07/2010 - 4000662402

KROHNE

Supplementary Installation and operating instructions

Level-Radar
PTB 99 ATEX 2061X

BM 70 A-Ex
BM 70 Ai-Ex
BM 70 P-Ex
BM 70 Pi-Ex
BM 700-Ex
BM 702-Ex
BM 702 A-Ex

- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- **Level measuring instruments**
- Communications engineering
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

Contents

1. General Safety Information

These additional ‘Ex’ instructions apply to BM 70..-Ex hazardous-duty versions. They are supplementary to the Installation and Operating Instructions issued for the non-hazardous-duty devices.
The information given in these Instructions contains only the data relevant to explosion protection.
The technical details given in the Installation and Operating Instructions for the non-hazardous-duty versions apply unchanged unless excluded or superseded by these present Instructions.

In accordance with European Directive 94/9 EC (ATEX 100a) to European Standards
EN 60079-xx, level gauges of the BM 70..-Ex series are approved for use in hazardous locations under

PTB 99 ATEX 2061 X

by the Physikalisch-Technische Bundesanstalt (PTB).

Note:

- In addition to the establishment regulations for high voltage systems (VDE 0100), attention should be paid to the regulations of EN 60079-14 "Electrical installations in hazardous areas".

- It is absolutely necessary that the details contained in this approval certificate together with its boundary conditions be observed (see also Annex A.1 “EC Type Test Certificate“).

- Assembly, installation, start-up and maintenance may only be carried out by personnel who have been specially ‘trained in explosion protection’!

2. Safety-relevant type code

Designation of the signal converter
(see nameplate, places not needed in the type code may be omitted):

BM	70..	/ .	/ .	- Ex
1	2	3	4	5

1: Tank level gauge

2: Signal converter series

70A	:	Advanced
70Ai	:	Advanced + intrinsically safe I/O function
70P	:	Precision
70Pi	:	Precision+ intrinsically safe I/O function
700	:	Low Cost
702	:	2-wire + intrinsically safe I/O function
702A	:	2-wire Advanced + intrinsically safe I/O function

3: Symbol for type of protection for the terminal compartment

E	:	terminal compartment in Increased Safety “e“ (standard)
D	:	terminal compartment as Flameproof Enclosure “d“ (option)
unassigned	:	intrinsically “ia“ (BM 702 / BM 702 A)

4: Ambient temperature range

S	:	Extended range –40°C ... +55°C
unassigned	:	Standard range –20°C ... +55°C

5: Safety function

Ex	:	explosion-protected electrical equipment

Designation of the flange system converter (see nameplate):

...	.	. . . . .	- ..
6	7	8	9

6: Flange system series

V96	:	Flange system V96
WS	:	Flange system Wave-Stick

7: Material of waveguide window

unassigned	:	standard (stainless steel)
H	:	Hastelloy window

8: Materials of wetted parts
Flange system V96:
» Antennas and flanges, including coating:

SS	:	stainless steel
HB	:	Hastelloy B
HC	:	Hastelloy C
Ti	:	Titanium
Ta	:	Tantalum

» Gasket materials:

FFKM	:	FFKM or Parofluor™
K2035	:	Gasket of FFKM 2035
K4079	:	Gasket of FFKM 4079
K6230	:	Gasket of FFKM 6230
K6375	:	Gasket of FFKM 6375
FEPS	:	FEP coated Silicone
FPM	:	FPM, e.g. Viton™
FEP	:	FEP coated FPM
PFA	:	Gasket PFA- coated stainless steel spring

Flange system WS

LPTFE	:	PTFE conductive	Rod 1A
PTFE	:	PTFE non-conductive	Rod 1B, 1C, 3A
PP	:	PP non-conductive	Rod 3B
SS PTFE	:	stainless steel / non-conductive	Rod 2A, 3A
SS PP	:	stainless steel / PP non-conductive	Rod 2B, 3B

9: Field of application, Device Group II

1G	:	Category 1G, (application in Zone 0) (1)
2G	:	Category 2G, (application in Zone 1)

(1) **Note !** See Section 3.2.1 for restricted application in Zone 0

3. Main safety-relevant characteristics

3.1. Signal converter

The BM 70..-Ex level gauges consist in each case of a combination of signal converter and flange system. The main characteristics of the explosion-protected signal converter are described below.

3.1.1. Category / Zone allocation

The signal converter part of the BM 70..-Ex is basically designed in Category 2 for application in Zone 1.

3.1.2. Type of protection

BM 70..-Ex with non-intrinsically safe I/O functions			
Variant	Device part	Type of protection	Symbol
BM 70./E-Ex	Electronics compartment	Flameproof Enclosure	Ex de
	Terminal compartment	Increased Safety	
	Pin coupler compartment	Increased Safety	
BM 70./D-Ex	Electronics compartment	Flameproof Enclosure	Ex de
	Terminal compartment	Flameproof Enclosure	
	Pin coupler compartment	Increased Safety	

BM 70Ai/.-Ex and BM 70Pi/.-Ex with intrinsically safe I/O functions			
Variant	Device part	Type of protection	Symbol
BM 70.i/E-Ex	Electronics compartment	Flameproof Enclosure	Ex de [ia]
	Terminal compartment	Increased Safety	
	Pin coupler compartment	Increased Safety	
BM 70.i/D-Ex	Electronics compartment	Flameproof Enclosure	Ex de [ia]
	Terminal compartment	Flameproof Enclosure	
	Pin coupler compartment	Increased Safety	

BM 702-Ex / BM 702 A-Ex with intrinsically safe I/O functions			
Variant	Device part	Type of protection	Symbol
BM 702i-Ex	Electronics compartment	intrinsic safety	Ex ia
	Terminal compartment	intrinsic safety	

3.1.3. Special lock

For all device variants BM 70A./.-Ex, BM 70P./.-Ex and BM 700/.-Ex, the sealing covers of terminal compartment and electronics compartment are secured by special locks. The locking screw requires use of an Allan key (4 mm size).

3.1.4. I/O functions

The following limit values need to be taken into account when connecting the I/O interfaces of the BM 70..-Ex level gauges:

BM 70./.-Ex with non-intrinsically safe I/O functions		
I/O function [(1)]	Nominal values of the non-certified receiver instrument	Additional restriction
Acc. to standard Installation & Operating Instructions	Acc. to standard Installation & Operating Instructions	Power for receiver instruments, max. 250 V
[(1)] Only for connection to circuits with “functional extra-low voltage with safety separation (PELV)“		

BM 70A/.i-Ex and BM 70Pi/.-Ex with intrinsically safe I/O functions				
I/O function	Identifying marking	Maximum safety values		
Passive current output	Ex ia IIC or Ex ib IIC	Ui = 30V Ci = 5nF	Ii = 250mA Li = negligible	Pi = 1,0W
Passive switching output	Ex ia IIC or Ex ib IIC	Ui = 30V Ci = 5nF	Ii = 250mA Li = negligible	Pi = 1,0W
Interface PROFIBUS-PA[(1)]	Ex ia IIC or Ex ib IIC/IIB	Ui = 30V Ci = 5nF	Ii = 380mA Li = negligible	Pi = 5,32W
Interface Fieldbus FF	Ex ia IIC or Ex ib IIC/IIB	Ui = 30V Ci = 5nF	Ii = 380mA Li = negligible	Pi = 5,32W
[(1)] Suitable for connection to intrinsically safe fieldbus systems based on the FISCO Model				

The intrinsically safe circuits of the I/O functions are galvanically isolated both from ground and also from each other (test voltage > 500 VAC).
Furthermore, all intrinsicaly safe circuits are safety-separated from the non-intrinsically safe power circuits up to a peak voltage of 375 V.

BM 702-Ex / BM 702 A-Ex with intrinsically safe I/O functions				
I/O functions	Identifying marking	Maximum safety values		
Passive current output	Ex ia IIC or Ex ib IIC	Ui = 30V Ci = 11nF	Ii = 250mA Li = negligible	Pi = 1,0W

The intrinsically safe circuit is galvanically isolated from ground (test voltage > 500 VAC).

3.2. Flange systems

3.2.1. Category / Zone allocation

The allowable operating conditions for the flange systems of the BM 70..-Ex devices are given in the following tables.

NOTE:
The application restrictions marked with indices should be observed without fail.

