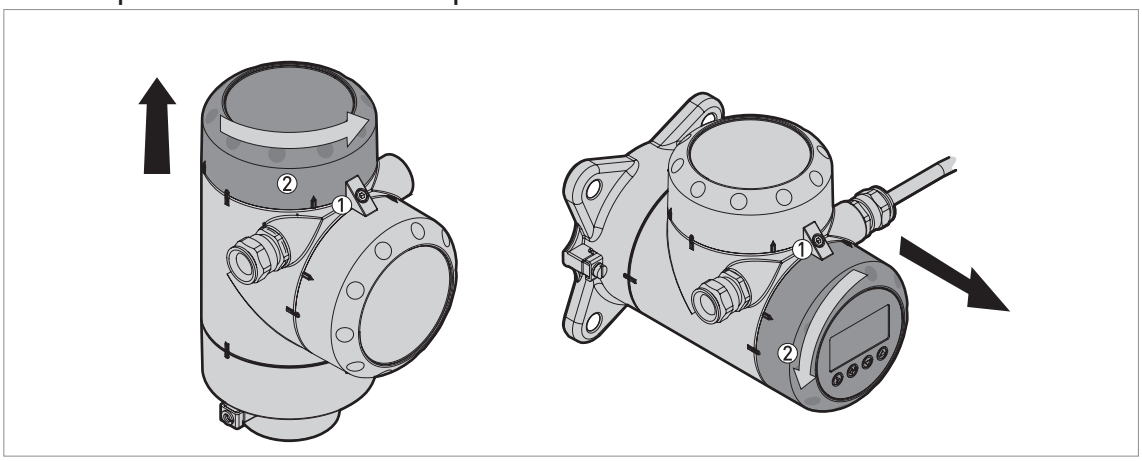

Figure 3-1: How to open the Ex i terminal compartment

How to open the Ex d / Ex t terminal compartment

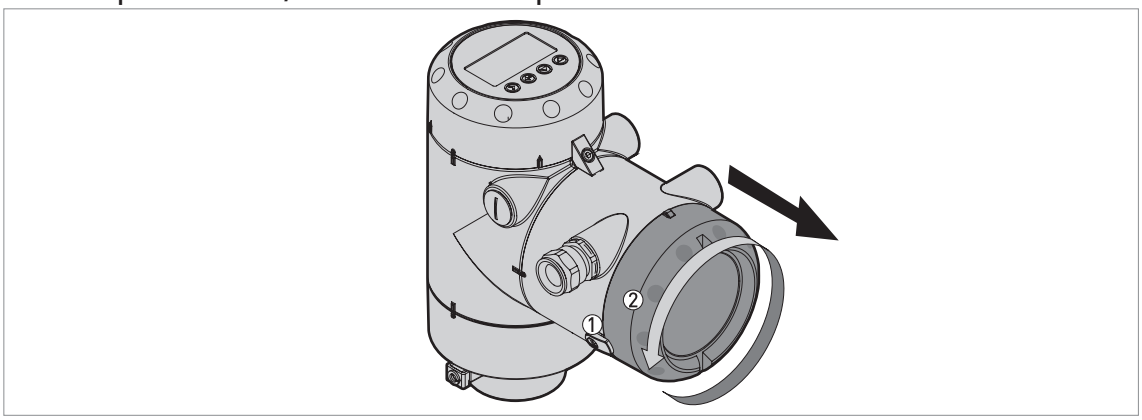

Figure 3-2: How to open the Ex d / Ex t terminal compartment

① Cover stop
② Terminal compartment cover

Equipment needed (not supplied)

- 2.5 mm Allen wrench.

INFORMATION!
Ex i applications
If you remove the terminal compartment cover, the device has a degree of ingress protection IP 20.

WARNING!
Ex d / Ex t applications
Do not remove the terminal compartment cover while the electrical power is connected.

- De-energize the circuit.
- After the time given in the table that follows, remove the cover stop ①.

➲ Use a 2.5 mm Allen wrench.

- Remove the terminal compartment cover ②.

