DR7000 SERIES

Supplementary instructions

Radar Level Instrument for 2-wire control systems (liquids)

Supplementary Instructions for IECEx applications

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AMETEK®
DREXELBROOK

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1.1 Scope of the document

These instructions are applicable only to the explosion-protection version of the radar 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 FMCW (Frequency-Modulated Continuous Wave) radar technology. It measures level, volume, distance to surface and reflectivity of liquids, pastes and slurries.It is suitable for installation on storage tanks, process tanks and stilling wells. Measurements are displayed via a DTM (device type manager) for remote communication or on 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 IECEx scheme rules, the IECEx version of the device described in these Supplementary Instructions conforms to International Standards IEC 60079-0:2004, IEC 60079-1:2007-04, IEC 60079-11:2006, IEC 60079-26:2006, IEC 61241-0:2004, IEC 61241-1:2004 and IEC 61241-11:2005. The Ex ia / Ex iaD and Ex d[ia] / Ex tD[iaD] versions are certified for use in hazardous areas by KEMA Quality B.V. under IECEx KEM 10.0081X.

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

The certificate is given on the CD-ROM supplied with the device. You can also download the certificate from our internet site.

1.4 Equipment protection levels (EPL)

1.4.1 Ex ia / Ex iaD-approved devices

These devices are suitable for use in potentially explosive atmospheres of all flammable substances in Gas Groups IIA, IIB and IIC. The Ex ia-approved device is certified for applications for which an EPL of Ga, Ga/Gb or Gb is necessary. The Ex iaD-approved device is certified for zone 20, zone 21/20 or zone 21 (combustible dust atmospheres).

DANGER!
The device must be fitted with the appropriate options.

1.4.2 Ex d[ia] / Ex tD[iaD]-approved devices

These devices are suitable for use in potentially explosive atmospheres of all flammable substances in Gas Groups IIA, IIB and IIC. The Ex d[ia]-approved device is certified for applications for which an EPL of Ga/Gb or Gb is necessary. The Ex tD[iaD]-approved device is certified for applications in zone 21/20 or zone 21 (combustible dust atmospheres).

DANGER!
The device must be fitted with the appropriate options.

1.4.3 Definitions of equipment protection levels

EPL Ga
The device is installed in hazardous areas that must have equipment with a very high level of protection. The device is not a source of ignition in usual conditions of operation or when possible or unusual faults occur.

EPL Gb
The device is installed in hazardous areas that must have equipment with a high level of protection. The device is not a source of ignition in usual conditions of operation or when possible faults occur. It is possible that this does not include frequent faults.

EPL Ga/Gb
The signal converter is installed in hazardous areas that must have equipment with a high level of protection. The antenna is installed in hazardous areas that must have equipment with a very high level of protection.

1.5 IECEx nameplate

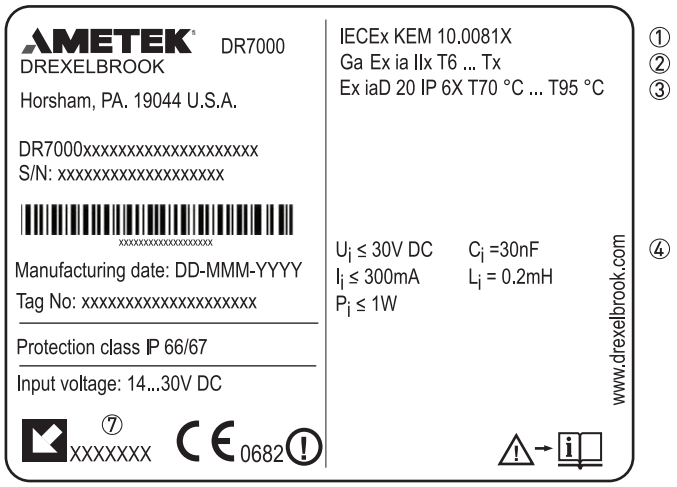

Figure 1-1: Ex ia / Ex iaD nameplate (4...20 mA output)