3.2.1.1. BM 70..-Ex with flange system V96

Standard-temperature version High-temperature version (with distance piece)						
V96		Allowable operating conditions				
Material	Version	Category	Zone	Gas Group	Flange temperature / product temperature [°C]	Tank pressure [bar]
all certified variants		1G	0	IIC	-20 ... 60°C (1)	-0,2 ... 0,1 (1) (0,8 ... 1,1 bar abs.)
			1		see standard Installation & Operating Instructions	

(1) Limitation to atmospheric conditions in accordance with EN 60079-26

Application restrictions - flange system V96:

- **Flange system V96 with heating**

The operator shall ensure that the temperature of the heating medium, when used in Zone 0 or 1, shall not exceed 80% of the ignition temperature (in °C) of the product(s) inside the tank, and shall not exceed the maximum allowable flange temperature as a function of the Temperature Class. The operating pressure of the heating system is limited to max. 6 bar. Ensure that the inlet and outlet of the heating system are correctly connected (see information plates on the upper side of the flange).

- **Flange system V96 with purging device**

When delivered, the purge connection is closed off by a 1/4“ screw. Connection and operation of the purge connection fall within the responsibility of the operator. When this screw is removed, the operator is responsible for ensuring conformance with the ’Ex’ requirements pertaining to the purging system (e.g. fitting a flame trap).
The operator is also responsible for selection of a suitable purging medium.

3.2.1.2. BM 70..-Ex with flange system WS

Standard-temperature version						
WS		Allowable operating conditions				
Material	Version Rod	Cate-gory	Zone	Gas Group	Flange temperature / product temperature [°C]	Tank pressure [bar]
LPTFE*	1A	1G	0	IIC	-20 ... 60°C (4)	-0,2 ... 0,1 (4) (0,8 ... 1,1 bar abs.)
			1		-40 ... 130	-1 ... 16 (2)
PTFE* SS PTFE*	1C 3A	1G(3)	0(3)	IIC(3)	-20 ... 60°C (4)	-0,2 ... 0,1 (4) (0,8 ... 1,1 bar abs.)
			1	IIC(1) / II B	-40 ... 130	-1 ... 16 (2)
PP* SS PP*	3B	1G (3)	0(3)	IIC(3)	-20 ... 60 (4)	-0,2 ... 0,1(4) (0,8 ... 1,1 bar abs.)
			1	IIC(1) / II B	-40 ... 100 (5)	-1 ... 16
PTFE	1B	2G	1	IIC(1) / II B	-40 ... 130	-1 ... 16 (2)
SS PTFE	2A	2G	1	IIC(1) / II B	-20 ... 130	-1 ...2
SS PP	2B	2G	1	IIC(1) / II B	-20 ... 100	-1 ...2

* with additional Metaglas pane (waveguide window)

High-temperature version with distance piece						
WS		Allowable operating conditions				
Material	Version Rod	Cate-gory	Zone	Gas Group	Flange temperature / product temperature [°C]	Tank pressure [bar]
LPTFE*	1A	1G	0	IIC	-20 ... 60°C (4)	-0,2 ... 0,1 (4) (0,8 ... 1,1 bar abs.)
			1		-40 ... 150	-1 ... 16 (2)
PTFE* SS PTFE*	1C 3A	1G(3)	0(3)	IIC(3)	-20 ... 60°C (4)	-0,2 ... 0,1 (4) (0,8 ... 1,1 bar abs.)
PP* SS PP*	3B	1G(3)	0(3)	IIC(3)	-20 ... 60 (4)	-0,2 ... 0,1(4) (0,8 ... 1,1 bar abs.)
			1	IIC(1) / II B	-40 ... 100 (5)	-1 ... 16
PTFE	1B	2G	1	IIC(1) / II B	-40 ... 150	-1 ... 16 (2)
SS PTFE	2A	2G	1	IIC(1) / II B	-20 ... 150	-1 ... 2 (2)
SS PP	2B	2G	1	IIC(1) / II B	-20 ... 100	-1 ... 2
* with additional Metaglas pane (waveguide window) (1) ...(5) observe the application limitation for flange system WS						

Application restrictions, flange system WS:

(1) If the operator cannot rule out the risk of electrostatic charging of the antennas, the antennas may **only be used in conjunction with Gas Group II B.**

(2) To reduce the maximum allowable tank pressure, where flange and product temperatures are > 100°C, see the following formula and table.

(3) If the operator cannot rule out the risk of electrostatic charging of the antennas, the antennas may **only be used in Zone 1/Gas Group II B.**

(4) Limitation to atmospheric conditions in accordance with EN 60079-26

(5) By using the standard microwave window of stainless steel (Type SS) the allowed flange / product temperature is minimum -30 °C.

To calculate the maximum allowable tank pressure, where flange and product temperatures are > 100°C, use the following formula and/or table for the flange system WS:

$PB = 16\ bar - 0{,}3 * (T_{flange,\ product} - 100\ °C)$

Tank pressure PB as a function of the flange or product temperature	
Flange temperature / product temperature [°C]	Tank pressure [bar]
100	16
110	13
120	10
130	7
140	4
150	±1

3.2.1.3. Tank connections

Allocation of tank connections to categories and zones:

Tank connection	Standard	Category	Tank Zone
Flange	DIN 2501, ANSI, JIS, BS	1G or 2G	0 or 1
Threaded	DIN ISO 258	2G	1
Sanitary	DIN 11851	2G	1

3.3. Temperature classes, complete device

3.3.1. General

In terms of maximum surface temperatures, level measuring devices are exposed to three heat sources:

- Ambient temperature Ta
- Electric power loss PV
- Product temperature Tp

Accordingly, at a given maximum ambient temperature (Ta < 55°C) and a given maximum loss power, we obtain maximum surface temperatures as a factor of the product temperature. For that reason, the devices are not allocated to any specific temperature class; rather, the temperature class of the devices is a function of the actual product temperature.

3.3.2. BM 70..-Ex with flange system V96 and WS Category 1 (Zone 0)

To simplify definition of the temperature class of the BM 70..-Ex level gauges with flange system V96, the only reference temperature required is the temperature at the device flange. If the following maximum values are not exceeded at the device flange, this will ensure that all other thermal limit values at the device are also maintained.

The temperature class can be defined in one of two ways:

1) Without measurement of the flange temperature

If the flange temperature is not known, the product temperature shall be taken as being the reference temperature of the flange.

2) With measurement of the flange temperature

For operating conditions which require Category 2 devices the product temperature may have higher values than the flange temperature, taking in consideration the limits of the temperature classes. The flange temperature shall be established under worst-case conditions (e.g. allowing for the maximum possible product level and any additional insulation measures).

Standard-temperature version V96 and WS	
Temperature Class	Maximum flange temperature [°C]
T6	85 (1)
T5	100 (1)
T4 ... T1	130
Boundary conditions:	Ambient temperature ≤ 55°C (1) observe application limitation for measuring devices BM 702-Ex / BM 702 A-Ex Where product temperature is > 100°C, a heat-resistant cable with a continuous service temperature of ≥ 80°C is required.

Application limitation for measuring devices BM 702-Ex / BM 702 A-Ex

Temperature Class	Maximum flange temperature [°C]	Maximum Ambient temperature [°C]
T6	50	40
T5	90	40

High-temperature version with distance piece V96	
Temperature Class	Maximum flange temperature [°C]
T6	85 (1)
T5	100 (1)
T4	135
T3	200
T2 , T1	250 (2)
Boundary conditions: Ambient temperature ≤ 55°C (1) observe application limitation for measuring devices BM 702-Ex / BM 702 A-Ex (2) can be reduced, depending on engaged gasket materials used, refer to ”Standard Installation and Operating Instructions"; Where product temperature is > 200°C, a heat-resistant cable with a continuous service temperature of ≥ 80°C is required	

Application limitation for measuring devices BM 702-Ex / BM 702 A-Ex

Temperature Class	Maximum flange temperature [°C]	Maximum Ambient temperature [°C]
T6	75	40
T5	100	40

High-temperature version with distance piece WS	
Temperature Class	Maximum flange temperature [°C]
T6	85 (1)
T5	100 (1)
T4	135
T3 ... T1	150
Boundary conditions: Ambient temperature ≤ 55°C (1) observe application limitation for measuring devices BM 702-Ex / BM 702 A-Ex	

Application limitation for measuring devices BM 702-Ex / BM 702 A-Ex

Temperature Class	Maximum flange temperature [°C]	Maximum Ambient temperature [°C]
T6	75	40
T5	100	40

3.3.3. BM 70..-Ex with flange system WS Category 2 (Zone 1)

For BM 70..-Ex level gauges with flange system WS…-2G, use only the product temperature to establish the temperature class.