Ex d ia- or Ex ia tb-approved devices:
Time for the internal temperature of the housing to decrease to a safe level

Temperature class	Time for the internal temperature of the housing to decrease to a safe level
	[minutes]
T6, T5	10
T4, T3	Not necessary

3.2.2 How to close the terminal compartment

Ex i applications

- Attach the terminal compartment cover ②. Turn the terminal compartment cover carefully to prevent damage to the thread and the gasket.
- Make sure that the terminal compartment cover is tight.

DANGER!
Ex d / Ex t applications
Make sure that the terminal compartment is correctly sealed. An explosion can cause death or injury to personnel and/or damage to equipment. Obey the instructions that follow:

Ex d / Ex t applications

- Attach the terminal compartment cover ②. Turn the terminal compartment cover carefully to prevent damage to the thread and the gasket.
- Make sure that the terminal compartment cover is tight.
- Use a 2.5 mm Allen wrench to attach the cover stop ①.
- Make sure that the cover stop ① screw is tight.

3.3 Terminal tightening capacity

The terminal tightening capacity for the current output terminal and the communication cable is:

Type of wire	Terminal tightening capacity	
	[mm²]	[AWG]
Rigid	4	11
Flexible	2.5	13

3.4 Equipotential bonding system

Compact version

There is a terminal at the bottom of the converter that can be used as an equipotential bonding conductor. Connect the device to the equipotential bonding system for the hazardous location.

Remote (Field) version

There is a terminal on the wall support and a terminal at the bottom of the probe housing that can be used as equipotential bonding conductors. Connect the device to the equipotential bonding system for the hazardous location.

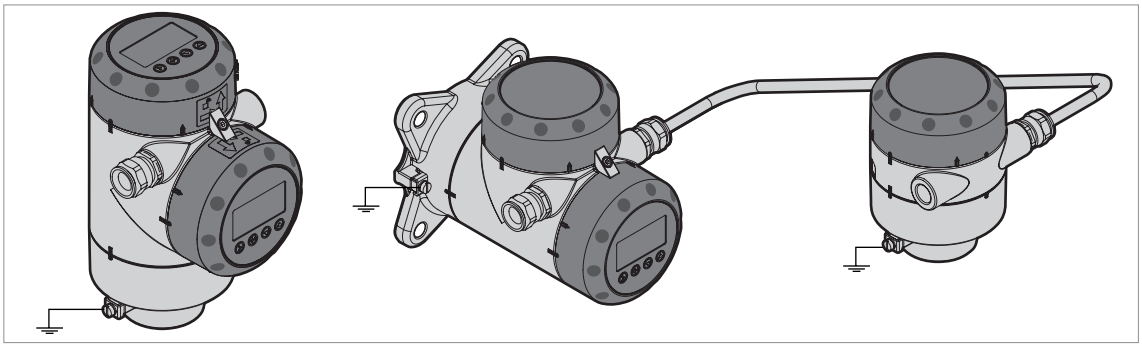

Figure 3-3: Ex i applications: Terminals for the equipotential bonding system

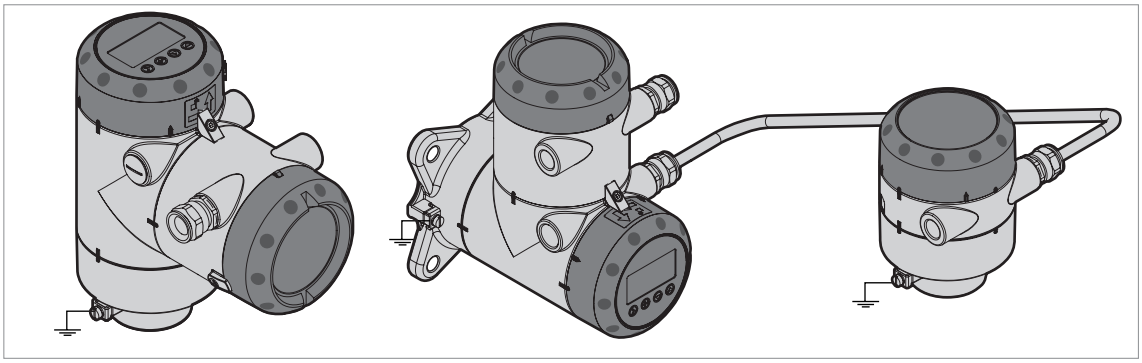

Figure 3-4: Ex d / Ex t applications: Terminals for the equipotential bonding system

3.5 Ex ia equipment

3.5.1 How to connect the electrical cables

Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥6x (EN 60529).

