KROHNE

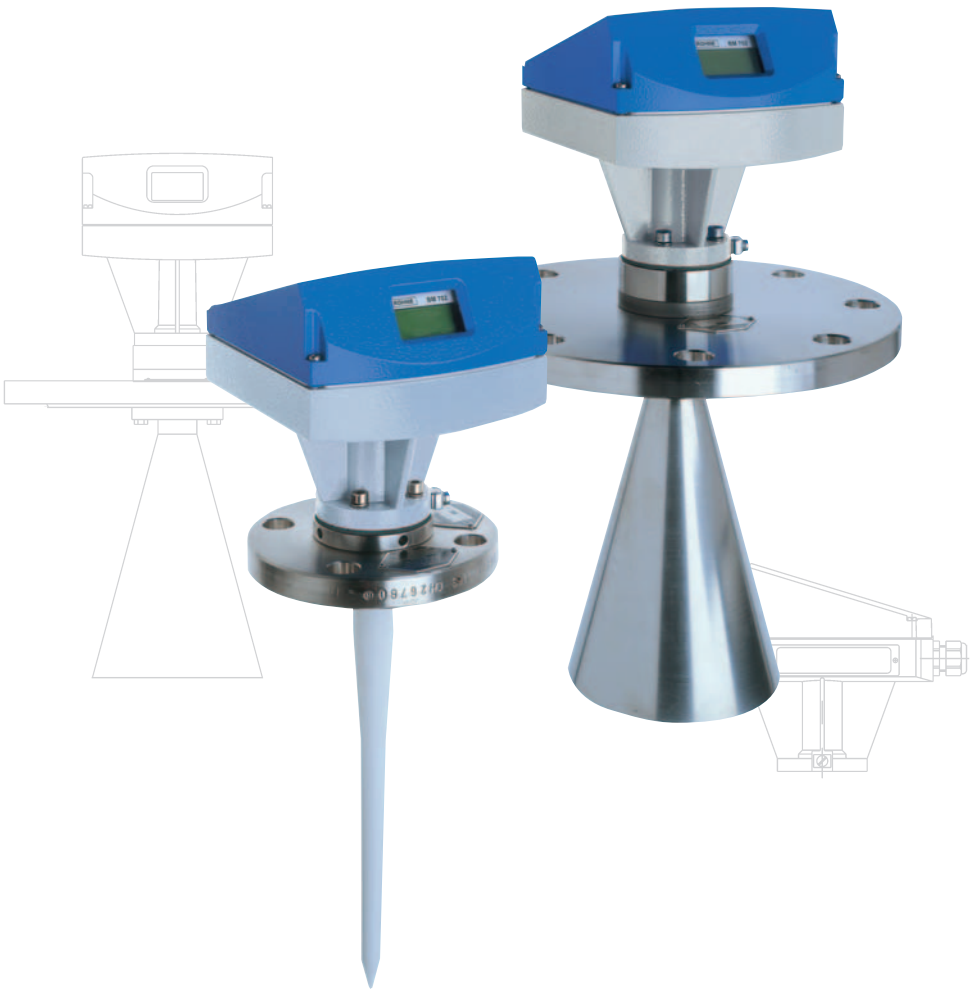
 7.02323.23.00

CMD

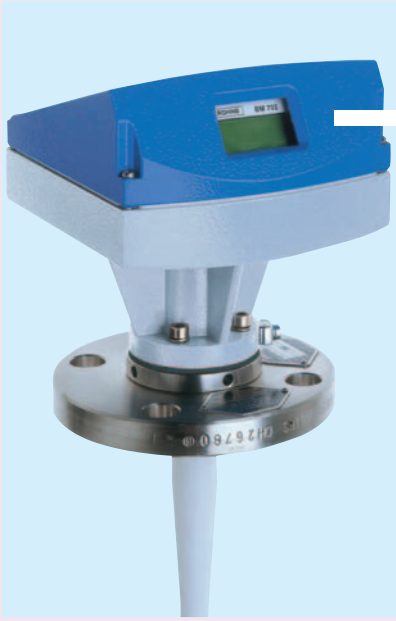
Level Gauge BM 702

2-Wire Level-Radar

2-Wire



- The first and only FMCW Radar Level Gauge with 2-wire technology
- The non-contact alternative to ageing technologies
- Maintenance-free