Standard-temperature version	
Temperature Class	Maximum flange temperature [°C]
T6	85 (1)
T5	100 (1)
T4 ... T1	130 (100) (2) (3)
Boundary conditions:	Ambient temperature ≤ 55°C (1) observe application limitation for measuring devices BM 702-Ex / BM 702 A-Ex (2) Figures in brackets in conjunction with rod 2B (3) Where product temperature is > 100°C heat-resistant cable with continuous service temperature of ≥ 80°C is required

Application limitation for measuring devices BM 702-Ex / BM 702 A-Ex

Temperature Class	Maximum flange temperature [°C]	Maximum Ambient temperature [°C]
T6	50	40
T5	90	40

High-temperature version with distance piece WS	
Temperature Class	Maximum flange temperature [°C]
T6	85 (1)
T5	100 (1)
T4	135 (100) (2)
T3 ... T1	150 (100) (2)
Boundary conditions:	Ambient temperature ≤ 55°C (1) observe application limitation for measuring devices BM 702-Ex / BM 702 A-Ex (2) Figures in brackets in conjunction with rod 2B

Application limitation for measuring devices BM 702-Ex / BM 702 A-Ex

Temperature Class	Maximum flange temperature [°C]	Maximum Ambient temperature [°C]
T6	75	40
T5	100	40

4. Identifying marking

The level measuring devices bear the following marking:

- signal converter: stick-on label or metal plate on the converter housing
- flange system: metal plate on the tank mounting flange or marking direct on the tank socket.

Matching of signal converter and flange system is assured by way of the serial number marked on the two nameplates.

The type code is described in Section 2.

4.1. Marking - signal converter

Marking of the signal converter is by means of the nameplates, shown as follows, for the variants:

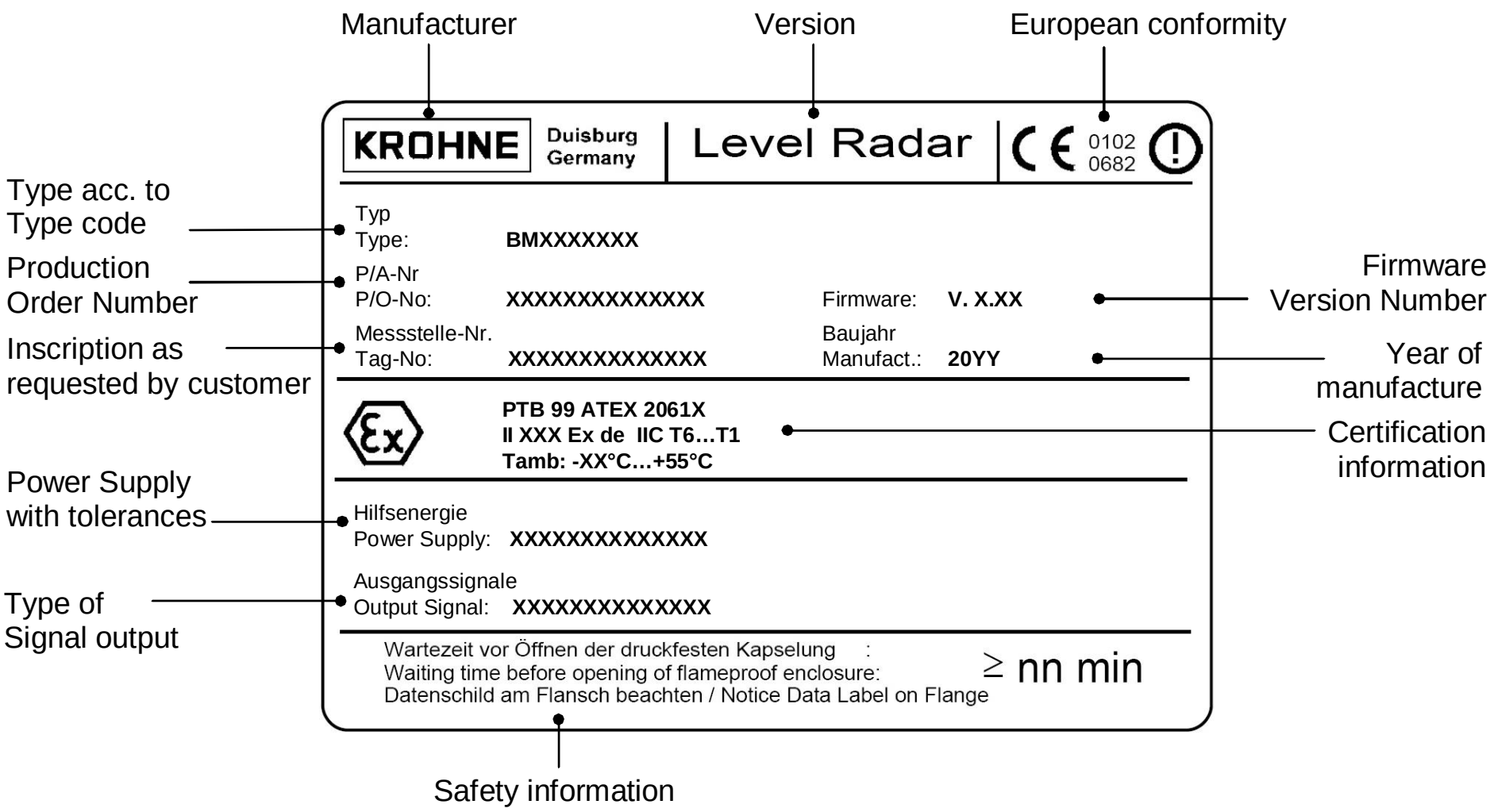
4.1.1. Signal converter without intrinsically safe I/O function

BM 70A-Ex	in Category 2G
BM 70P-Ex	in Category 2G
BM 700-Ex	in Category 2G

in combination with:
Flange system V96 or WS (rod antenna 1A, 1C, 3A and 3B)
in Category 1G
characterization: **II1/2 G**

in combination with:
Flange system WS (rod antenna 1B, 2A or 2B) in Category 2G
characterization : **II 2G**

NOTE:
In the case of the flange system WS with rod antenna 1C, 3A or 3B, be aware of application restrictions given in Section 3.2.1.!



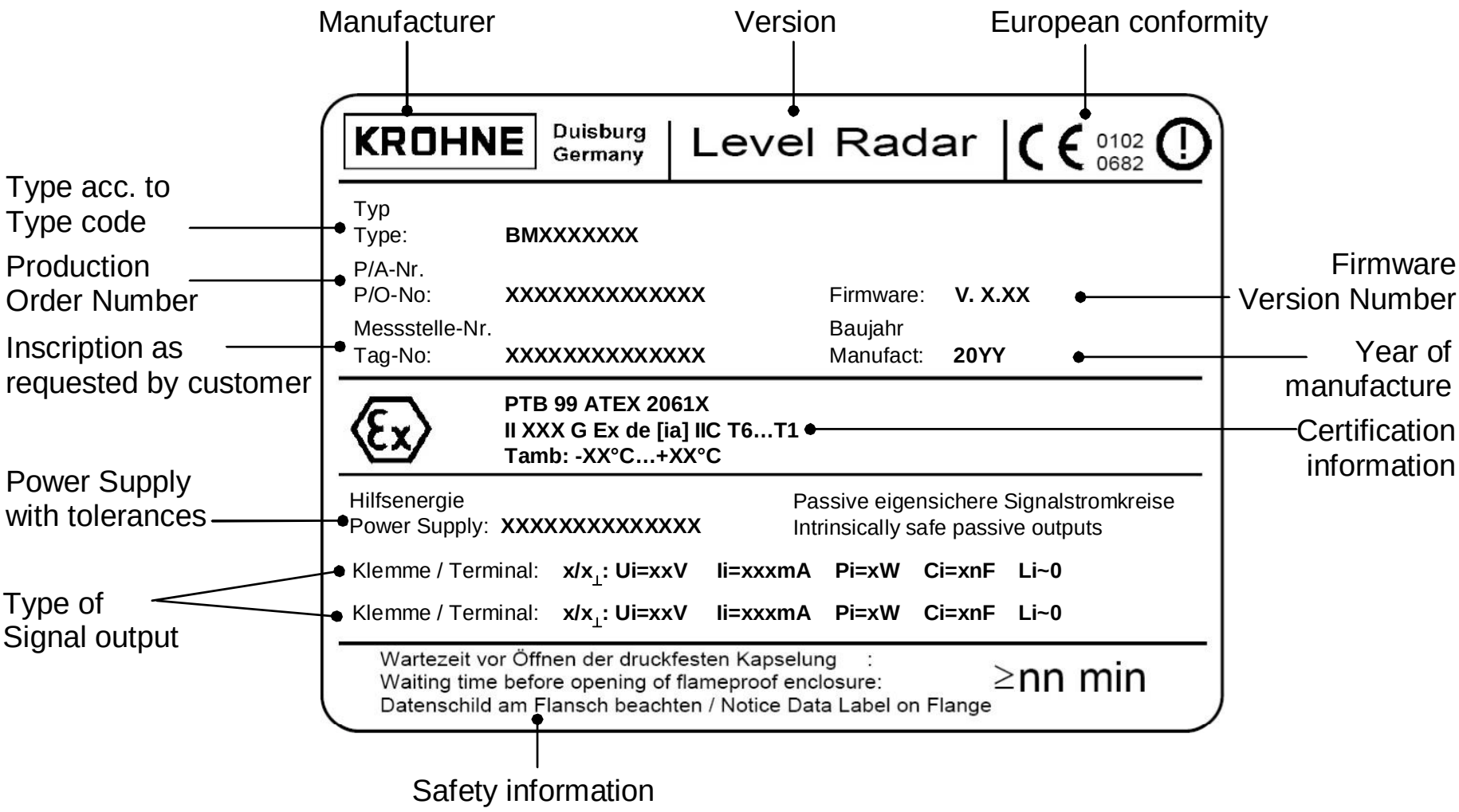
4.1.2. Signal converter with intrinsically safe signal outputs