- Use the electrical connection procedure in the Handbook.
- If possible, use galvanically-isolated equipment.
- Supply the Ex i equipment connected to the device. Use only certified intrinsically-safe equipment.
- Connect only to separate certified, intrinsically-safe circuits. Make sure that the electrical circuit characteristics are not more than the values that follow.
- Do not remove more than 6 mm / 0.2" of insulation from the wire.

3.5.2 Maximum intrinsically-safe values for the electrical circuit

Output option		Intrinsically-safe values for the electrical circuit				
		U_i	I_i	P_i	C_i	L_i
		[V]	[mA]	[W]	[nF]	[µH]
4...20 mA passive - HART		≤30	≤300	≤1	=30	=30
PROFIBUS PA	Entity	≤24	≤300	≤1.2	=1	=0
	FISCO	≤17.5	≤380	≤5.32	=1	=0

3.5.3 Supply voltage

Level transmitter with the 4...20 mA output option

	Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Current output terminal	12 ①	30 ①

① For a current output of 22 mA

Level transmitter with the PROFIBUS PA output option

		Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Output terminal	Entity	9	24
	FISCO	9	17.5

3.5.4 Electrical schematic

Level transmitter with the 4...20 mA passive - HART output option

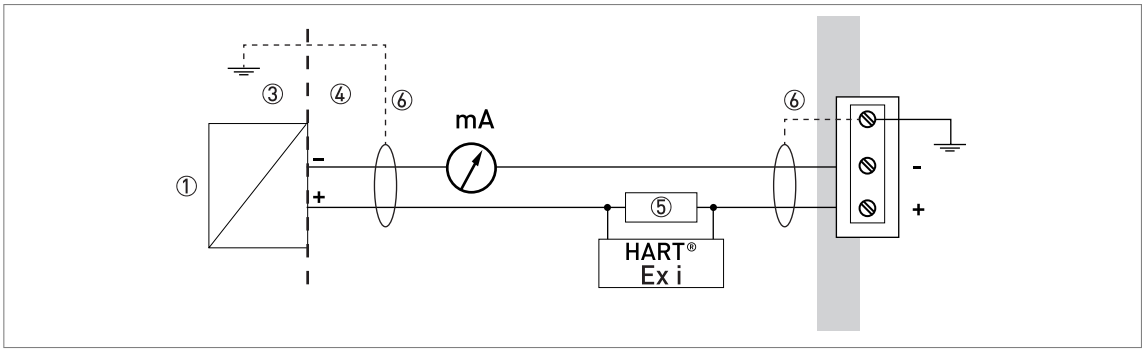

Figure 3-5: Electrical schematic for Ex ia-approved equipment with the 4...20 mA passive - HART output option

Level transmitter with the PROFIBUS PA output option

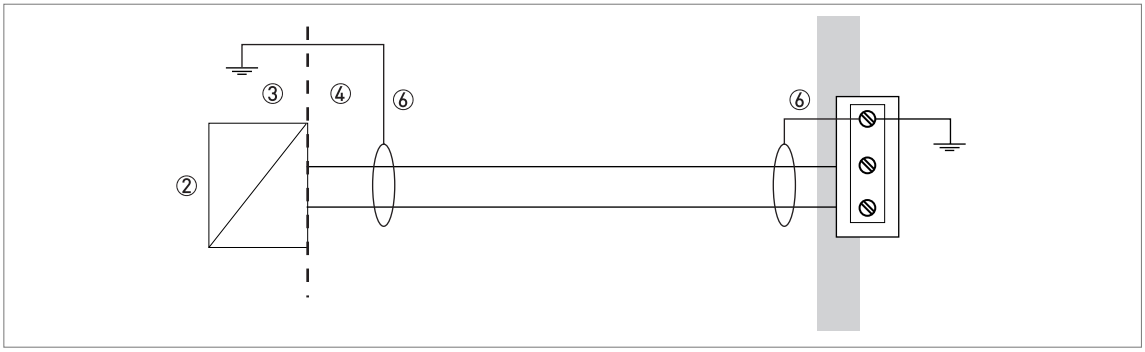

Figure 3-6: Electrical schematic for Ex ia-approved equipment with the PROFIBUS PA output option

① Intrinsically-safe power supply
② Approved barrier with entity parameters or FISCO power supply
③ Non-Ex zone
④ Ex zone
⑤ Resistor for HART® communication
⑥ Grounding wire - if the electrical cable is shielded (braided wire etc.). NOTE: Shielded electrical cable is mandatory for fieldbus output options.

