Data sheet
D184S043U02

Electromagnetic Flowmeter FXT4000 (COPA-XT)

2-Wire Compact Design with Pulsed DC Excitation

Function

- Electromagnetic flowmeters can be used to accurately measure the flowrate of liquids, pulps, slurries and sludges
- Minimum fluid conductivity 20 µS/cm
- The flowmeter system consists of a flowmeter primary and a 2-Wire converter in a compact design

Applications

- Suitable for flowrate measurements in Chemical and Pharmaceutical industries, system manufacture, Water and Waste Water facilities and other fields.
- The multitude of products which can be metered speaks to the great flexibility and effectiveness of the measurement principle.

Flowmeter Advantages

- 2-Wire design reduces installation costs
- Straight forward, menu controlled operator interface
- Parameters can be set from the outside using a Magnet Stick
- EEPROM-Module for ease if converters are exchanged
- Long term, stable accuracy ≤ 1 % of rate
- HART-Protocol with (4-20) mA
- Binary output can be set as a pulse or contact output

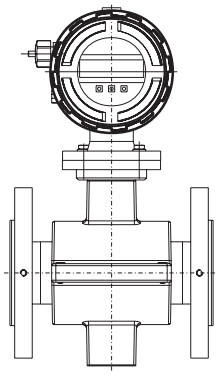
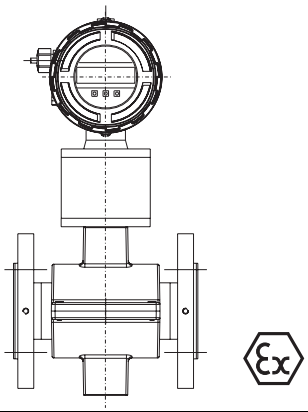
Important Flowmeter Features

- Pressure Equipment per EU-Pressure Equipment Directive 97/23/EG
- Flanges per DIN/ANSI/JIS DN 10 - DN 100 [3/8" - 4"]
- Approved for installation in Ex-Area „Zone 1" per ATEX: II 2G EEx emd [ib] IIC T3 ... T6

HART® FIELD COMMUNICATIONS PROTOCOL

Pulsed DC Magnetic Field Compact Design

Overview, Flowmeter Primary and Converter Designs for Models DT43F, DT47F

		
Models	**Flanged**	**Flanged**
Accuracy	1 % of rate	1 % of rate
Model Number	**DT43F**	**DT47F**
Flowmeter Primary		
	Sizes Pressure	Sizes Pressure
Flange design DIN 2501	DN 10– 100 [3/8" - 4"] PN 10– 40	DN 10– 100 [3/8" - 4"] PN 10– 40
Flange design ASME B 16.5	DN 3/8" – 4" CL 150/300	DN 3/8" – 4" CL 150/300
Flange design JIS B 2210–10K	DN 10– 100 [3/8" - 4"] PN 10	DN 10– 100 [3/8" - 4"] PN 10
Liner	Hard rubber, soft rubber, PTFE, others upon request	Hard rubber, soft rubber, PTFE, others upon request
Conductivity	≥ 20 µ S/cm	≥ 20 µ S/cm
Electrode material Signal and/or grounding electrodes	SST 1.4571[316Ti], SST 1.4539, Hastelloy B3/C4, Platinum-Iridium, Tantalum, Titanium	SST 1.4571[316Ti], SST 1.4539, Hastelloy B3/C4, Platinum-Iridium, Tantalum, Titanium
Protection Class	IP 67	IP 67
Fluid temperature	(-25 to +130) °C (-13 to +266) °F	(-25 to +130) °C (-13 to +266) °F see Temperature Class and liner
Ambient temperature	(-20 to +60) °C (-4 to +140) °F	(-20 to +60) °C (-4 to +140) °F
Converter		
Supply power (operating voltage)	14 V– 42 V DC	14 V– 20 V DC for Ex „ib"; 14 V– 42 V DC for Ex „e"
Current output	4– 20 mA	4– 20 mA "ib" or "e"
HART-Protocol	yes	yes
Profibus	in preparation	in preparation
Binary Output		
Pulse output	Opto	Opto
Alarm	yes	yes
Forward/reverse flow metering	yes	yes
Self monitoring	yes	yes
Display, Operation		
Local display / totalization	yes	yes
Fluid monitoring	yes	yes
Display with Magnet Stick operation	yes	yes
Approvals		
EEx-Design TÜV 98 ATEX 1333 X	–	II 2G EEx emd [ib] IIC T3 ... T6

Accuracy, Reference Conditions and Operating Principle

Reference Conditions per EN 29104:

Fluid temperature

20 °C ± 2K

Ambient temperature

20 °C ± 2K

Supply power

Nominal voltage, see Instrument Tag U_N ± 1 %

Installation per EN 29104

Upstream >10xD straight pipe section,
Downstream >5xD straight pipe section
Please see also the FXT4000 (COPA-XT) Operation Manual

Warm up time

30 min

Effect of analog output

Additional ± 0.1 % of rate based on the digital flowrate value displayed (HART®, display indication)