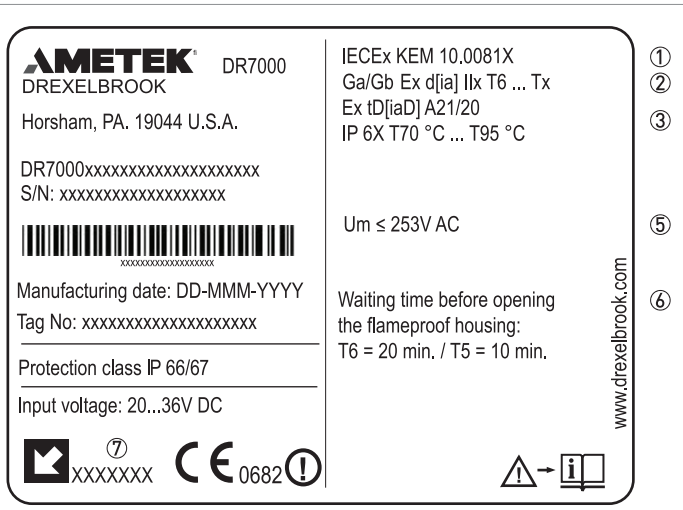

Figure 1-2: Ex d[ia] / Ex tD[iaD] nameplate (4...20 mA output)

① IECEx certification agency code
② Types of device protection for explosive atmospheres with gas, including approved Gas Groups (IIA, IIB or IIC) and temperature classes (T6...T4 or T3 - depends on the antenna type) and equipment protection level
③ Types of device protection for explosive atmospheres with dust, zones, degree of ingress protection (if fitted with the appropriate cable glands) and maximum surface temperature
④ Intrinsically-safe circuit data
⑤ Maximum voltage in accordance with IEC 60079-0
⑥ Minimum waiting time after power-off before it is safe to open the terminal compartment
⑦ Cable entry type and size (Aluminium housing: M26×1.5, M20×1.5, ½ NPT or G ½; Stainless steel housing: M25×1.5, M20×1.5, ½ NPT or G ½)

2.1 Precautions

2.1.1 General notes

WARNING!
When you install the device, obey the conditions in the IECEx approval certificate. These conditions include:

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

The certificate is given on the CD-ROM supplied with the device. You can also download the certificate from our internet site.

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

2.1.2 Electrostatic discharge

DANGER!
Risk of electrostatic discharge from the blue plastic sun cover, the Drop antenna and the flange plate protection (if the Drop antenna has this option). Make sure that all personnel and equipment are correctly grounded.

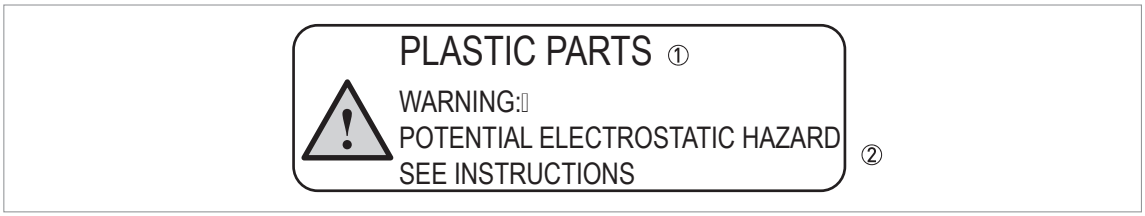

Figure 2-1: ESD warning sticker (below the device nameplate)

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 to ventilation systems, for example) where the electrostatic charge can increase.