Remote (Field) version

The communication cable (between the converter electronics and the probe end electronics) is supplied by the manufacturer for ATEX applications. The communication cable cannot be changed by the user. For more data, speak to the supplier.

3.6 Ex d ia / Ex ia tb equipment

3.6.1 General notes

Ex d ia- and Ex ia tb-approved equipment have two separate compartments. The electronics in the electronics block compartment are Ex ia-approved and the terminals compartment is Ex d / Ex t-approved.

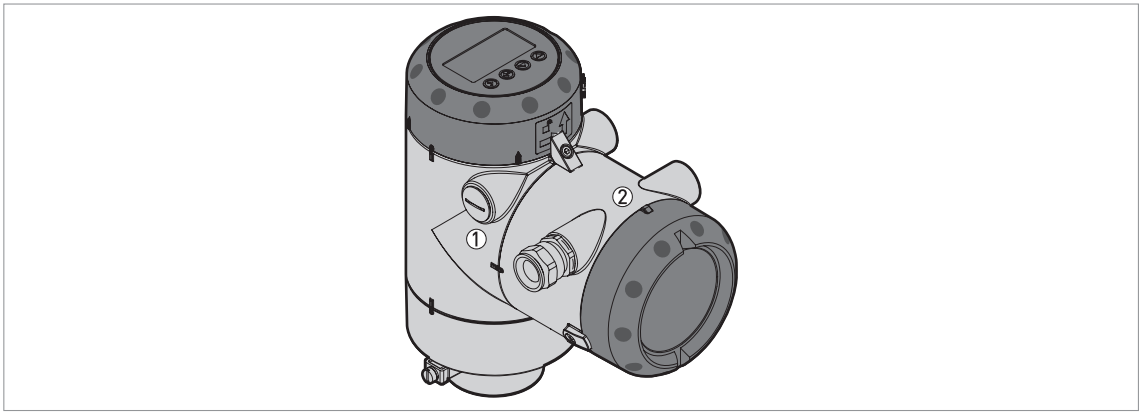

Figure 3-7: Compact version: Compartments in Ex d ia- and Ex ia tb-approved equipment

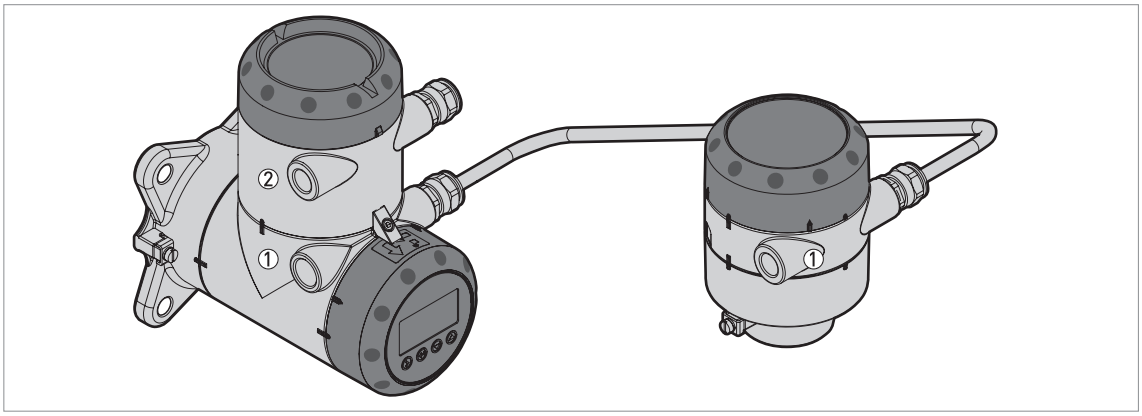

Figure 3-8: Remote (Field) version: Compartments in Ex d ia- and Ex ia tb-approved equipment

① Electronics block (Ex ia) compartment
② Terminal (Ex d / Ex t) compartment

INFORMATION!
The flamepath dimensions are better than the values specified in the European Standard EN 60079-1 (minimum length 13.9 mm and maximum gap 118 µm).