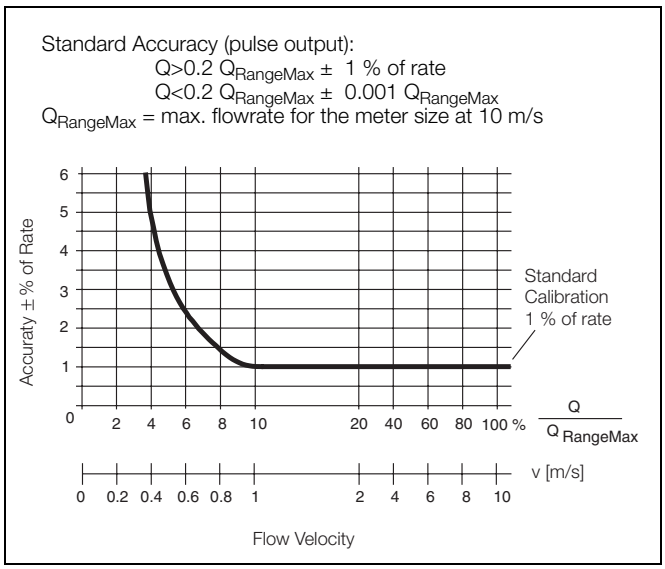


Fig. 1: Flowmeter System Accuracy FXT4000

Operating Principle

The operation of the electromagnetic flowmeter is based on Faraday's Laws of Induction. A voltage is generated in a conductor as it moves through a magnetic field.

This measurement principle is applied to a conductive fluid which flows in a pipe through which a magnetic field is generated perpendicular to the flow direction (see Schematic).

The signal voltage $\mathbf{U_E}$ which is induced in the fluid is measured at two electrodes located diametrically opposite to each other. This signal voltage $\mathbf{U_E}$ is proportional to the magnetic induction **B**, the electrode spacing **D** and the average fluid velocity **v**.

Noting that the magnetic induction **B** and the electrode spacing **D** are constant values, indicates that a proportionality exists between the signal voltage $\mathbf{U_E}$ and the average flow velocity **v**. The equation for calculating the volumetric flowrate shows that the signal voltage $\mathbf{U_E}$ is linear and proportional to the volumetric flowrate.

The induced signal voltage is converted into scaled analog and digital output signals in the converter.

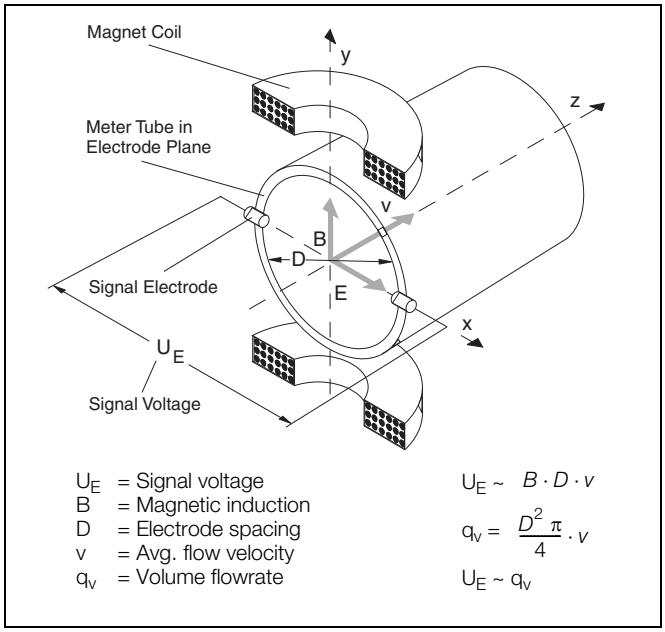


Fig. 2: Electromagnetic Flowmeter Schematic

Meter Sizes, Pressure Ratings, Flow Ranges and Flowrate Nomograph

Meter Size DN	Inch	Std. Press. Rating PN	Min. Flow Range Flow Velocity (0 to 0.5) m/s		Max. Flow Range Flow Velocity (0 to 10) m/s	
10	3/8	40	0 to 2.25	l/min	0 to 45	l/min
15	1/2	40	0 to 5	l/min	0 to 100	l/min
20	3/4	40	0 to 7.5	l/min	0 to 150	l/min
25	1	40	0 to 10	l/min	0 to 200	l/min
32	1-1/4	40	0 to 20	l/min	0 to 400	l/min
40	1-1/2	40	0 to 30	l/min	0 to 600	l/min
50	2	40	0 to 3	m^3/h	0 to 60	m^3/h
65	2-1/2	40	0 to 6	m^3/h	0 to 120	m^3/h
80	3	40	0 to 9	m^3/h	0 to 180	m^3/h
100	4	16	0 to 12	m^3/h	0 to 240	m^3/h

Flowrate Nomograph

The volume flowrate is a function of both the flow velocity and the flowmeter size. The Flowrate Nomograph shows the flow range applicable to each flowmeter size as well as the flowmeter sizes suitable for a specific flowrate.

Example:

Flowrate = 7 m^3/h (maximum value = flow range end value).
Suitable are flowmeter sizes DN 20 to DN 65 [3/4" to 2-1/2"] for a flow velocity from 0.5 to 10 m/s.

Flanged Design and Pressure Ratings

Size	Flanges	Material	PN	PED
DN10 – 25 3/8"– 1"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	40 bar CL 150, CL 300 10 bar	SEP Art.3 Par. 3
DN32 1-1/4"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	40 bar CL 150, CL 300 10 bar	Certificate of Compliance per Category III, Model B1 + D, Fluid Group 1
DN40 1-1/2"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	40 bar CL 150, CL 300 10 bar	
DN50 2"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	40 bar CL 150, CL 300 10 bar	
DN65 2-1/2	DIN ASME JIS	SS 1.4571 [316Ti} or steel	16, 40 bar CL 150, CL 300 10 bar	
DN80 3"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	40 bar CL 150, CL 300 10 bar	
DN100 4"	DIN ASME JIS	SS 1.4571 [316Ti} or steel	16, 40 bar CL 150, CL 300 10 bar	