2-Wire Level-Radar BM 702

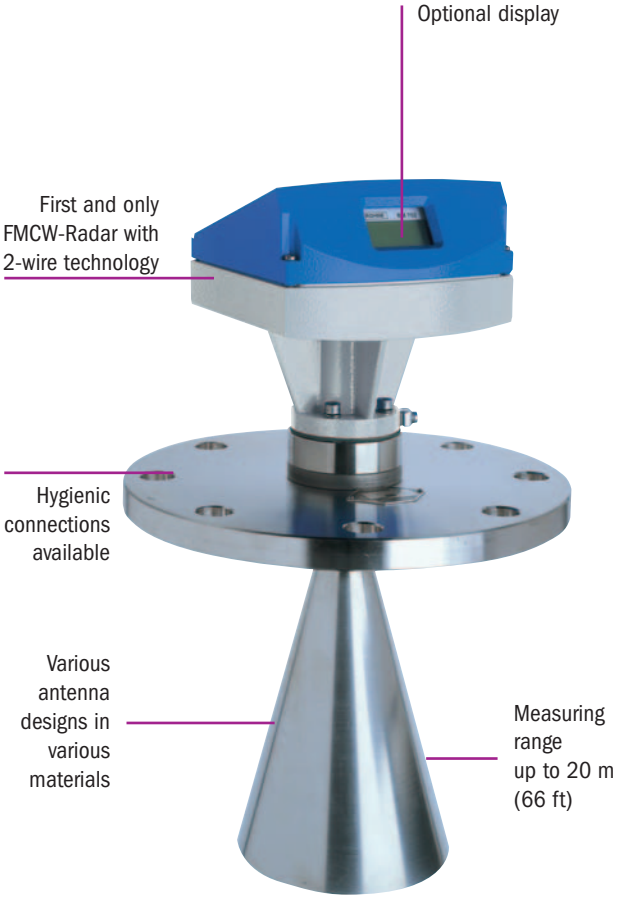
- **Replaces switches, displacers, ultrasonic meters and pressure transmitters**
- **Low cabling costs**
- **High accuracy and repeatability**

Operating principle

FMCW:
Frequency Modulated Continuous Wave

FMCW-Radar uses a high-frequency signal (~10 GHz) which increases in frequency linearity during the measurement (frequeny sweep). The signal is emitted, reflected on the measuring surface and received time-delayed. For further signal processing the difference Δf is calculated from the actual transmit frequency and the receive frequency. The difference is directly proportional to the distance i.e. a large frequency difference correspond to a large distance and vice versa.

This frequency difference is converted into a frequency spectrum using a Fourier transformation (FFT) and yields the distance to the surface. The level in turn is the difference between surface and previously determined empty tank distance.



Communication

BM 702 can communicate via this interface:

– **HART®**

For parametrisation and evaluation the user-friendly Software **PC-CAT** is available.

Flexibility through modular design

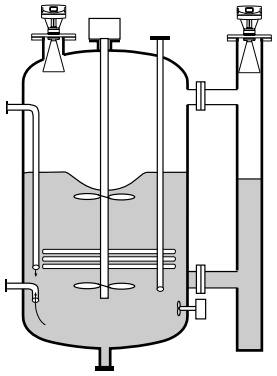
The system consists of:

- Converter
- Flange
- Antenna

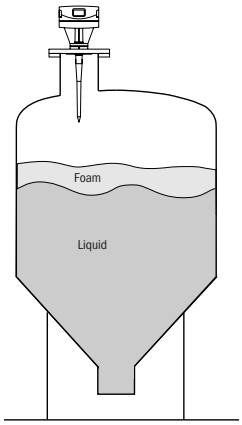
The antenna is completely encapsulated which means that the converter can be replaced without interupting the process, without purging the tank, and without having to discard the cleansing fluid as industrial waste.

Typical applications

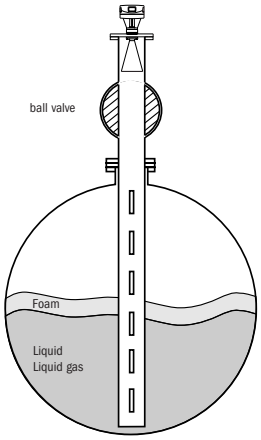
BM 702 Horn antenna mounted on a process tank and on a side vessel



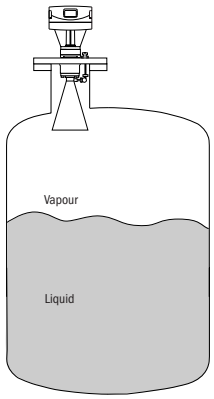
BM 702 Wave-Stick mounted on a process tank for the food and beverage industry