BM 70Ai-Ex in Category 2G
BM 70Pi-Ex in Category 2G

in combination with:
Flange system V96 or WS (rod antennas 1A, 1C, 3A and 3B)
in Category 1G
characterization : **II 1/2 G**

in combination with:
Flange system WS (rod antennas 1B, 2A or 2B) in Category 2G
characterization : **II (1)2 G**

NOTE:
In the case of the flange system WS with rod antennas 1C, 3A or 3B be aware of application restrictions given in Section 3.2.1.!

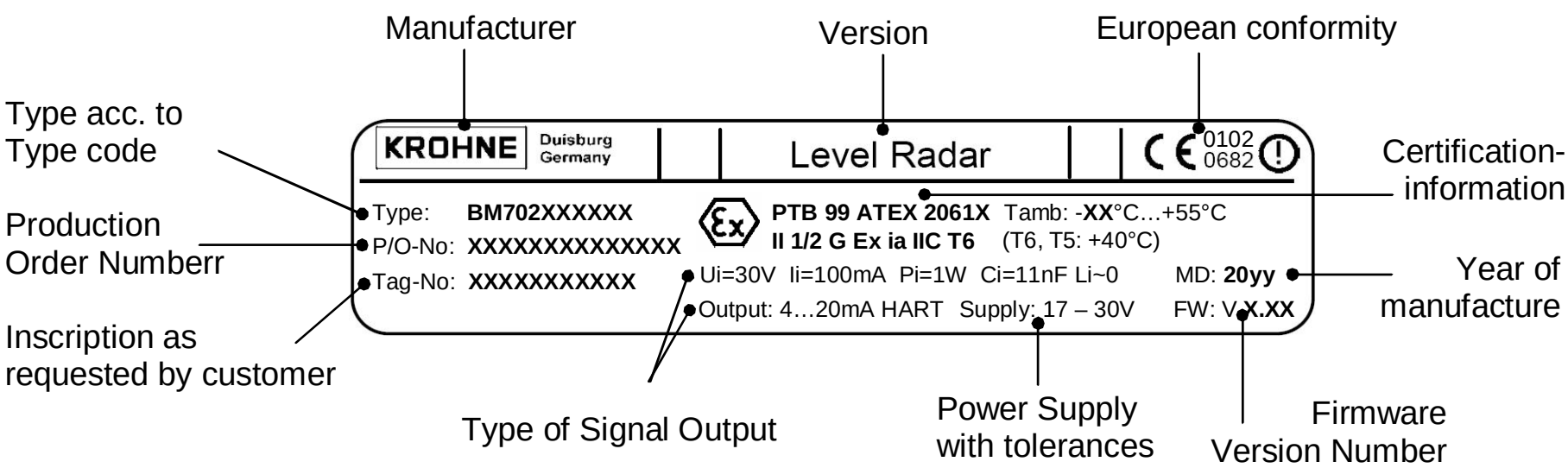


BM 702-Ex	in category 2G
BM 702 A-Ex	in category 2G

in combination with:
Flange system V96 or WS (rod antennas 1A, 1C, 3A and 3B)
in category 1G
characterization: **II 1/2 G**

in combination with:
Flange system WS (rod antennas 1B, 2A or 2B) in category 2G
characterization: **II 1/2 G**

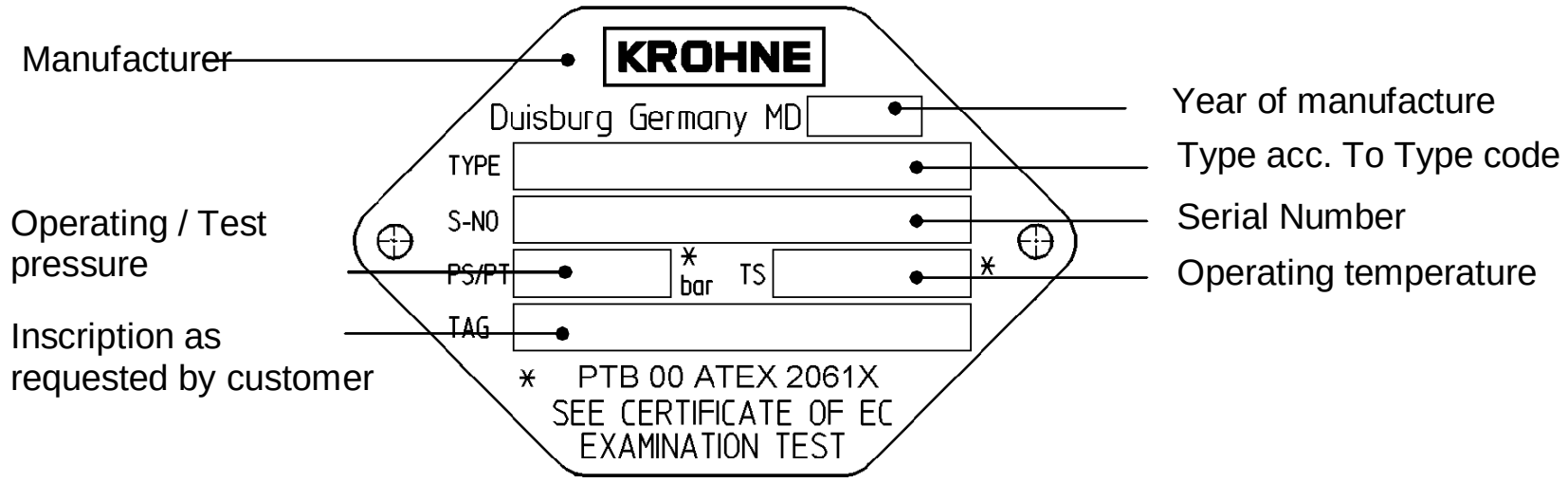
NOTE!
In the case of the flange system WS with rod antennas 1C, 3A or 3B, be aware of application restrictions given in Section 3.2.1 !