Other pressure ratings upon request

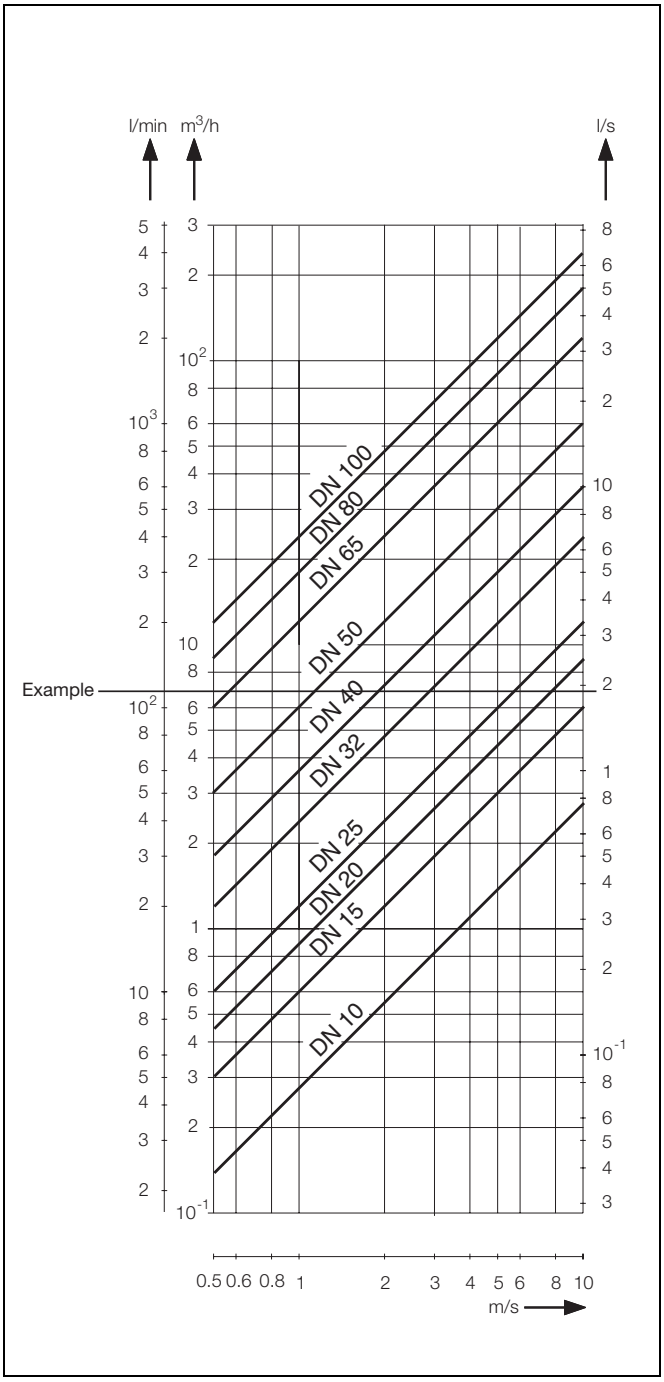


Fig. 3: Flowrate Nomograph DN 10 to DN 100 [3/8" to 4"]

Material Load Curves

Liner: PTFE, hard/soft rubber (limited to 90 °C, 194 °F)

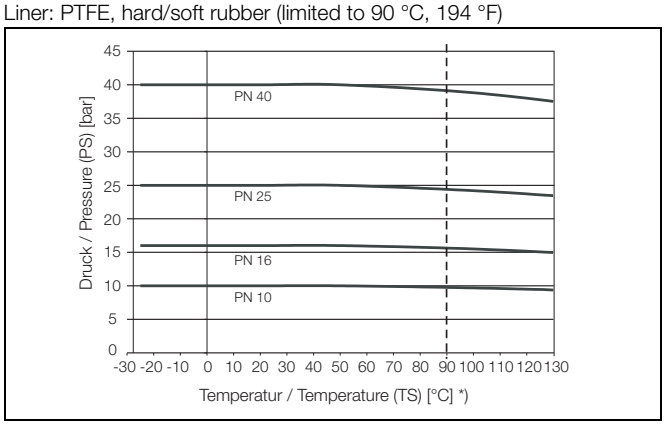


Fig. 4: DIN-Flanges SS 1.4571[316Ti] to DN 100 [4”]

Liner: PTFE, hard/soft rubber (limited to 90 °C, 194 °F)

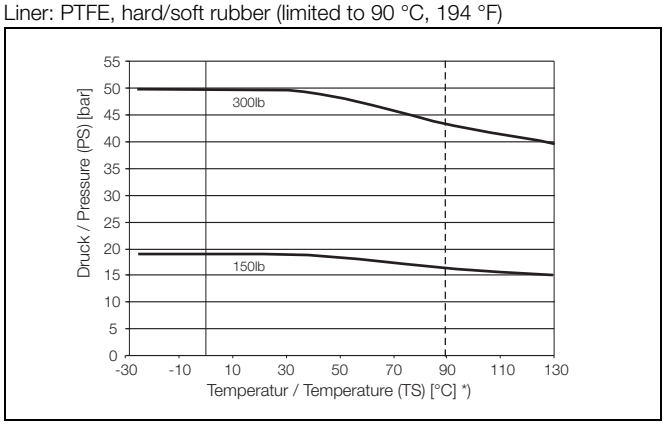


Fig. 5: ANSI-Flanges 316Ti [SS1.4571] to 4” [DN100] (CL150/300)

JIS 10K-B2210 Flanges SS 1.4571[316Ti]

Meter Size DN	Material	PN	TS [°C]	PS [bar]
32–100 [1-1/4” - 4”]	SS1.4571[316Ti]	10	-25 to +130 °C*) (-13 to +266) °F	10

Liner: PTFE,
Hard/soft rubber (limited to 90 °C, 194 °F)

Attention!
*) For meter sizes DN 25 and 32 [1” and 1-1/4”] see Model DT47 $T_o \leq 125$ °C (257 °F)

Installation Requirements and Grounding

In- and Outlet Straight Sections

The measurement principle is independent of the velocity profile as long as standing eddies do no extend into the measurement zone, e.g., after double elbows, tangential inflow or partially opened gate valves upstream of the flowmter primary. It is recommended that control device be installed downstream from the flowmeter. Additional, it is essential that the meter tube be always completely filled with fluid. (See also FXT4000 (COPA-XT) Operation Manual).