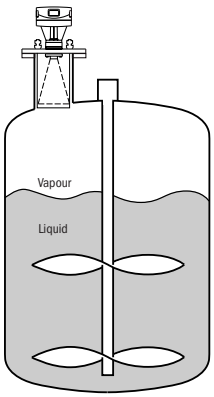
BM 702 Still-Pipe
on a liquefied-gas tank



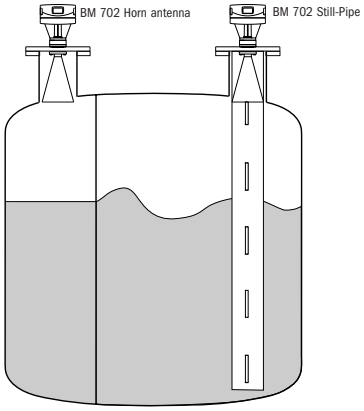
BM 702 Purging system
for cleaning, heating or cooling the antenna



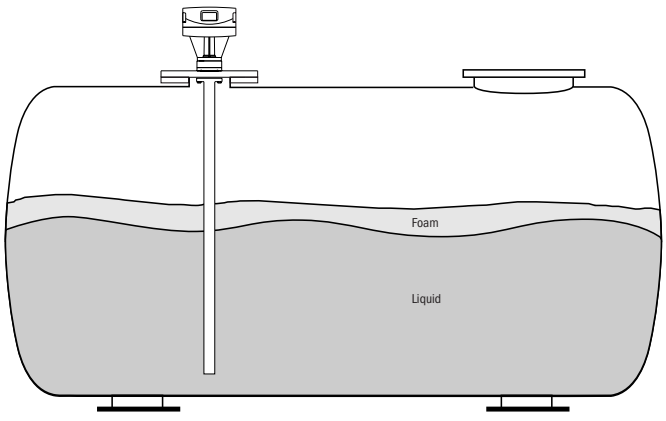
BM 702 Heating system
for condensing products



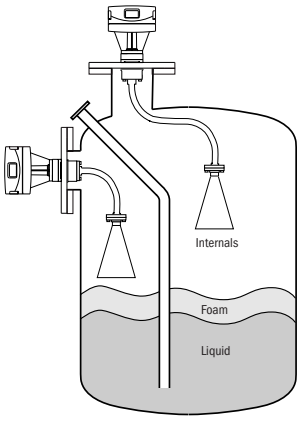
Horn antenna / Still-Pipe
on a storage tank



Wave-Guide
on a cylindrical tank in horizontal position



BM 702 with **curved** antenna extensions for difficult applications



Technical data

1 Application range	distance, level, volume measurement of liquids, pastes, slurries, in storage tanks, still wells or reference vessels
2 Operating mode/system structure	FMCW radar in the X band (8.5-9.9 GHz) with digital signal processing; compact device, modular design

3 Input

Measured quantities	
Primary quantity	distance
Derived quantities	level, volume
Measuring range	
Min. tank height	0.5 m (1.6 ft)
Max. measuring range	20 m (65.6 ft)
Block distance	min. 0.2 – 0.5 m (0.7 – 1.6 ft)
Rate of change in level	≤ 10 m/min (≤ 33 ft/min)

4 Output

2-wire connection	Type	passive (current sink); EEx-ia
	Current range	4 – 20 mA (error: 3.6/22 mA)
	Accuracy/linearity	0.1 % (rel. 20 mA; 20°C/68°F)
	Temperature drift	≤ 150 ppm/K (typically 50 ppm/K)
	Power supply	≥ 17 V (I = 4 mA); ≥ 13 V (I = 20 mA) max. 30 V
Failure signal	Current output: error signal 3.6/22 mA, plain text in local display	

5 Measuring accuracy

Error of measurement	min. ±1 cm (0.4") or ±0.2%
Repeatability	≤ 0.5 x error of measurement
Measured-value resolution	1 mm (0.04")
Ambient temperature effect	no temperature effect on measured value

6 Field service conditions

6.1 Installation conditions	avoid interference reflections and multiple reflections
6.2 Ambient conditions	
Hazardous locations	Zone 0, 1, 2; IIC/IIB, T1 –T6
Ambient temperature at signal converter	–20 ... +55°C (–4 ... +131°F); functional range: –40 ... +70°C (–40 ... +158°F)