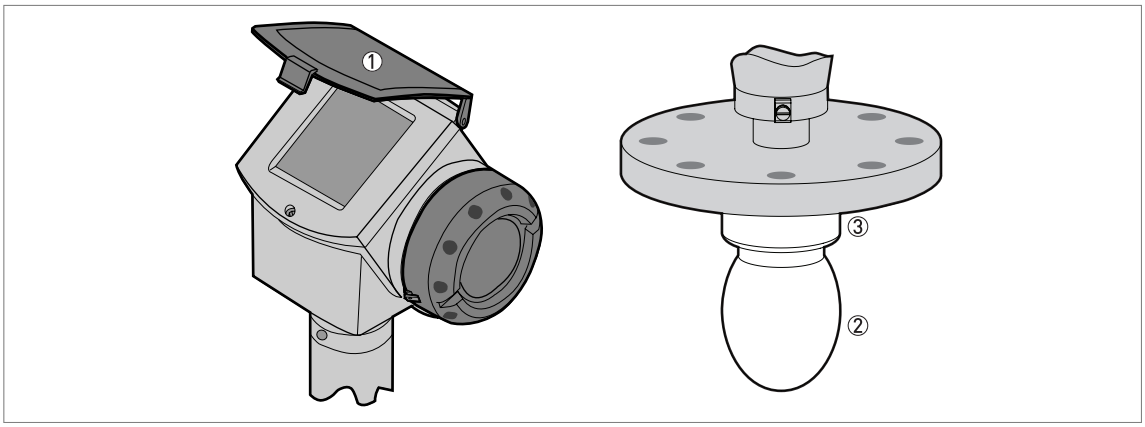

Figure 2-2: Risk of ESD

① Sun cover
② Drop antenna
③ Flange plate protection (option for the Drop antenna)

2.1.3 Special conditions

WARNING!
Aluminium housing: Possible source of ignition in a potentially explosive atmosphere. The housing is made of either aluminium alloy or stainless steel. If the device has an aluminium alloy housing, make sure that iron/steel objects do not hit or rub against the device.

2.1.4 Optional purging system

The purging system is supplied as an option for devices that have horn antennas.

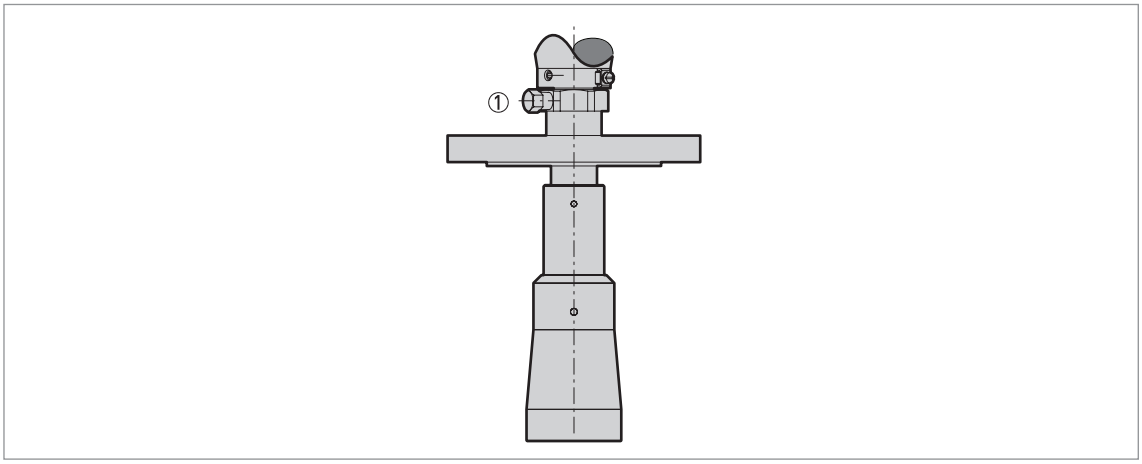

Figure 2-3: Optional purging system

① ¼ NPTF purging connection (optional)

INFORMATION!
If delivered with the device, the purging connection is plugged with a ¼ NPTF screw and engaged on a minimum of 3½ threads.

Connection and operation of the purging connection are the responsibility of the user. The operator is also responsible for selection of a suitable fluid to purge the device.

- If the screw is removed, make sure that the installation agrees with the Ex requirements for the purging system.

2.2 Operating conditions

The allowable ambient temperature and corresponding flange temperature range for the device depends on the Ex equipment category and temperature classes marked on the nameplate.

2.2.1 Ambient and flange temperature

The equipment protection level (EPL) 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.