Electrode Axis

The flowmeter can be installed in verticle, horizontal or sloped pipelines. The electrode axis should be horizontal if possible or at 45°, to prevent air or gas bubbles from affecting the flow signal being measured at the electrodes. A vertical electrode axis should be avoided. An ideal installation os shown in Fig. 6.

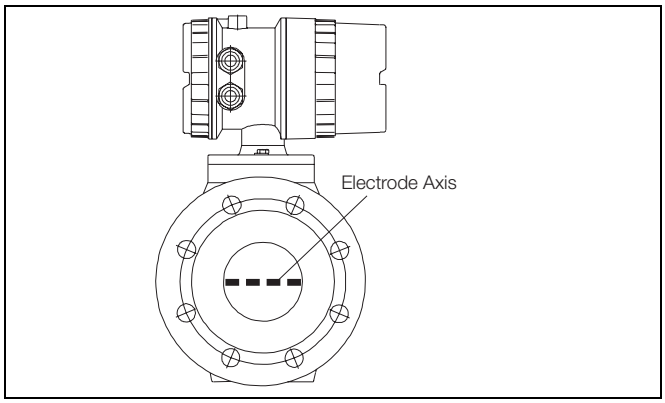


Fig. 6: Electrode Axis Example FXT4000

Grounding

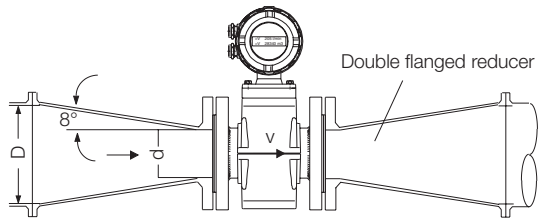
The grounding of the flowmeter primary is not only essential for safety reasons but also of importance to assure trouble free operation of the electromagnetic flowmeter. The ground screws on the flowmeter primary are to be connected to the ground potential in accordance with VDE 0100, Section 540 (for Ex-Designs to Potential Equalization). For technical reasons this should be identical to the potential of the metering fluid if possible.

For plastic or insulated lined pipelines the fluid is grounded by utilizing a grounding plate (see Footnotes in Dimensions and Ordering Information Flowmeter Primary). When there are stray potentials present in the pipeline a grounding plate is recommended at both ends of the meter primary.

Installations in Larger Size Pipelines

The flowmeter primary can readily be installed in larger pipeline sizes by utilizing reducers (e.g. flanged reducers EN 545). The pressure drop which results from the reduction can be determined from the Nomograph Fig. 7. The pressure drop is determined in the following manner:

1. Calculate the diameter ratio d/D.
2. The flow velocity can be determined from the Flowrarte nomograph Fig. 3.
3. Read the pressure drop on the Y-axis in Fig. 7.



d = EMF inside diameter
D = Pipeline inside diameter
v = Flow velocity [m/s]
Δp = Pressure drop [mbar]