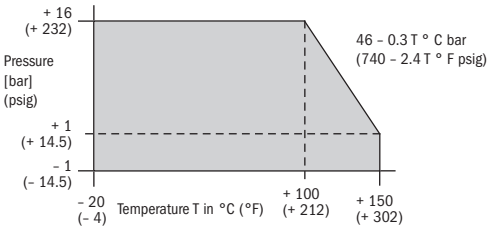
Flange temperature

Version	Min. flange temperature		Max. flange temperature	
	Standard version	Special version	w/o HT-distance piece	with HT-distance piece
V96 with horn antenna / Wave-guide with				
Gasket K4079	–20°C (–5°F)	–	+130°C (+260°F)	+250°C (+480°F)*
Gasket K2035	–20°C (–5°F)	–	+130°C (+260°F)	+210°C (+410°F)
Gasket K6375	–20°C (–5°F)	–	+130°C (+260°F)	+250°C (+480°F)
Gasket Viton / FEP	–15°C (+5°F)	–	+130°C (+260°F)	+200°C (+390°F)
Gasket Silicone / FEP	–30°C (–20°F)	–60°C (–75°F) on request	+130°C (+260°F)	+200°C (+390°F)
LP Flange system with horn antenna / Wave-Guide	–20°C (–4°F)	–	+130°C (+266°F)	–
Wave-Stick				
PTFE with flange plate	–20°C (–5°F)	–	+130°C (+260°F)**	+150°C (+300°F)**
PTFE w/o flange plate	–20°C (–5°F)	–	+130°C (+260°F)	+150°C (+300°F)**
PP w/o flange plate	–20°C (–5°F)	–	+100°C (+210°F)	–
	* Safety limit 280°C (536°F)		** pressure dependant, see below	

Environment class	Locations exposed direct to open-air climate, D1 Severity in conformity with EN 60654-1
Protection category EN 60529/IEC 529	(signal converter) IP 66 / IP 67
Shock resistance	Impact test to EN 61010, Sect. 8.2 with 0.5 J energy; drop test to prEN 50178
Vibration endurance limit	IEC 68-2-6 and prEN 50178 (10-57 Hz: 0.075 mm / 57-150 Hz: 1 g)
EMC	EN 50081-1, EN 50082-2; NAMUR Recommendation

6.3 Product conditions

Physical properties	No effect on measurement results; for reliable measurements, the relative permittivity should have the following minimum values:
Relative permittivity	$\varepsilon_r \geq 1.5$; $\varepsilon_r < 3$: still well recommended; Wave-Stick immersed: $\varepsilon_r \geq 4$
Product limitations	liquid ammonia (NH_3); liquid hydrogen (H_2); liquid helium (He)
Process temperature	Unrestricted (but be aware of ambient and flange temperatures!)
Operating pressure	
Horn antenne/Wave-Guide	dependent on flange size and pressure rating (see table) Standard: up to 40 bar (580 psig) (higher on request)
Wave-Stick	w/o flange plate: ≤ 2 bar/29 psig with flange plate: see diagram



7 Component parts

Dimensions and weights	see “Dimensions and weights”	
Materials		
Signal converter housing	Aluminium with electrostatic powder coating; sight window: glass	
Flange system, antenna, antenna extension	Stainless steel 1.4571 (316 Ti) or 1.4435 (316 L), Hastelloy C4 or B2, titanium, tantalum (information on other materials available on request)	
Gaskets	Kalrez 4079, 2035, 6375; Viton (FPM); FEP-coated (basically, in all versions, PTFE is also in contact with the product)	
Wave-Stick	only PP or PTFE in contact with the product; flanges made of stainless steel 1.4571 (316 Ti)	
Process connection		
Horn antenna/Wave-Guide	DIN 2501/DIN 2526, Form C ASME B 16.5	DN 50 – DN 200, PN 6 – PN 64 2”– 8”, 150/300 lb/RF
Wave-Stick	DIN 2501/DIN 2526, Form C ASME B 16.5	DN 50 – 150 G 1½, 2”– 6”
Dairy screw connection	DIN 11851 SMS 1145	DN 50, DN 65, DN 80 51 mm, 63 mm, 76 mm
Tri-Clamp connection	ISO 2852	2”– 4”
Electrical connection	Cable entries Terminals FE and PA	1 x M 20 x 1.5 0.5 – 1.5 mm² (solid conductor: max. 4 mm²) U-clamp terminal (max. 4 mm²)