EPL Ga: Ex ia devices only - with the 4...20 mA output option

Temperature class	Ambient temperature		Flange temperature	
	[°C]	[°F]	[°C]	[°F]
T6	-20...+57	-4...+122	-20...+60	-4...+140

EPL Ga/Gb: Ex ia and Ex d[ia] devices - with the 4...20 mA output option

Temperature class	Ambient temperature		Flange temperature	
	[°C]	[°F]	[°C]	[°F]
T6	-40...+57	-40...+134	-20...+60	-4...+140
T5	-40...+72	-40...+161	-20...+60	-4...+140
T4	-40...+80	-40...+176	-20...+60	-4...+140

EPL Gb:
Ex ia and Ex d[ia] devices - with the 4...20 mA output option

Temperature class	Ambient temperature						Flange temperature	
	Hygienic antennas		Drop and horn antennas		Drop and horn antennas with the distance piece			
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
T6	-40...+57	-40...+134	-40...+57	-40...+134	-40...+57	-40...+134	-50...+60 ①	-58...+140 ①
	-40...+50	-40...+122	-40...+47	-40...+116	-40...+51	-40...+124	-50...+85 ①	-58...+185 ①
T5	-40...+72	-40...+161	-40...+72	-40...+161	-40...+72	-40...+161	-50...+75 ①	-58...+167 ①
	-40...+65	-40...+149	-40...+62	-40...+143	-40...+66	-40...+151	-50...+100 ①	-58...+212 ①
T4 ②	-40...+80	-40...+176	-40...+80	-40...+176	-40...+80	-40...+176	-50...+85 ①	-58...+185 ①
	-40...+76	-40...+169	-40...+74	-40...+165	-40...+79	-40...+174	-50...+100 ①	-58...+212 ①
	-40...+73	-40...+163	-40...+70	-40...+158	-40...+74	-40...+165	-50...+110 ①	-58...+230 ①
	-40...+66	-40...+151	-40...+60	-40...+140	-40...+68	-40...+154	-50...+135 ①	-58...+275 ①
T3 ③	-40...+62	-40...+143	-40...+54	-40...+129	-40...+64	-40...+147	-50...+150 ①	-58...+302 ①
	-	-	-	-	-40...+57	-40...+134	-50...+180 ①	-58...+356 ①
	-	-	-	-	-40...+52	-40...+125	-50...+200 ①	-58...+392 ①

① Min. -50°C / -58°F, if an EPDM gasket is used. Min. -20°C / -4°F, if a Kalrez® 6375 gasket is used. Min. -40°C / -40°F, if an FKM/FPM gasket is used. Min. -30°C / -22°F, if a Metaglas® feedthrough is used. Min. -50°C / -58°F, if a PEI feedthrough is used.

② Max. flange temperature is +100°C / +212°F, if the PP Drop antenna used

③ Do not use this temperature class for the PP Drop antenna. Max. flange temperature is +150°C / +302°F, if the PTFE Drop antenna or Hygienic antenna are used.

Zone 20: Ex iaD devices only
Zone 21/20: Ex iaD and Ex tD[iaD] devices

Ambient temperature		Flange temperature	
[°C]	[°F]	[°C]	[°F]
-40...+85	-40...+185	-50...+200 ①	-58...+392 ①

① Max. flange temperature is +100°C / +212°F, if PP Drop antenna used. Max. flange temperature is +150°C / +302°F, if the PTFE Drop or the Hygienic antenna is used. Min. -50°C / -58°F, if an EPDM gasket is used. Min. -20°C / -4°F, if a Kalrez® 6375 gasket is used. Min. -40°C / -40°F, if an FKM/FPM gasket is used. Min. -30°C / -22°F, if a Metaglas® feedthrough is used. Min. -50°C / -58°F, if a PEI feedthrough is used.