Pressure Drop Nomograph for EMF Flanged Reducers with $\alpha/2 = 8°$

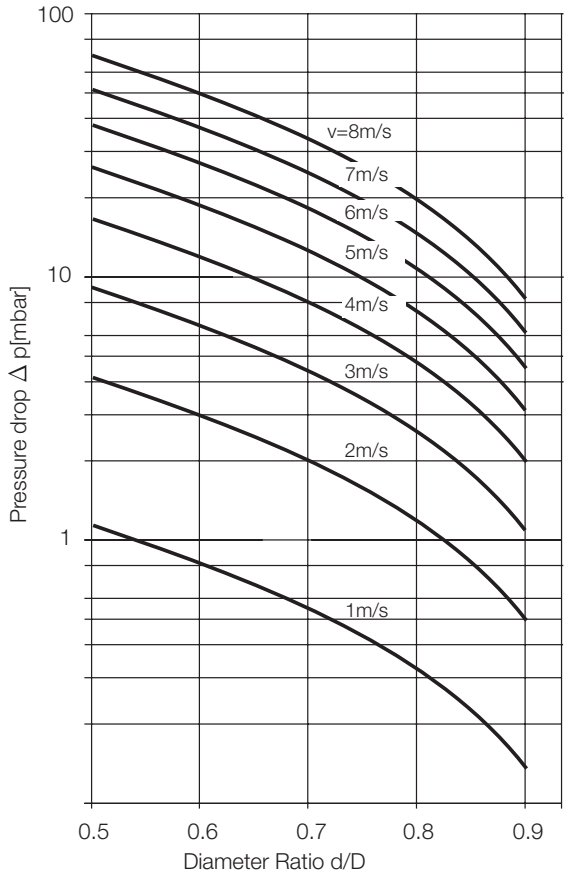


Fig. 7: Nomograph for Pressure Drop Determinations

Specifications: Flowmeter Primary Flanged Models DT43, DT47

Temperature Diagram

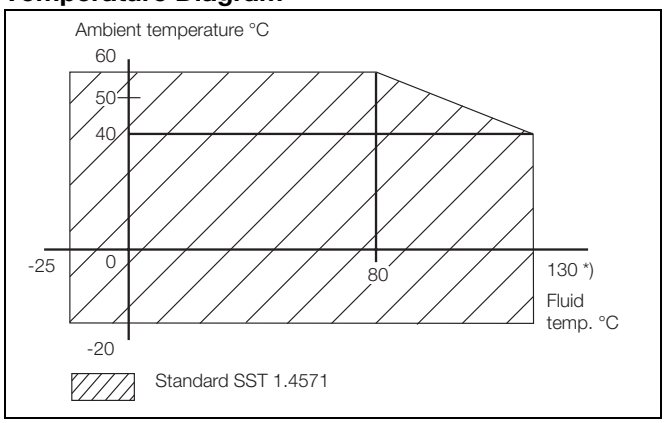


Fig. 8: Fluid Temperature as a Function of the Ambient Temperature

⚠ **Attention!**
*) For meter sizes DN 25 and 32 [1" and 1-1/4"] see Model DT47 $T_b \leq 125$ °C

⚠ **Attention!**

Max. allow. Cleaning Temperature

For steam or liquid cleaning the temperature specifications in the Ex-Approval must be observed! See Temperature Table Page 8.

CIP-Cleaning	Liner	T_{max} °C	T_{max} minutes	$T_{amb.}$ °C
Steam	PTFE	150	60	25
Liquid	PTFE	140	60	25

If the ambient temperature >25 °C, the max. cleaning temperature is to be reduced by the difference. T_{max} - Δ °C.
where Δ °C = ($T_{amb.}$ -25 °C).

Protection Class

IP 67

Pipeline Vibration

Max. allow 10 – 60 Hz: amplitude = 0.15 mm
60 – 150 Hz: acceleration = 20 m/s^2
per EN 60068-2-6

Designs

Flanged per DIN 2501 and JIS K10

The flanged flowmeters correspond to the specifications defined in VDI/VDE 2641,ISO 13359 or DVGW (Working Paper W420, Design WP,ISO 4064 short).

ASME CL 150/CL 300

Installation length Series 1000
Protection plate same as Series 1000 or grounding plate.
Installation lengths per ISO 13359 short

Ex-Protection

Ex-Protection per European Standard: TÜV 98, ATEX 1333 X.
II 2G EEx emd [ib] IIC T3 ... T6

Ex-Design and Identification

The design of the Ex-Design to Transmitter Power Supplies with intrinsically safe circuits (ground free) or non-intrinsically safe circuits can be recognized by the following identifications.

Instrument Tag

Identification on the Instrument Tag based the Ex-Specifications EEx "ib" or "e", e.g. Supply power EEx „ib" or supply power EEx „e".

Cable Connectors

The cable connectors for EEx "ib" are blue and black for EEx "e".

Identification of the Converter

There is an information tag on the converter indicating if its design is EEx "ib" or EEx "e". There is also a sticker on the converter with the Software Revision Number.

Materials

Fluid Wetted Parts

Part	Standard	Options
Liner	PTFE Hard rubber, Soft rubber	–
Signal and grounding electrodes for liners - hard rubber, soft rubber	SST 1.4571 [316Ti]	Hast. B-3, Hast. C-4, Titanium, Tantalum, Platinum-Iridium
- PTFE (FDA, KTW app'd.)	Hast. C-4 (2.4610)	SST 1.4571[316Ti] SST 1.4539 Hast. B-3, (2.4600) Titanium, Tantalum, Platinum-Iridium
Grounding plate	SST 1.4571 [316Ti]	others upon request
Protection flange	SST 1.4571 [316Ti]	others upon request

Non-Fluid Wetted Parts

Part	Standard	Options
Housing DN 10 – 100 [3/8" – 4"]	Two piece housing Cast Alum., painted, Paint color RAL 9002	–
Flanges DN 10 – 100 [3/8" – 4"]	SST 1.4571 [316Ti]	–
Connection Box	Alum. alloy, painted, Paint color: Frame: RAL 7012, Cover: RAL 9002	–
Meter Tube	SST 1.4301 [304]	–
Pg-Connector	Polyamide	PVDF

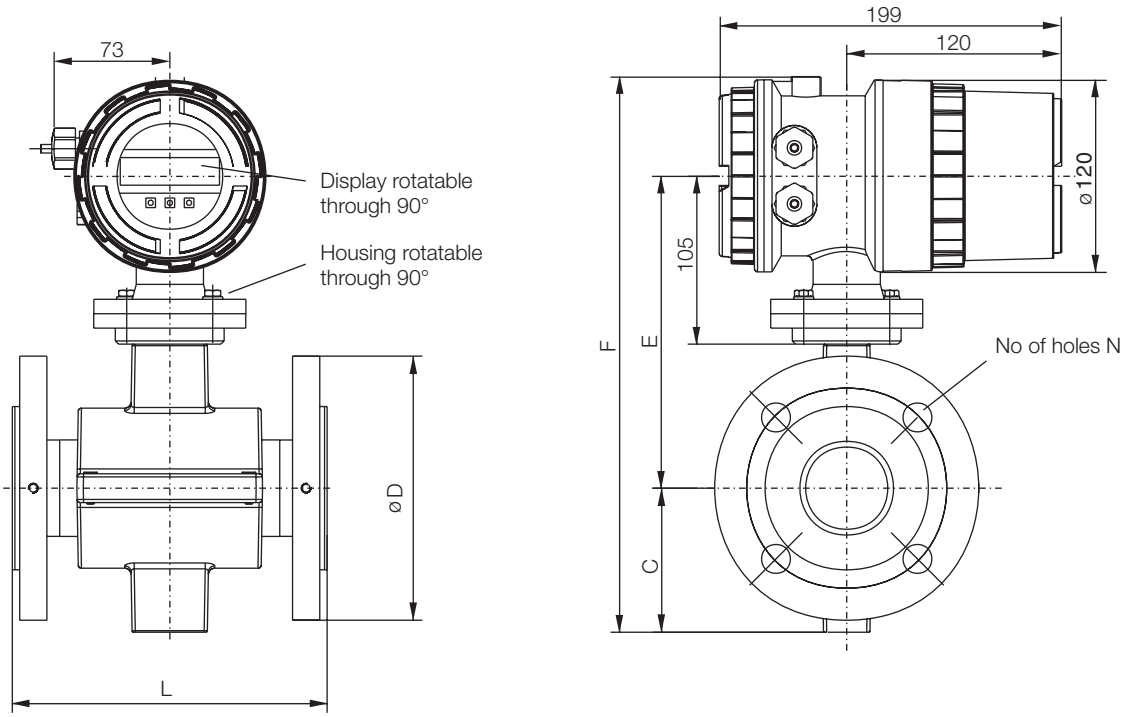
Max. allow. Fluid Temperature, max. Ambient temperature, Temperature Classes for Model DT47F