3.6.2 How to connect the electrical cables

Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥6x (EN 60529).

WARNING!
Use only Ex d-approved cable entries and plugs for Ex d applications. Use only Ex t-approved cable entries and plugs for Ex t applications.
Do not remove more than 6 mm / 0.2" of insulation from the wire.

- Do not remove more than 6 mm / 0.2" of insulation from the wire.
- Connect the load resistor to the positive terminal of the power supply
- Ground the negative connection.
- If the load resistor has to be connected to the negative terminal, the loop resistance must not be more than 350 ohms.

CAUTION!
4...20 mA passive - HART output option: *Do not ground the positive connection.*

3.6.3 Supply voltage

INFORMATION!
For maximum intrinsically-safe values, refer to Maximum intrinsically-safe values for the electrical circuit on page 22.

Level transmitter with the 4...20 mA output option

	Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Current output terminal	16 ①	36 ①

① For a current output of 22 mA

Level transmitter with the PROFIBUS PA output option

		Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Output terminal	Entity	9	24
	FISCO	9	17.5

For more data, refer to *Maximum intrinsically-safe values for the electrical circuit* on page 22.

3.6.4 Electrical schematic

DANGER!
Keep the grounding wire a minimum distance of 2 mm / 0.83" away from the output terminal.

CAUTION!
Make sure that you connect the load resistor to the positive side.

Level transmitter with the 4...20 mA passive - HART output option

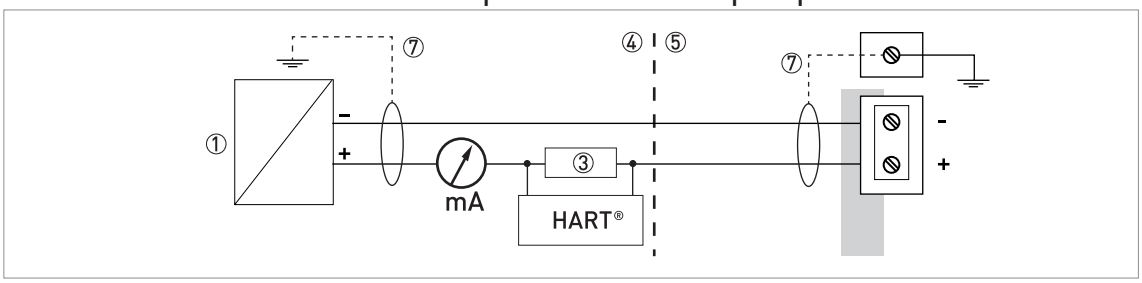

Figure 3-9: Electrical schematic for Ex d ia / Ex ia tb-approved equipment (with galvanic isolation)

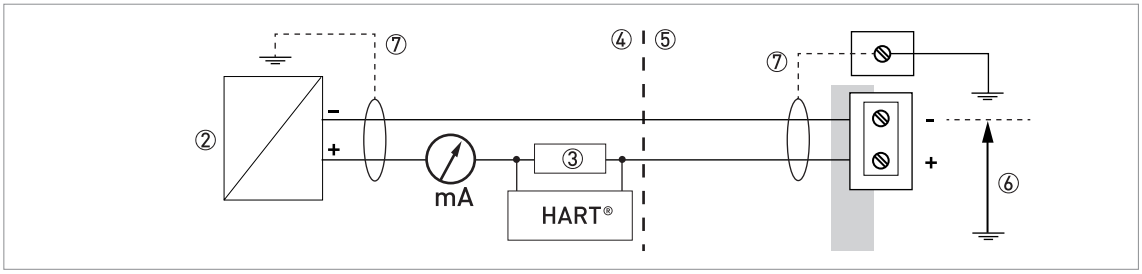

Figure 3-10: Electrical schematic for Ex d ia / Ex ia tb-approved equipment (without galvanic isolation)

① Galvanically-isolated power supply
② Power supply
③ Resistor for HART® communication
④ Non-Ex zone
⑤ Ex zone
⑥ |U|
⑦ Grounding wire - if the electrical cable is shielded (braided wire etc.)