2.2.2 Maximum surface temperature of the housing

Zone 20: Ex iaD devices only
Zone 20/21: Ex iaD and Ex tD[iaD] devices only

Max. ambient temperature						Max. flange temperature		Max. surface temperature	
Hygienic antennas		Drop and horn antennas		Drop and horn antennas with the distance piece					
[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
+60	+140	+60	+140	+60	+140	+60	+140	+62	+143
+75	+167	+75	+167	+75	+167	+75	+167	+77	+170
+85	+185	+85	+185	+85	+185	+85	+185	+87	+188
+67	+152	+59	+138	+62	+143	+150 ①	+302 ①	≤+90	≤+194
-	-	-	-	+57	+134	+200 ②	+302 ②	≤+90	≤+194

① Max. flange temperature is +100°C / +212°F, if the PP Drop antenna is used. Max. flange temperature is +150°C / +302°F, if the PTFE Drop antenna or Hygienic antenna are used.

② Do not use the PP Drop antenna. Max. flange temperature is +150°C / +302°F, if the PTFE Drop antenna or Hygienic antenna are used.

2.2.3 Process pressure

Equipment protection level	Allowable process pressure	
	[kPa]	[psi]
EPL Ga 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 >70°C / >158°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

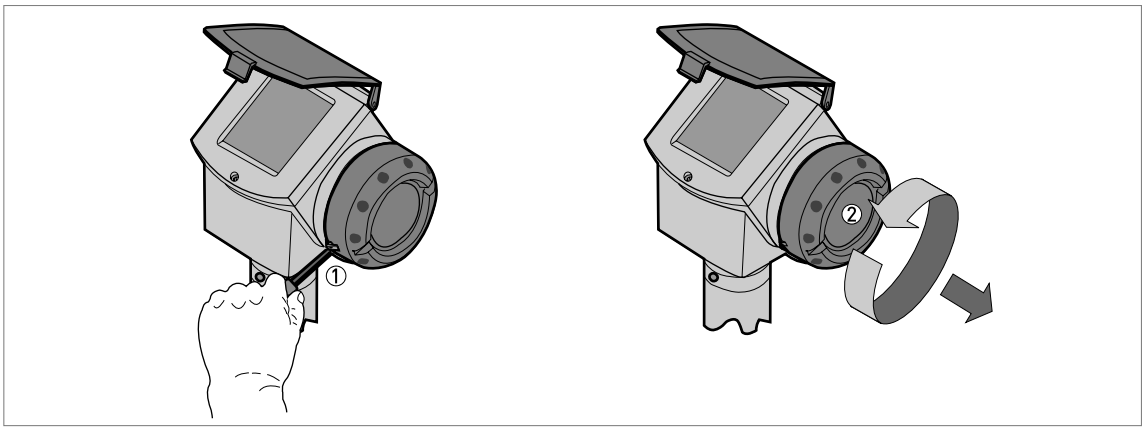

Figure 3-1: How to open the terminal compartment

① Cover stop
② Terminal compartment cover

WARNING!
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 3 mm allen wrench.

- Remove the terminal compartment cover ②.

Time necessary to de-energize an Ex d[ia]- or Ex tD[iaD]-approved device

Temperature class	Time to de-energize the Ex d[ia]- or Ex tD[iaD]-approved device
	[minutes]
T6	20
T5	10
T4, T3	Not necessary

3.2.2 How to close the terminal compartment

DANGER!
Ex d 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 tD 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 3 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 curent output terminals 1 and 2 is:

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

3.4 Equipotential bonding system

There is a terminal in the terminal compartment and another on the side of the converter support pillar that can be used equipotential bonding conductors.

3.5 Ex ia / Ex iaD 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 (IEC 60529).

- Use the electrical connection procedure in the Handbook.
- If possible, use galvanically-isolated equipment.
- Supply the Ex i / Ex iD 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.

3.5.2 Maximum intrinsically-safe values for the electrical circuit

INFORMATION!
The optional second output is galvanically isolated from the main power supply, output 1 and parts of the device that are grounded.

Level transmitter with the 4...20 mA output option (output terminal 1 or 2)

- $U_i \leq 30$ V
- $I_i \leq 300$ mA
- $P_i \leq 1$ W
- $C_i = 30$ nF
- $L_i = 0.2$ mH

3.5.3 Supply voltage

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

Current output terminal	Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
1 (U_{S1})	14 ①	30 ①
2 (U_{S2}) ②	10 ①	30 ①

① Minimum voltage at output terminal for a current output of 22 mA
② Optional. Use a second power supply. This power supply energizes current output terminal 2 only.