4.2 Marking - flange systems

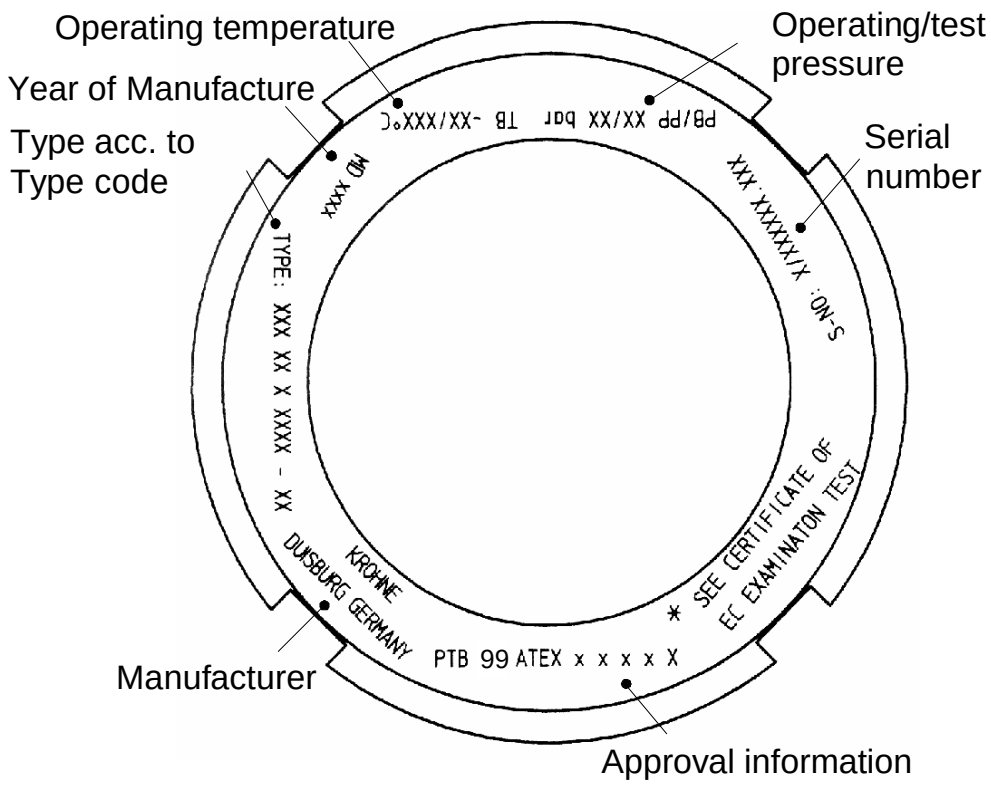
Marking of the flange systems with the metal plates reproduced below.

4.1.3. Flange systems V96 or WS with tank mounting flange (all versions)

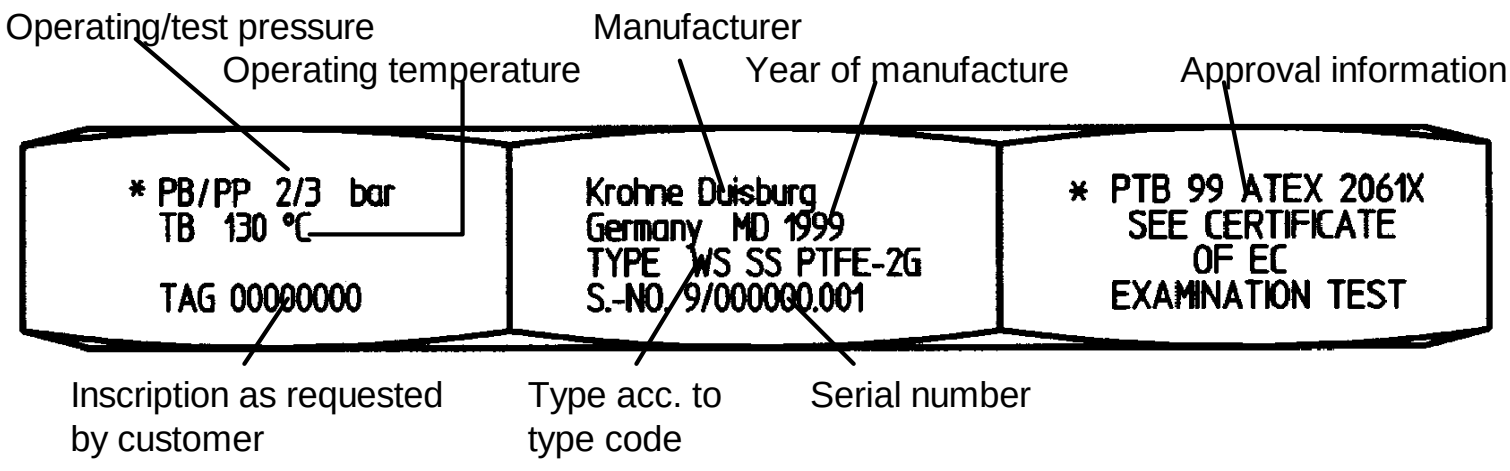


NOTE:
Be aware of application restrictions given in Section 3.2.1.!

4.1.4. Flange system WS with sanitary screw connection or threaded tank socket



NOTE:
Sanitary and G 1½" screw connections not permitted for use in Zone 0!



Attention!
When mounting the G 1½" screw connection you have to take care that the marking on the wrench faces will not be damaged (do not use pipe wrench!)

5. Assembly and installation

Assembly and installation shall, in accordance with the valid installation standards for hazardous locations (e.g. EN 60079-14 / VDE 0165), be carried out by specialist personnel who have received ‘training in explosion protection’.

In this connection, take note of the information given in the Installation and Operating Instructions and in these Supplementary Installation and Operating Instructions (‘Ex’) as well as the EC Type Test Certificate (see Annex A.1).

Check the suitability of the level gauge by comparing the information given on the nameplate with that given in Section 3.2.1 (Categories / Zone allocation), Section 2 (Type Code) and Section 4 (Identifying marking).

Attention is drawn in particular to the following points.

5.1. Flange systems

5.1.1. Flange system V96

Install appropriately to avoid mechanical loads and sparking caused by blows at the antenna and the extensions (e.g. by agitators).

5.1.1.1. Flange system V96 with heating

The operator shall ensure that the temperature of the heating medium, when used in Zone 0 or 1, shall not exceed 80% of the ignition temperature (in °C) of the products inside the tank, and shall not exceed the maximum allowable flange temperature as a factor of the Temperature Class, see Section 3.2.1.

The pressure of the heating medium should not exceed 6 bar. In addition, make sure that inlet and outlet are correctly connected when the system is operated (see information labels on the flange).

5.1.1.2. Flange system V96 with purging system

The locking screw for the purging system, together with the screw thread of the tank mounting flange, forms a flameproof joint when given at least five full turns. The quality grade of the thread of the inserted screw is ‘medium’ in accordance with DIN 13 and ISO 965.
This screw must be removed before the purge connection can be used. But do not remove the screw unless the tank is in non-pressurized condition. Adopt suitable measures to ensure that the purge connection is fitted with a flame trap. Together with the thread in the tank mounting flange, the connection screwed into the tank mounting flange must form a flameproof joint in conformity with EN 60079-1 (note thread quality grade and threaded length).
The choice of a suitable purging medium and operation of the purge connection are the responsibility of the operator.
When the purge connection is used, the operator shall ensure that no impermissible changes are made to the process conditions (e.g. temperature, pressure, etc.).

5.1.1.3. Flange system V96 with heating and purging devices

Please refer to the information given in Section 5.1.1.1 and 5.1.1.2.

5.1.2. Flange system WS (Wave Stick)

When installing the Wave Stick, make sure that:

- the rod is always screwed down to the stop (plate or collar),
- any integrated plate on antennas forms a proper sealing face,
- the conductive plate on conductive antennas has adequately conductive contact with the tank mounting flange (leakage resistance $\leq 10^6\ \Omega$)
- the antennas are not subjected to radial loads when being installed
- when mounting the G 1½" screw connection you will not damage the marking on the wrench faces (do not use pipe wrench!).

5.2. Electrical connection BM 70A.-Ex, BM 70P.-Ex und BM 700-Ex

5.2.1. General

5.2.1.1. Terminal compartment

The electrical connection of the power supply and I/O functions is made in the terminal compartment of the signal converter. The terminal compartment may optionally be designed in type of protection Ex e, Ex d, Ex ei or Ex di, as described in Section 2 (Type Code) and Section 3 (Main safety-relevant characteristics):

Terminal compartment in type of protection Ex e or Ex ei

Permissible as cable entries and blanking plugs are only parts certified to EN 60079-7. The cable clamping area for the supplied cable entries measures 9 - 16 mm. Use cables with the appropriate diameter, or approved cable entries with matched clamping area in accordance with their test certificate.

Terminal compartment in type of protection Ex d or Ex di

The cables can basically be routed into the flameproof terminal compartment in one of two ways.

1) Direct entry of the power cables by way of flameproof cable glands into the flameproof terminal compartment requires a separate test certificate to EN 60079-1 for the flameproof glands.

2) Direct entry of the power cables by way of conduits into the flameproof terminal compartment of the device requires, after the conduit has been screwed in, a flameproof joint in accordance with ISO 965 / DIN 13 with a minimum of five full turns depth of engagement. A suitable stopping box (EN 60079-1) shall be provided within 450 mm of the entry into the terminal compartment. Installation of the conduit must be carried out in keeping with its separate test certificate. As a rule, an EN 60079-1 certified adapter is required between the ‘PG thread’ (heavy-gauge conduit thread) of the terminal compartment and the conduit thread.