The max. allowable fluid temperature [°C] as a function of the Temperature Class, the max. allowable ambient temperature, the liner and the meter size is listed in the following table:

Max. Ambient Temperature [°C]	Liner	Meter Size DN [Inch]	Temperature Class	Max. allow. Fluid Temperatures [°C] (Operating Values) (Meter Insulated)		Temperature Resistant Cable = 80 °C (176 °F) (Meter Insulated)	
40 °C 104 °F	PTFE/PFA	3-20 [1/10-3/4]	T3	130	(125)	130	(125)
	PTFE/PFA		T4	110	(110)	110	(110)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	25 - 32	T3	125	(125)	125	(125)
	PTFE/PFA	[1 - 1¼]	T4	110	(110)	110	(110)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	40 - 100	T3	135	(135)	135	(135)
	PTFE/PFA	[1½ - 4]	T4	115	(115)	115	(115)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	80	(80)	80	(80)
	all		T6	70	(70)	70	(70)
50 °C 122 °F	PTFE/PFA	3-20 [1/10-3/4]	T3	130	(125)	130	(125)
	PTFE/PFA		T4	110	(110)	110	(110)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	25 - 32	T3	125	(125)	125	(125)
	PTFE/PFA	[1 - 1¼]	T4	110	(110)	110	(110)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	40 - 100	T3	125	(125	125	(125
	PTFE/PFA	[1½ - 4]	T4	115	(115)	115	(115)
	Hrd./sft. rbr.		T4	90	(90)	90	(90)
	all		T5	80	(80)	80	(80)
	all		T6	70	(70)	70	(70)
60 °C 140 °F	PTFE/PFA	3-20 [1/10-3/4]	T3	-	(-)	130	(120)
	PTFE/PFA		T4	85	(85)	110	(110)
	Hrd./sft. rbr.		T4	85	(85)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	25 - 32	T3	-	(-)	120	(120)
	PTFE/PFA	[1 - 1¼]	T4	85	(85)	110	(110)
	Hrd./sft. rbr.		T4	85	(85)	90	(90)
	all		T5	75	(75)	75	(75)
	all		T6	60	(60)	60	(60)
	PTFE/PFA	40 - 100	T3	-	(-)	120	(120)
	PTFE/PFA	[1½ - 4]	T4	-	(-)	115	(115)
	Hrd./sft. rbr.		T4	-	(-)	90	(90)
	all		T5	80	(80)	80	(80)
	all		T6	70	(70)	70	(70)

Information:
The higher Temperature Classes always include the lower classes.
The min. allowable fluid temperature is -25 °C (-13) °F.

Dimensions: Flowmeter Primary DN 10 – 100 [3/8" – 4"], Flanged per DIN & ANSI, Model DT43F



DIN Flanges

Dimensions								Weight Compact Design
DN	PN[1)]	D	N	L[2)3)]	F	C	E	ca. kg
10-15	10-40	90/95	4	200	291	62	167	4.0
20	10-40	105	4	200	302	73	178	5.0
25	10-40	115	4	200	302	73	178	5.5
32	10-40	140	4	200	307	78	183	7.0
40	10-40	150	4	200	311	82	187	7.5
50	10-40	165	4	200	347	90	195	10.0
65	10-16 25-40	185 185	4 8	200 200	375 375	104 104	209 209	14.0 14.0
80	10-40	200	8	200	387	110	215	17.0
100	10-16	220	8	250	427	130	235	18.0

ANSI Flanges

Dimensions								Weight Compact Design
		CL 150		CL 300		Series 1000	ISO	
DN	Inch	D	N	D	N	L[4)]	L[2)3)]	ca. kg
10-15	1/2	89	4	96	4	270	200	4.0
20	3/4	99	4	118	4	270	200	5.0
25	1	108	4	124	4	270	200	5.5
32	1 1/4	118	4	134	4	280	200	7.0
40	1 1/2	127	4	156	4	280	200	7.5
50	2	153	4	165	8	280	200	10.0
65	2 1/2	178	4	191	8	330	200	14.0
80	3	191	4	210	8	340	200	17.0
100	4	229	8	254	8	400	250	18.0