Level transmitter with the PROFIBUS PA output option

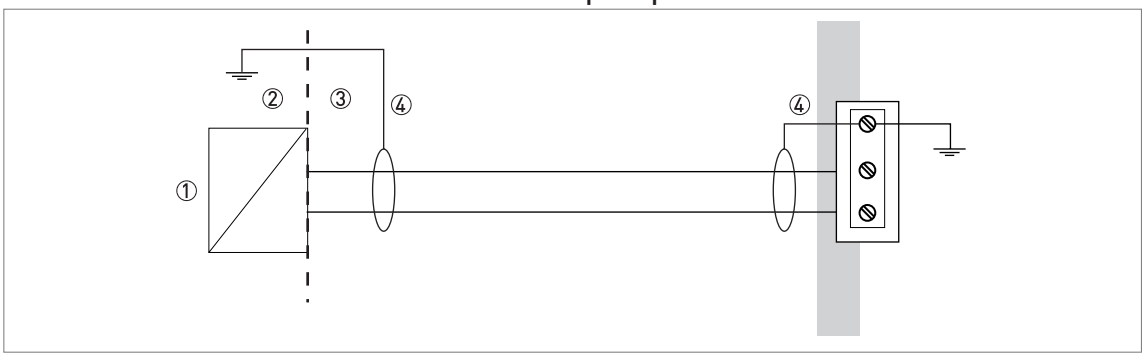

Figure 3-11: Electrical schematic for Ex d ia / Ex ia tb-approved equipment with the PROFIBUS PA output option

① Approved barrier with entity parameters or FISCO power supply. For more data, refer to *Maximum intrinsically-safe values for the electrical circuit* on page 22.
② Non-Ex zone
③ Ex zone
④ Grounding wire. NOTE: Shielded electrical cable is mandatory for fieldbus output options.

Remote (Field) version

The communication cable (between the converter electronics and the probe end electronics) is supplied by the manufacturer for ATEX applications. The communication cable cannot be changed by the user. For more data, speak to the supplier.

3.7 Ex ic equipment

3.7.1 How to connect the electrical cables

Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥6x (EN 60529).

- Use the electrical connection procedure in the Handbook.
- If possible, use galvanically-isolated equipment.
- Supply the Ex i equipment connected to the device. Use only certified intrinsically-safe equipment.
- Connect only to separate certified, intrinsically-safe circuits. Make sure that the electrical circuit characteristics are not more than the values that follow.
- Do not remove more than 6 mm / 0.2" of insulation from the wire.

3.7.2 Maximum intrinsically-safe values for the electrical circuit

Output option		Intrinsically-safe values for the electrical circuit				
		U_i	I_i	P_i	C_i	L_i
		[V]	[mA]	[W]	[nF]	[µH]
4...20 mA passive - HART		≤30	≤300	≤1	=30	=30
PROFIBUS PA	Entity	≤32	①	①	=1	=0
	FISCO	≤17.5	①	①	=1	=0

① Ii and Pi values are not applicable.

3.7.3 Supply voltage

Level transmitter with the 4...20 mA output option

	Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Current output terminal	12 ①	30 ①

① For a current output of 22 mA

Level transmitter with the PROFIBUS PA output option

		Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
Output terminal	Entity	9	32
	FISCO	9	17.5