3) Direct entry of the power cords by use of conduits into the conical thread adapters. Only pipes with a connection thread, subject to the regulations of the adapter, are allowed to be entered into the thread adapters. The threads of the conduits must meet the requirements of the standard EN 60079-1 (min. number of 6 convolutions). A convenient spark arrester must be provided within 450mm distance in front of the connection room.

Attention!
Attention should be paid to the proper fastening of the thread adapters in the housing. This applies in particular after dismantling of the conduit. The devices have to be switched zero potential before dismantling the conduit.
The necessary standby time before opening the housing has to be considered before loosing the conduit adapters.

5.2.1.2. Power cables

The power cables for the non-intrinsically safe power circuits, and for the non-intrinsically safe or intrinsically safe I/O circuits, shall be selected in keeping with the valid installation standard (e.g. EN 60079-14 / VDE 0165).
Where elevated product temperatures are involved (see also Sections 3.3.2 and 3.3.3 ”Temperature Classes”), heat-resistant cables with a continuous service temperature of ≥ 80°C shall be provided in conformity with the type test certificate.

5.2.1.3. Connection of power and I/O functions

- Before connecting or disconnecting the electrical interconnecting cables of the device, make sure that all cables leading to the signal converter are isolated from the ground (reference potential) of the hazardous location. This also applies to safety conductors (PE) and equipotential bonding conductors (PA).

- The terminal clamps must be tightened with a torque of 0,7 Nm.

- All cores and shields of the power cables not safety-connected to the equipotential bonding system for the hazardous location should be carefully insulated from each other and from ground (test voltage 500Vrms for conductors of intrinsically safe cables, test voltage 1500Vrms for conductors of non-intrinsically safe cables).

- Connect all shields by the shortest possible route to the press-fitted U-clamp terminal (FE) in the terminal compartment. If shields are to be grounded at both ends (e.g. for EMC reasons), adequate equipotential bonding is required between the two shield ends to avoid unacceptable equalizing currents

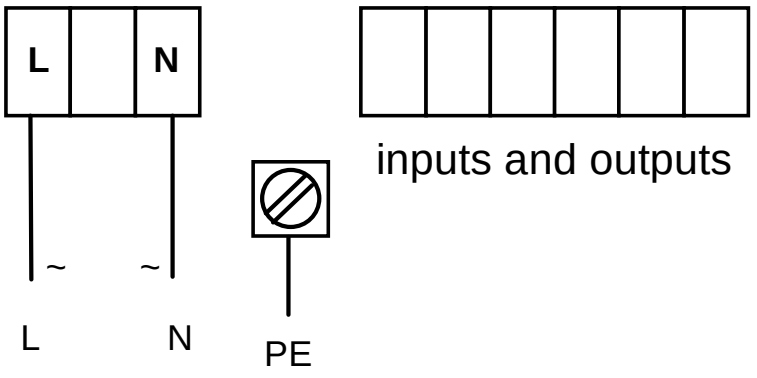
- Independent of the type of supply power, the device must be incorporated in the equipotential bonding system in the hazardous location. This can be done by way of a suitable conductive connection between the device flange system and the tank. If connection to the equipotential bonding system is to be made via a separate conductor, this must be connected to the outer press-fitted U-clamp terminal on the signal converter flange.

Given device versions with intrinsically safe I/O functions (BM 70Ai-Ex and BM 70Pi-Ex), only certified intrinsically safe equipment with the maximum values (see Section 3.1.4 and Type Test Certificate, Annex A.1) may be connected to the power terminals marked as being intrinsically safe. This requirement also applies when the device is not operated in the hazardous location!

5.2.2. Terminal assignment
5.2.2.1. Supply power

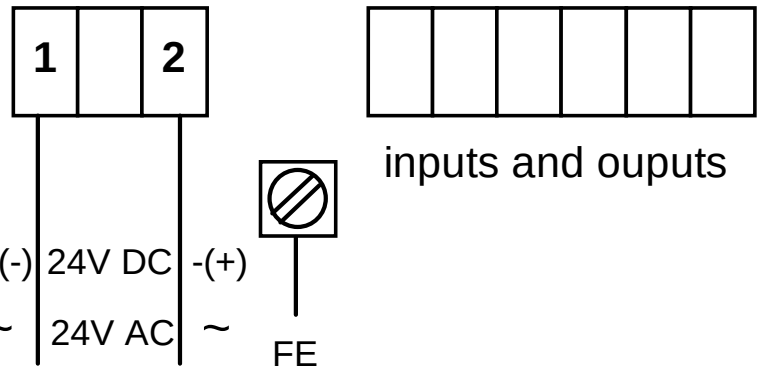
The power connection is of the non-intrinsically safe type for all Variants BM 70..-Ex and BM 700-Ex.

(BM 70..-Ex)



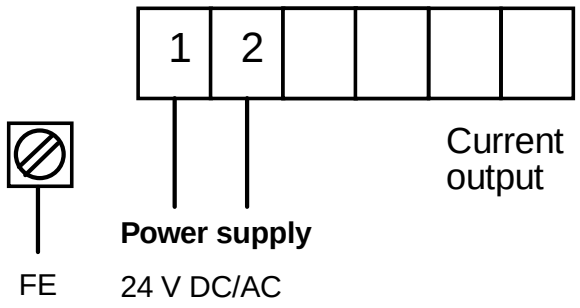
a. Power: low voltage
115 / 230V AC

(BM 70..-Ex)



b. Power: functional extra-low voltage
with safety separation (PELV) 24 V DC/AC
(Connection of a functional ground FE is not mandatory)

(BM 700-Ex)



c. Power: functional extra-low voltage
with safety separation (PELV) 24V DC/AC
(Connection of a functional ground
FE is not mandatory)

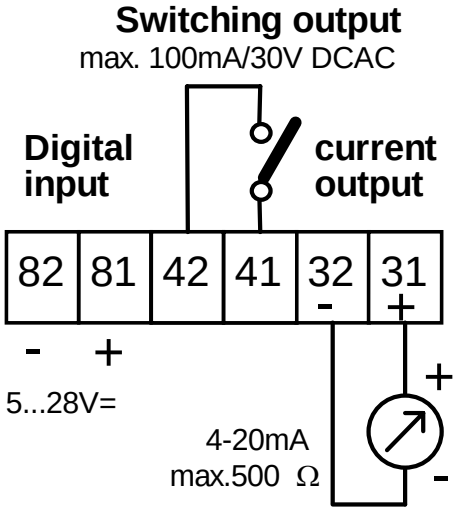
5.2.2.2. Terminal assignment - I/O functions

Non-intrinsically safe I/O functions and intrinsically safe I/O functions are available for the BM 70..-Ex. The BM 700-Ex has only non-intrinsically safe I/O functions:

Non-intrinsically safe I/O functions BM 70.-Ex und BM 700-Ex					
I/O function [(1)]		Fig.	available for variant		Electrical data
			BM 70.	BM 700	
Digital input + switching output + current output HART®	passive passive active	1	X	-	see Section **Fehler! Verweisquelle konnte nicht gefunden werden.**
Current output	active	2	X	X	
Interface RS 485 + current output	active	3	X	-	
[(1)] Only for connection to circuits with functional extra-low voltage with safety separation (PELV)					

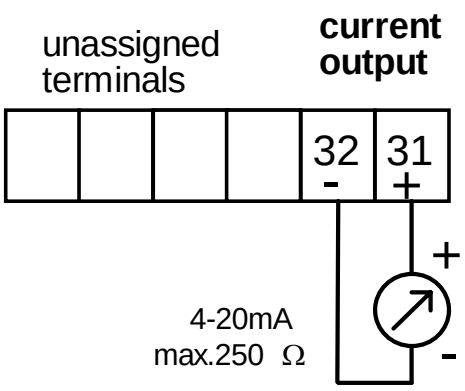
Intrinsically safe I/O function BM 70.i-Ex				
I/O function		Fig.	Variant	Maximum safety data
Current output HART®	passive	4	BM 70Ai BM 70Pi	see Section **Fehler! Verweisquelle konnte nicht gefunden werden.**
Current output HART® + switching output	passive passive	5		
Fieldbus PROFIBUS-PA	passive	6		
Fieldbus Fieldbus Foundation	passive	6		
Fieldbus PROFIBUS-PA / + current output HART®	passive passive	7		
Fieldbus Fieldbus Foundation + current output	passive passive	7		
Fieldbus PROFIBUS-PA + switching output	passive passive	8		
Fieldbus Fieldbus Foundation + switching output	passive passive	8		