For the dim's F, C, E see Table DIN Flanges

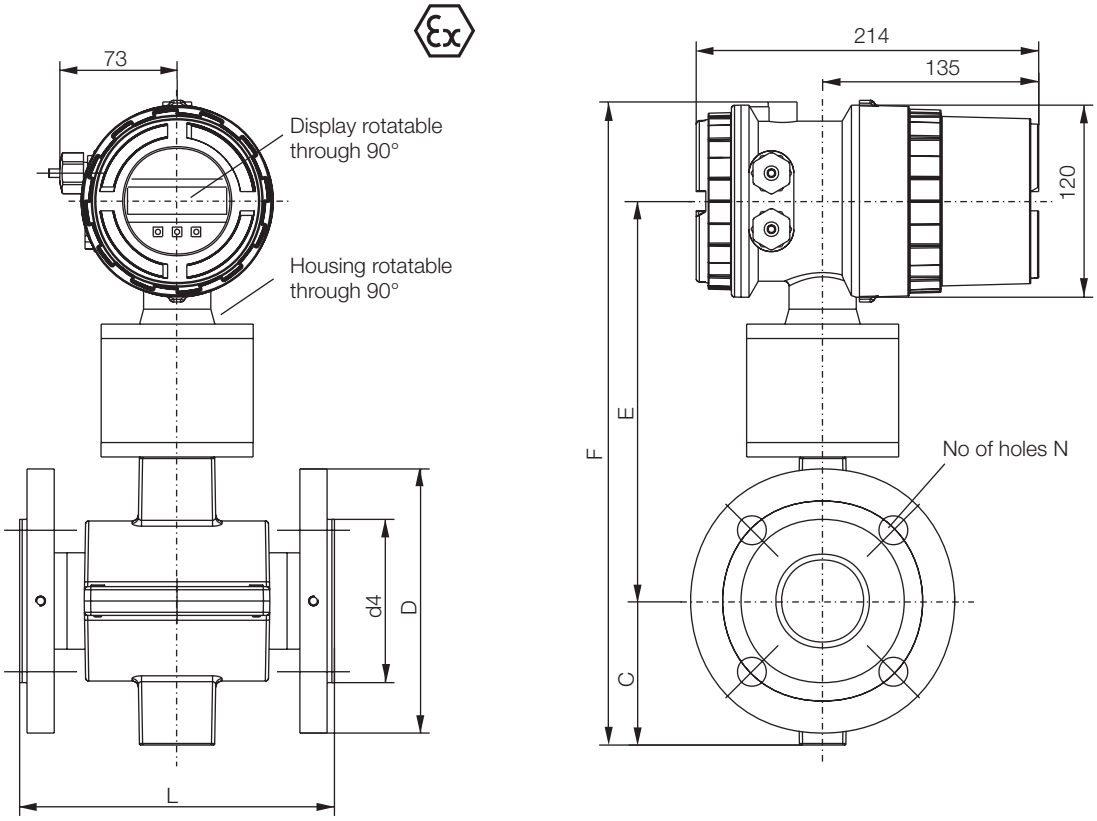
1) Other pressure ratings upon request.
2) If a grounding plate is installed on one flange, then the dimension L increases as follows: DN 10–DN 100 [3/8"-4"] by 3 mm.
3) If protection plates are installed, then the dimension L increases as follows: DN 10–DN 100 [3/8"-4"] by 6 mm. A grounding plate is no longer required!
4) If protection flanges are installed, then the dimension L increases as follows: DN 10–DN 80 [3/8"-3"] by 20 mm, DN 100 [4"] by 25 mm.

All dim´s in mm

ISO Projection Method E

Fig. 9: Flowmeter Primary DN 10 – 100 [3/8" – 4"], Flanges per DIN and ANSI

Dimensions: Flowmeter Primary DN 10 – 100 [3/8" – 4"], Flanged per DIN & ANSI, Model DT47F



DIN Flanges

Dimensions								Weight Compact Design
DN	PN[1)]	D	N	L[2)3)]	F	C	E	ca. kg
10-15	10-40	90/95	4	200	346	62	284	6.0
20	10-40	105	4	200	368	73	306	6.5
25	10-40	115	4	200	368	73	306	7.0
32	10-40	140	4	200	378	78	316	8.0
40	10-40	150	4	200	386	82	324	9.0
50	10-40	165	4	200	402	90	340	11.5
65	10-16 10-40	185 185	4 8	200 200	430 430	104 104	368 368	16.5 16.5
80	10-40	200	8	200	442	110	380	19.5
100	10-16	220	8	250	482	130	420	20.5

ANSI Flanges

Dimensions								Weight Compact Design
		CL 150		CL 300		Series 1000	ISO	
DN	Inch	D	N	D	N	L[4)]	L[2)3)]	ca. kg
10-15	1/2	89	4	96	4	270	200	6.0
20	3/4	98	4	118	4	270	200	6.5
25	1	108	4	124	4	270	200	7.0
32	1 1/4	118	4	134	4	280	200	8.0
40	1 1/2	127	4	156	4	280	200	9.0
50	2	153	4	165	8	280	200	11.5
65	2 1/2	178	4	191	8	330	200	16.5
80	3	191	4	210	8	340	200	19.5
100	4	229	8	254	8	400	250	20.5

For the dim's F, C, E see Table DIN Flanges

1) Other pressure ratings upon request.
2) If a grounding plate is installed on one flange, then the dimension L increases as follows: DN 10–DN 100 [3/8"-4"] by 3 mm.
3) If protection plates are installed, then the dimension L increases as follows: DN 10–DN 100 [3/8"-4"] by 6 mm. A grounding plate is no longer required!
4) If protection flanges are installed, then the dimension L increases as follows: DN 10–DN 80 [3/8"-3"] by 20 mm, DN 100 [4"] by 25 mm.