3.5.4 Electrical schema

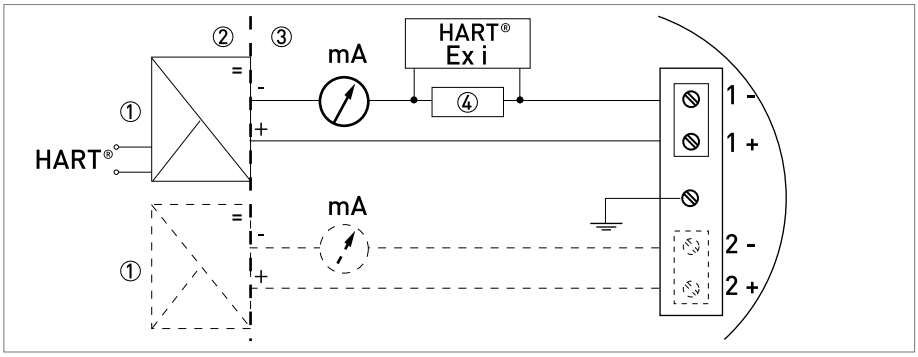

Figure 3-2: Electrical schema for Ex i-approved equipment with the 4...20 mA output option

① Intrinsically-safe power supply (use a second power supply for optional terminal 2 if the device has two 4...20 mA outputs)
② Non-Ex zone
③ Ex zone
④ Resistor for HART® communication

3.6 Ex d[ia] / Ex tD[iaD] equipment

3.6.1 General notes

Ex d[ia]- and Ex tD[iaD]-approved equipment have two separate compartments. The electronics in the electronics block compartment are Ex ia / ExiaD-approved and the terminals compartment is Ex d / Ex tD-approved.

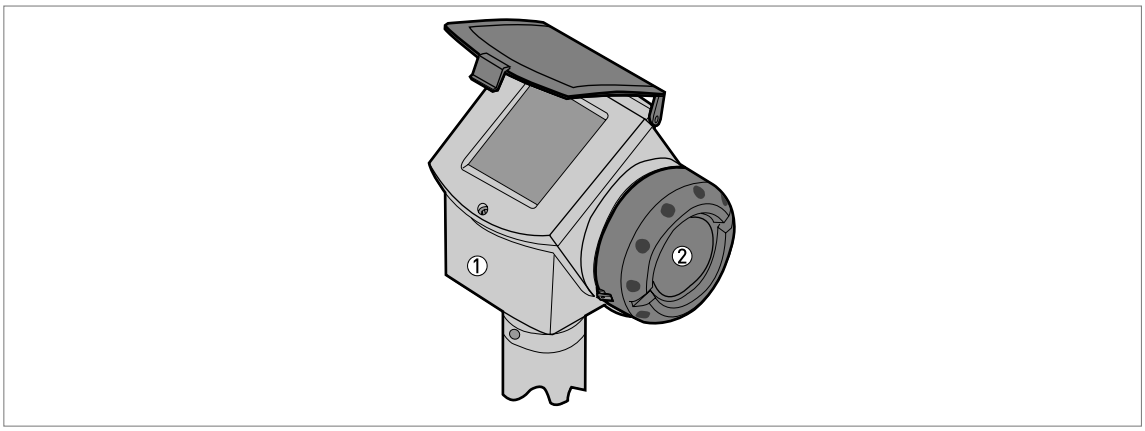

Figure 3-3: Compartments in Ex d[ia]- and Ex tD[iaD]-approved equipment

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

INFORMATION!
If you must open the electronics block compartment and remove the electronics blocks for servicing, it is not necessary to disconnect the wires from the Ex d / Ex tD terminal.

INFORMATION!
The flamepath dimensions are better than the values specified in the International Standard IEC 60079-1 (minimum length 14.5 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 (IEC 60529).

WARNING!
Use only Ex d-approved cable entries and plugs for Ex d applications. Use only Ex tD-approved cable entries and plugs for Ex tD applications.

Load resistor

- 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 250 ohms.

CAUTION!
Do not ground the positive connection.