3.7.4 Electrical schematic

Level transmitter with the 4...20 mA passive - HART output option

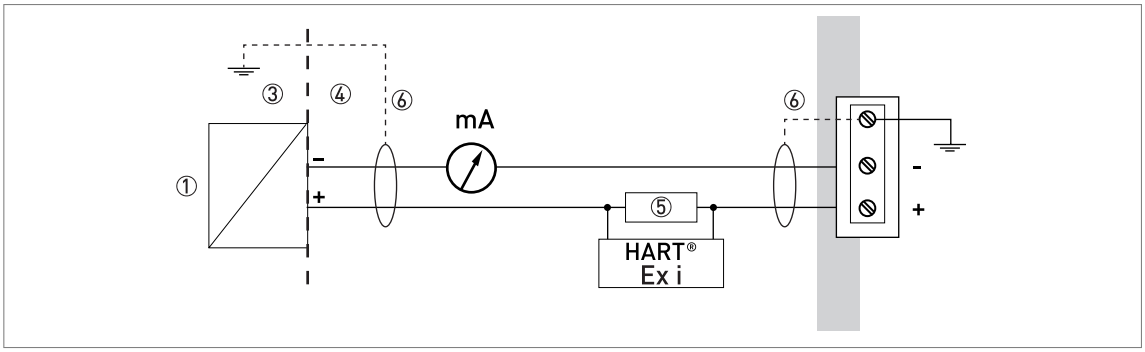

Figure 3-12: Electrical schematic for Ex ic-approved equipment with the 4...20 mA passive - HART output option

Level transmitter with the PROFIBUS PA output option

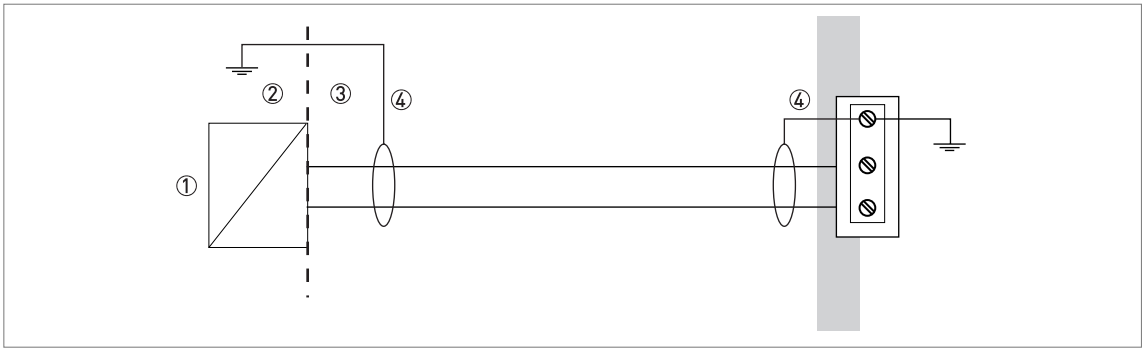

Figure 3-13: Electrical schematic for Ex ic-approved equipment with the PROFIBUS PA output option

① Approved barrier with entity parameters or FISCO power supply
② Non-Ex zone
③ Ex zone
④ Grounding wire - if the electrical cable is shielded (braided wire etc.). NOTE: Shielded electrical cable is mandatory for fieldbus output options.

Remote (Field) version

The communication cable (between the converter electronics and the probe end electronics) is supplied by the manufacturer for ATEX applications. The communication cable cannot be changed by the user. For more data, speak to the supplier.

WARNING!
Make sure that it is safe to supply electrical power. Do a start-up check:

- Are the wetted components (gasket, flange and probe) resistant to corrosion by the tank product?
- Does the information given on the nameplate agree with the application?
- Did you connect the equipotential bonding system correctly?
- **Ex d applications:** Are the cable entries, plugs and adaptors Ex d-approved?
- **Ex t applications:** Are the cable entries, plugs and adaptors Ex t-approved?
- **Ex ia applications:** Are you using an intrinsically-safe barrier within the correct parameters? For more data, refer to *Ex ia equipment* on page 22. The electrical circuit characteristics must not be more than the maximum intrinsically-safe values.
- **Ex ic applications:** Are you using an intrinsically-safe barrier within the correct parameters? For more data, refer to *Ex ic equipment* on page 27. The electrical circuit characteristics must not be more than the maximum intrinsically-safe values.
- Did you install the correct cable entries? Is the terminal compartment correctly sealed?

5.1 Periodic maintenance

No maintenance is necessary.

5.2 Keep the device clean

Obey these instructions:

- Keep the thread of the terminal compartment cover clean.
- If dirt collects on the device, clean it.

5.3 Returning the device to the manufacturer

5.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

CAUTION!
If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

5.3.2 Form (for copying) to accompany a returned device

Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.		
Date:		Signature:
Stamp:		

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