Current output active, HART® (non-intrinsically safe)
Switching output passive (non-intrinsically safe)
Digital input passive (non-intrinsically safe)

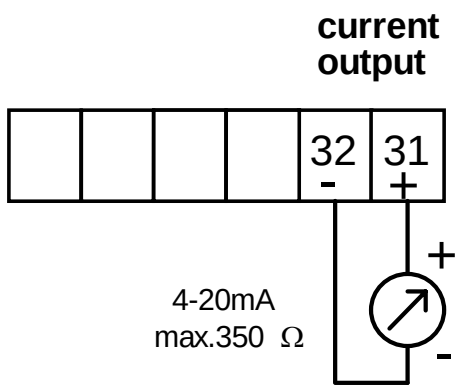


Current output active, HART® (non-intrinsically safe)

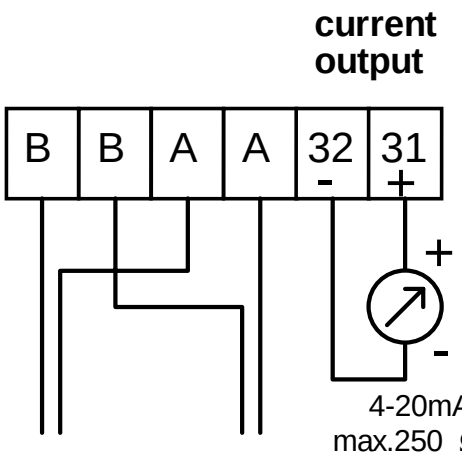
BM 70.-Ex



BM 700-Ex

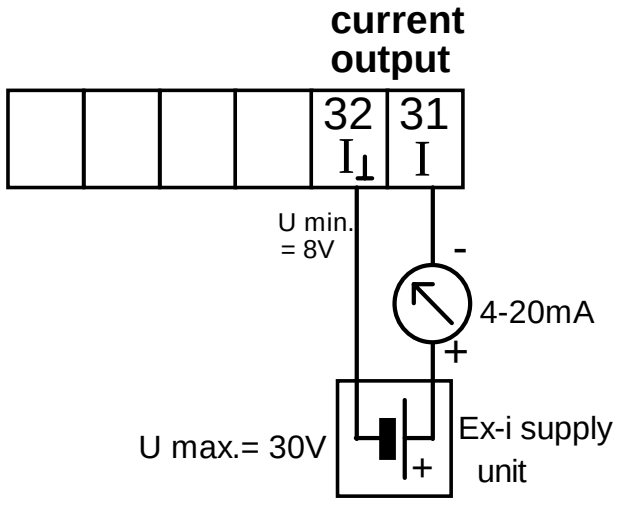


RS 485 interface (non-intrinsically safe)

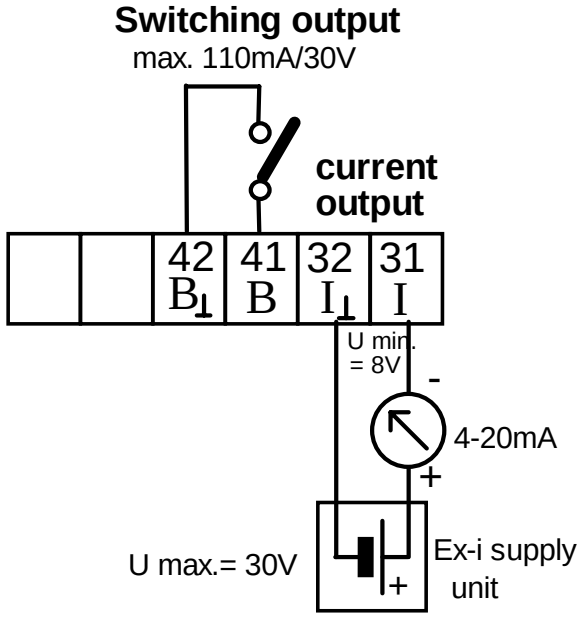


RS 485 input
RS 485 output

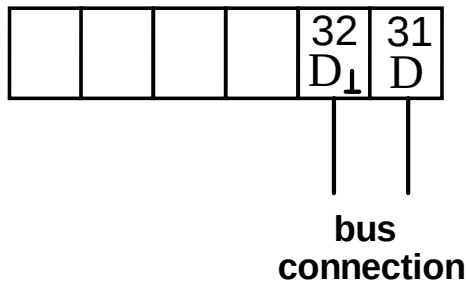
Current output HART® passive (intrinsically safe)



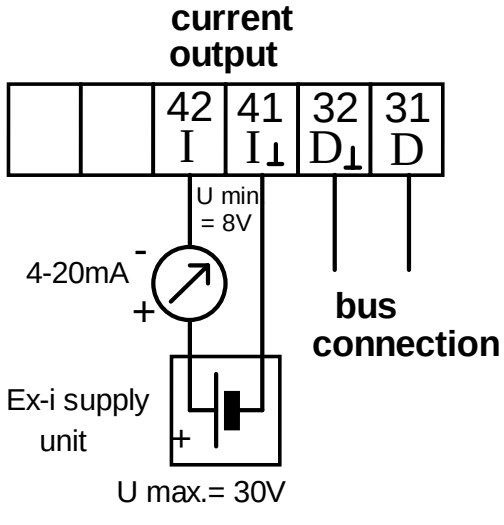
Current output HART® passive (intrinsically safe)
Switching output passive (intrinsically safe)



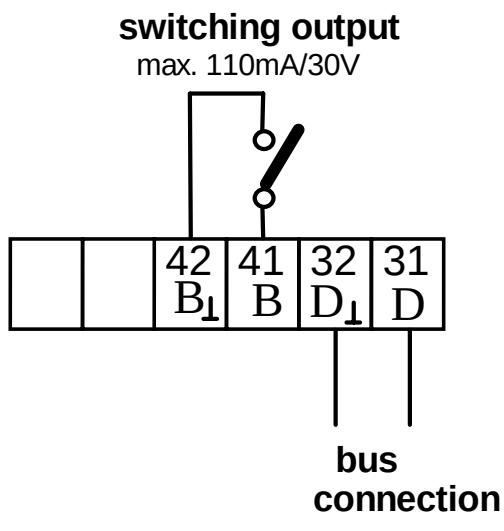
PROFIBUS-PA fieldbus or Foundation Fieldbus (FF) (intrinsically safe)



PROFIBUS-PA / FF with current output (intrinsically safe)



PROFIBUS-PA /FF with switching output (intrinsically safe)



5.3. Electrical Connection BM 702-Ex / BM 702 A-Ex

5.3.1. General Information

5.3.1.1. Terminal Compartment

The electrical connection is made in the terminal compartment of the converter.

The cable clamping range of the delivered cable entrances enfolds 9 - 16 mm.
There have to be used cables with appropriate bores or cable entrances with adapted clamping range.

5.3.1.2. Connecting Cables

The connecting cable for intrinsically safe electric circuits, is to choose appropriate to the valid installation standard.

By increased product temperatures (also see Section 3.3.2 and 3.3.3 "temperature class")
heat resistant cables with a permanent use temperature of 80°C have to be used according the type test certificate.

5.3.1.3. Connection power supply and I/O Function

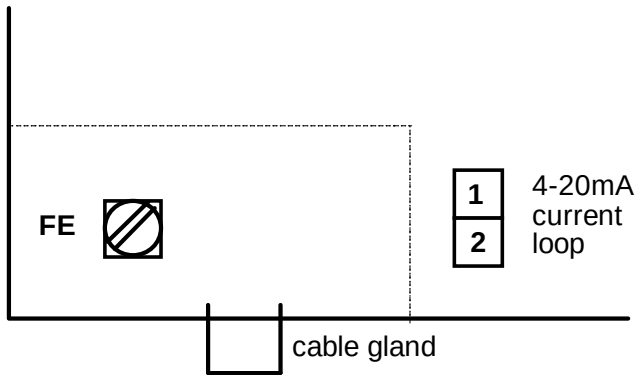
- The connections are carefully to insulate from all not used conductors, as well as from the screening of the connecting cable, against each other and towards earth. (Test voltage 500 V eff for conductors of the intrinsically safe cable).

- Only certified intrinsically safe equipment is allowed to be affiliated to the connecting clamps. At this the permitted maximum values (see section 3.1.4 and type test certificate annex A.1) have to be taken into account. This demand applies even, if the device is not operating in hazardous locations!