3.6.3 Supply voltage

Current output terminal	Minimum voltage at output terminal [VDC]	Maximum voltage at output terminal [VDC]
1 (U_{S1})	20 ①	36 ①
2 (U_{S2}) ②	10 ①	30 ①

① Minimum voltage at output terminal for a current output of 22 mA
② Optional. Use a second power supply. This power supply energizes current output terminal 2 only.

3.6.4 Electrical schema

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

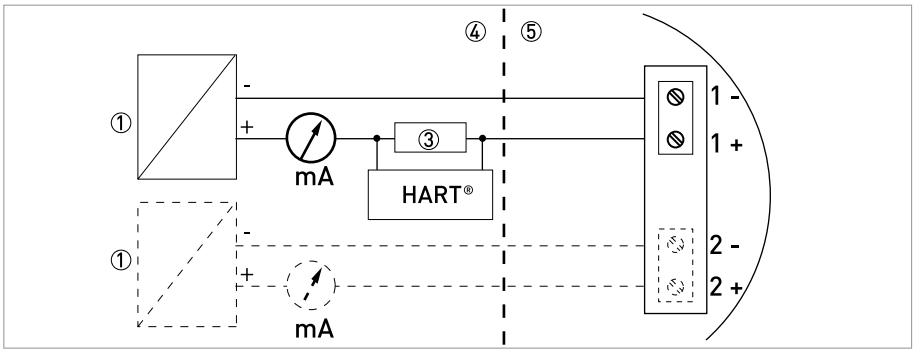

Figure 3-4: Electrical schema for Ex d[ia] / Ex tD[iaD]-approved equipment (with galvanic isolation)

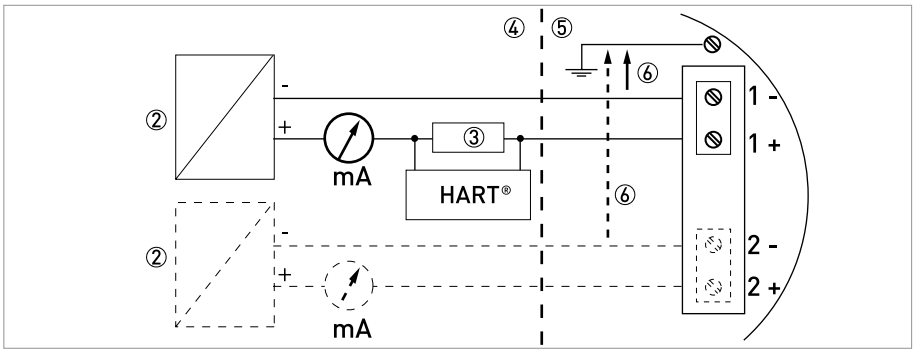

Figure 3-5: Electrical schema for Ex d[ia] / Ex tD[iaD]-approved equipment (without galvanic isolation)

① Galvanically-isolated power supply (use a second power supply for optional terminal 2)
② Power supply (use a second power supply for optional terminal 2)
③ Resistor for HART® communication
④ Non-Ex zone
⑤ Ex zone
⑥ |U| < 5 V

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

- Are the wetted components (gasket, flange and antenna) 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 tD applications:** Are the cable entries, plugs and adaptors Ex tD-approved?
- **Ex i / Ex iD applications:** Are you using an intrinsically-safe barrier within the correct parameters? For more data, refer to *Ex ia / Ex iaD equipment* on page 13. 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?
- Does the optional purging system agree with Ex requirements?

5.1 Periodic maintenance

No maintenance is necessary.

5.2 Keep the device clean

DANGER!
Risk of electrostatic discharge from the blue plastic sun cover, Drop antenna and the flange plate protection (an option for the Drop antenna).

WARNING!
Do not clean plastic parts in a hazardous area.

Obey these instructions:

- Keep the thread of the terminal compartment cover clean.
- If dirt collects on the device, clean it. Wipe the plastic sun cover with a damp cloth.
- If you clean the Drop antenna or the flange plate protection, wipe the plastic parts with a damp cloth.

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 neutralizing, 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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