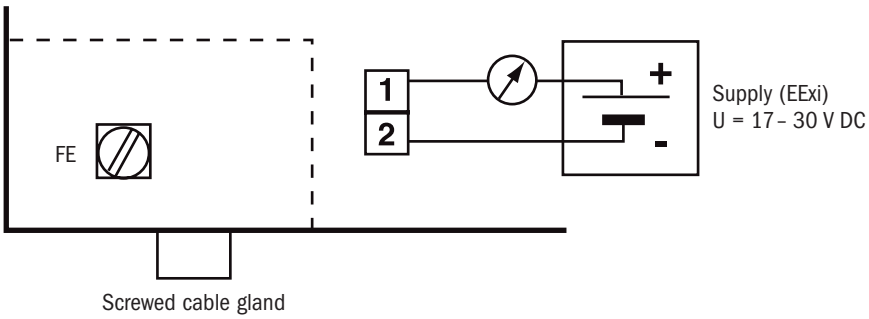
8 Local operator interface

Key pad	4 keys
Local display	3-line LCD
Operator interface language	English, German, French, Spanish, Portuguese, Swedish, Italian
Units of measurement	Lengths: m, cm, mm, inch, ft, %, Volume: m³, Liter, US Gal, GB Gal, ft³, bbl, %

9 Power supply

Over 2-wire-connection	4 – 20 mA

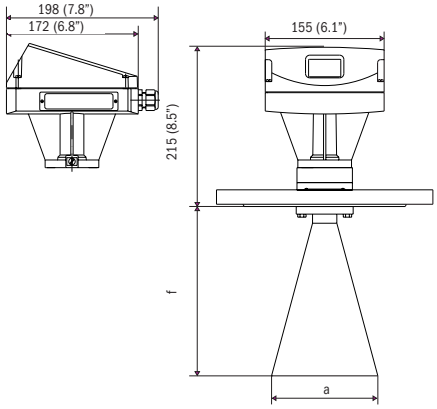
Electrical connection



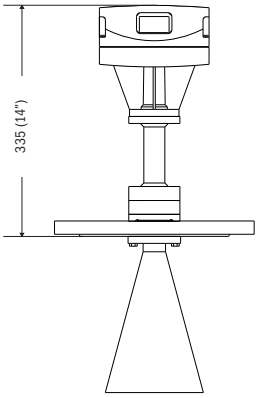
Any polarity possible.

Dimensions and weights

BM 702 Horn antenna



High-temperature version



Flange connections to:

DIN 2501 (BS 4504) DN 50 – DN 200 / PN 6 – PN 64

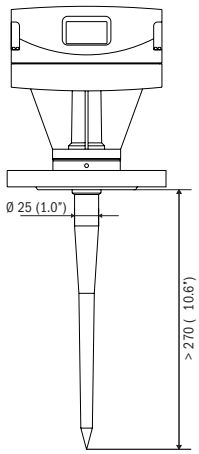
ASME B 16.5 2"– 8" / Class 150/300 lb/RF

Nominal size to		Antenna	Dimensions in mm (inches)				approx. Weight
DIN (BS) DN	ASME inches	Type	dia. a	SS 1.4571 or SS 316 Ti f	Hastelloy C4 f	Titanium, tantalum f	kg (lb)
80	3	1	80 (3.15)	110 (4.33)	145 (5.71)	110 (4.33)	9 (20)
100	4	2	100 (3.94)	148 (5.83)	177 (6.97)	146 (5.75)	10 (22)
150	6	3	140 (5.51)	223 (8.78)	250 (9.84)	220 (8.66)	16 (35)
200	8	4	200 (7.87)	335 (13.19)	360 (14.17)	332 (13.07)	21 (46)

Subject to change without notice

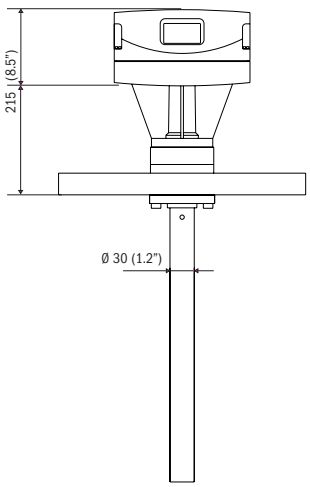
BM 702 Wave-Stick

Weight DN 50: approx. 6 kg (13.2 lb)