Connection assignment

Terminal Compartment BM 702-Ex / BM 702 A-Ex:

The polarity of the 4-20 mA
Connection is arbitrary



Attention!

It is not allowed to use the 10-pin service connector X6 in hazardous locations.

6. Start-up

Check the following before initial start-up:

- Check suitability of the materials used for the flange system (e.g. flange, gaskets and antenna) for adequate corrosion resistance to the product.
- Compare the data on the nameplates of the signal converter and flange with existing operating data.
- Check that signal converter and flange system are properly assembled.
- Check that the level gauge is properly mounted on the tank, including any optional equipment such as purge and/or heating system, and the signal converter.
- Check that the equipotential bonding system is properly connected.
- Check the connection for supply power and I/O functions.
- Check that the covers of the terminal and electronics compartment are firmly in place, that special locks have been tightened down.

7. Operation

Do not open the covers of terminal compartment and electronics compartment during operation in the presence of an explosive atmosphere.
Should parameterization of the device become necessary in the presence of an explosive atmosphere, this can be done by using the supplied ‘programming bar magnet’ and applying it to the glass window of the electronics compartment, without opening the housing, or digitally via the signal output.

If necessary the converter BM 702-Ex / BM 702 A-Ex may be opened.
Please note: when opening the housing no dirt and no humidity may enter into the housing and it must be excluded, that the electronic will be damaged.

8. Preventive maintenance

8.1. Signal converter

The signal converter requires no maintenance under normal operating conditions and when ‘used as prescribed’.
Should it prove necessary to open the flameproof enclosure of the electronics compartment in the presence of an explosive atmosphere, first make sure that the device is disconnected from the supply. Before opening the flameproof enclosure, be absolutely sure to allow the waiting time, specified on the nameplate of the signal converter (22 minutes for BM 70..-Ex and 10 minutes for BM 700-Ex), to elapse first.

Before connecting or disconnecting the device interconnecting cables, make sure that all cables leading into the signal converter are isolated from ground (reference potential) of the hazardous location. This also applies to safety conductors (PE) and equipotential bonding conductors (PA).
Exception: intrinsically safe operated converter of type BM 702-Ex / BM 702 A-Ex.

After any maintenance work has been carried out, be sure to grease the flameproof cover thread of the signal converter including seals with a resin-free and acid-free all-purpose grease again.
Use the multi-purpose grease NONTRIBOS®, type Li EP2.

Within the scope of checks required to be carried out in hazardous locations to maintain systems in proper working order, the following visual inspections should be carried out at regular intervals:

- Inspection of the housing, cable entries and incoming cables for signs of corrosion and damage.
- Inspection of the tank connections for leakages.

8.2. Flange systems

The flange systems do not require any maintenance under normal operating conditions and when ‘used as prescribed’. Depending on application, however, in unfavourable operating conditions the measuring function may be impaired by contamination of the antenna system. The antenna should then be cleaned as described in the Installation and Operating Instructions for non-hazardus-duty versions. Cleaning requires that the flange system be dismantled. This dismantling will need to be coordinated with field conditions (e.g. check for the existence of a flammable liquid or explosive atmosphere in or at the tank, pressurized tanks) and is the responsibility of the operator.

9. Dismantling

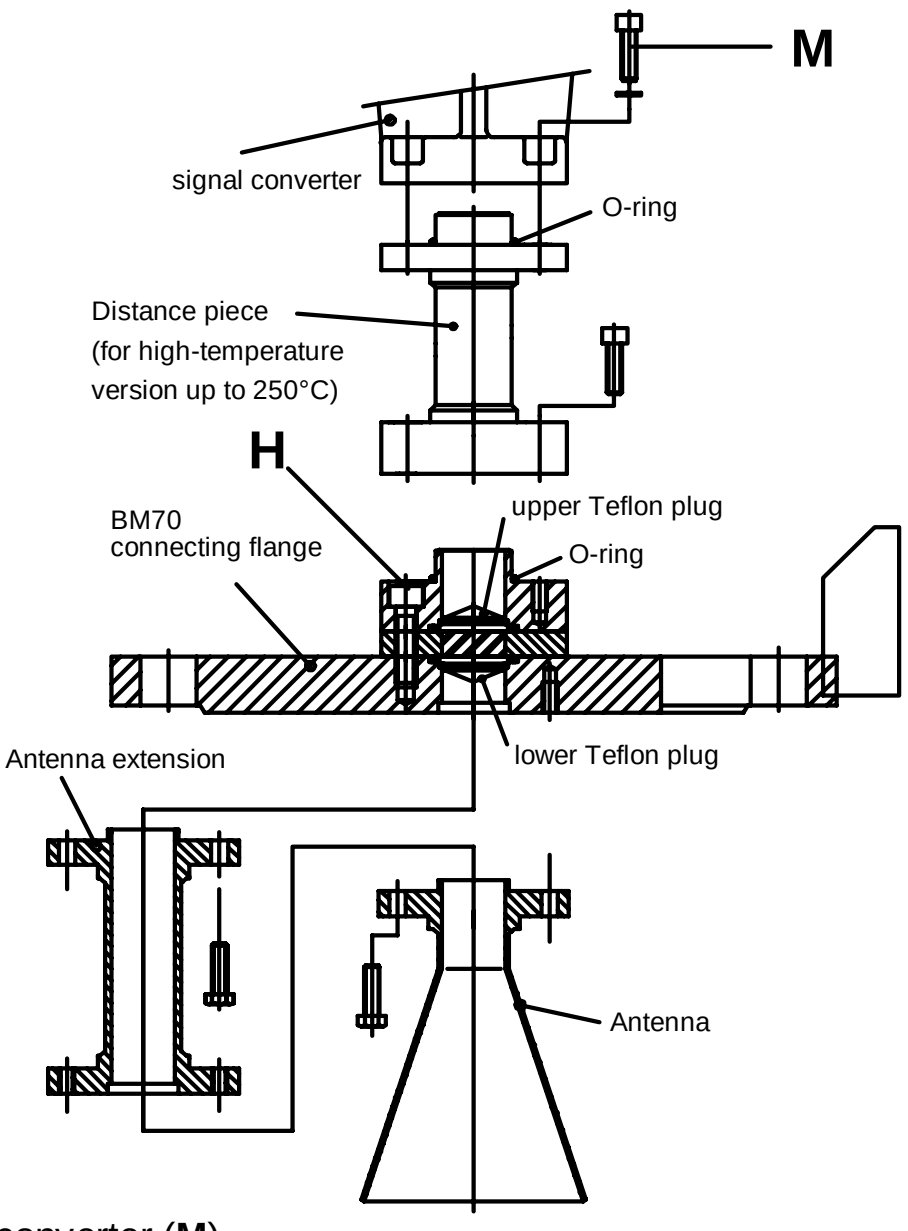
9.1. Replacement of the signal converter

The modular design of the BM 70..-Ex and BM 700-Ex devices allows replacement of the signal converter to be carried out by undoing screws M as shown in the diagram on the next page. The flange system need not be removed from the tank. This applies to pressurized tanks as well.

Caution:
On pressurized tanks, do not remove the 4 screws (**H**)
connecting the waveguide window to the tank mounting flange.
DANGER TO LIFE!

Before disconnecting the device interconnecting cables, make sure that all cables leading into the signal converter are isolated from ground (reference potential) of the hazardous location. This also applies to safety conductors (PE) and equipotential bonding conductors (PA). Exception: intrinsically safeoperated converter of type BM 702-Ex / BM 702 A-Ex.

Should it prove necessary to open the flameproof enclosure of the electronics compartment in the presence of an explosive atmosphere, first make sure that the device is disconnected from the supply. Before opening the flameproof enclosure, be absolutely sure to allow the waiting time, specified on the nameplate of the signal converter (22 minutes for BM 70..-Ex and 10 minutes for BM 700-Ex), to elapse first.



Assembly bolts for signal converter (**M**)

9.2. Replacement of complete device

The requirements described in Section 9.1 also apply in this instance.

In addition, make sure that the tank and all process connections are unpressurized.

Caution:
On pressurized tanks, do not remove the 4 screws (H), as shown in the diagram above, connecting the waveguide window to the tank mounting flange.
DANGER TO LIFE!

In connection with environmentally critical products, carefully decontaminate the wetted parts of the flange system after dismantling.

10. Maintenance

Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorized representative or under the supervision of authorized inspectors.