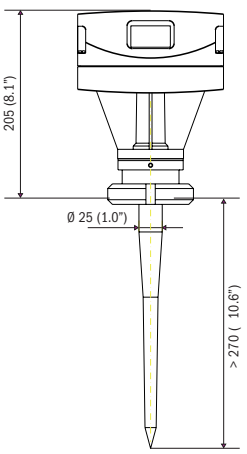
BM 702 Wave-Guide

Weight DN 50; 1 m (3.9"): approx.: 7 kg (15.4 lb)



BM 702 Wave-Stick

(Dairy screw connection to DIN 11851):
approx. 4.4 kg (8.8 lb)



Dimensions in mm (inches)

User program PC-CAT for Windows

Our BM 702 is easy to install. To facilitate configuration, each unit is supplied with the intuitive and time-tried software, PC-CAT for Windows. PC-CAT provides a number of useful features including:

- Quick on-site configuration
- Print-out of configuration protocol
- Simple conversion, volume or correction tables
- Check routine to monitor functionality of the BM 702
- Monitoring and recording of the radar signal during operation
- Trend and evaluation of the signal during operation

PC-CAT works on all IBM-compatible PC's using Windows 9x or NT.

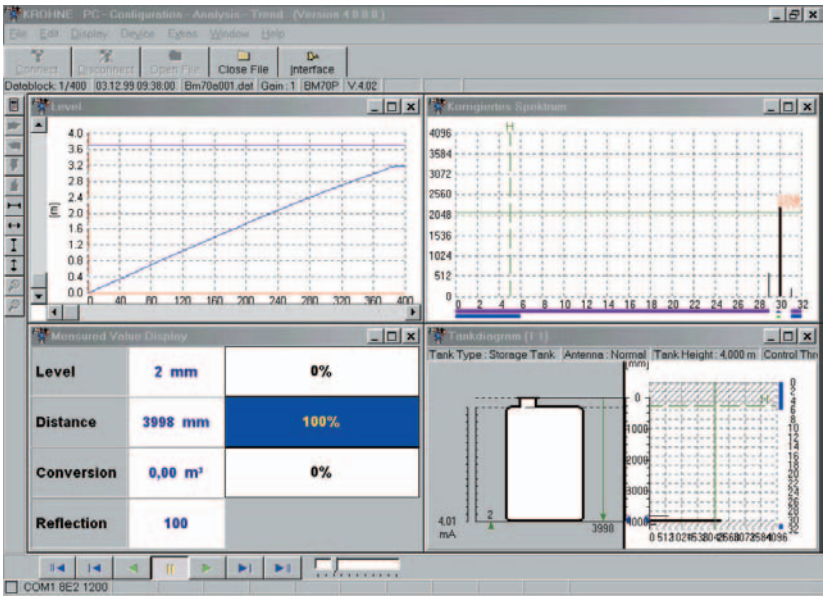
PC-CAT Version 4.00 and higher can communicate with all current KROHNE level radar gauges including BM 70 A/P, BM 700, BM 702 versions, also with HART® protocol and RS 485.
The PC-CAT kit includes a PC adapter for current output. The adapter can be connected to the PC's standard RS 232 interface.

PC-CAT allows convenient remote control of all functions of the signal converter. The vessel can be shown in schematic form together with the associated measured values and the measured spectrum. A trend graph of the output signal and threshold signal strength is also provided. All relevant instrument data can be recorded in the form of a data set small enough to be stored on a floppy disk or transferred electronically. Stored data can also be used for configuring other units of the BM 70 product line.

PC-CAT files can later be used to analyse the performance of the level gauge. All graphs and screens can be exported to word processing systems or other programs.

The customer's PC containing PC-CAT is connected to the current output via the supplied PC adapter, max. distance from the level gauge: 1000 m or 3300 ft. The PC adapter has no effect on in-line instruments such as milliammeters, recorders, etc., connected to the current output.

With every BM 702 delivery you get the freeware program PC-CAT for Windows Lite (Vers. 4.01 / Order No.: V 5001 00 506). Herewith you can perform the normal configuration, simple analyses and record PC-CAT files - all you need is a regular HART®-adapter.



Approvals

Application	Approved by	Instrument version	Certification mark
Explosion protection in stationary storage tanks for flammable, water pollutants liquids, classes AI, AII and B	PTB (II 1/2 G EEx de IIC T1 – T6, Zone 0)	BM 70.Ex BM 70.i	PTB 99 ATEX 2061 X
	(EEx de (Ia)/(Ib) IIC/IIB T1 – T6, Zone 0)		JI 300 8930
	FM / USA		
	CSA / Canada		
	RIIS / Japan		