All dim´s in mm

ISO Projection Method E

Fig. 10: Flowmeter Primary DN 10 – 100 [3/8" – 4", Flanges per DIN and ANSI

Ordering Information: Flowmeter Primaries DN 10 - 100 [3/8" - 4"], Flanged Design

In addition to the Ordering Number, please supply the following information: Fluid, fluid temperature, operating pressure, flow range, pipeline type, grounding plate[1], grounding electrode[1].

Ordering Number			**DT43F**										
Ex-Design			**DT47F**										
Liner Material													
Hard rubber	DN 15 – DN 100	1/2" - 4"		**H**									
Soft rubber	DN 50 – DN 100	2" - 4"		**S**									
PTFE	DN 10 – DN 100	3/8" - 4" FDA, KTW app'd		**T**									
Meter Size													
DN 10	3/8"				**10**								
DN 15	1/2"				**15**								
DN 20	3/4"				**20**								
DN 25	1"				**25**								
DN 32	1-1/4"				**32**								
DN 40	1-1/2"				**40**								
DN 50	2"				**50**								
DN 65	2-1/2"				**65**								
DN 80	3"				**80**								
DN 100	4"				**1H**								
Signal Electrode Mat'l		**Grounding Electrode Mat'l**											
SST 1.4571[316Ti]		none				**S**							
Hastelloy B-3		none				**B**							
Hastelloy C-4		none				**H**							
Titanium		none				**M**							
Tantalum		none				**T**							
SST 1.4539		none				**F**							
Platinum-Iridium		none				**P**							
SST 1.4571[316Ti]		with				**E**							
Hastelloy B-2		with				**N**							
Hastelloy C-4		with				**O**							
Titanium		with				**I**							
Tantalum		with				**Q**							
SST 1.4539		with				**R**							
Platinum-Iridium		with				**G**							
Pressure Rating 1)													
DIN PN 6	ISO 1.3359 short						**B**						
DIN PN 10	„						**C**						
DIN PN 16	„						**D**						
DIN PN 25	„						**E**						
DIN PN 40	„						**F**						
JIS K10							**K**						
ANSI CL 150 Series 1000 installation length (for replacements only)							**P**						
ANSI CL 300 Series 1000 installation length (for replacements only)							**Q**						
ANSI CL 150 installation length ISO 13359 short							**R**						
ANSI CL 300 installation length ISO 13359 short							**S**						
Flange Material													
SST 1.4571 [316Ti]								**3**					
Flange Accessories													
None									**A**				
Protection plates[2]	SST 1.4571 [316Ti]	(installed both sides)							**B**				
Grounding plate[2]	SST 1.4571 [316Ti]	(installed one sides)							**C**				
Protection flanges[3]	SST 1.4571 [316Ti]	(installed both sides)							**D**				
Temperature Range													
DT43F (standard)										**S**			
DT47F ambient temperature ≤ 40 °C (standard)										**A**			
DT47F ambient temperature ≤ 50 °C										**B**			
DT47F ambient temperature ≤ 60 °C										**C**			
Certifications													
Standard, none											**AA**		
Material Certificate 3.1B per EN 10204 and Pressure Test per AD-2000											**DA**		
Pressure Test per AD-2000											**GA**		
Inspection Certificate per EN 10204 3.1B											**FA**		
Operating Mode and Design		**( ) for Ex-Zone**											
Standard with display & Magnet Stick operation		(Increased Safety "e")										**D**	
With display and Magnet Stick operation		(intrinsically safe "i")										**F**	
Communication													
Standard, none													**A**
HART-Protocol													**D**

1) Connection dimensions for flanges acc. to DIN 2501 or ASME B16.5 or JIS B2210-10K.
2) Protection plates are installed on both sides and grounding plates on one side, other materials upon request.
3) Protection flanges only for Series 1000 with ANSI flanges, installed on both sides, other materials upon request.

Specifications: Converter

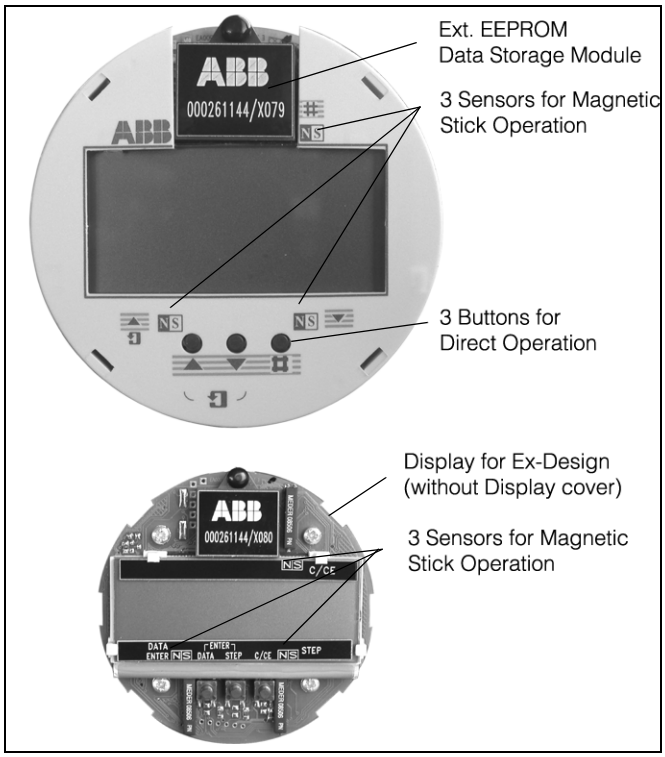


Fig. 11: Converter Keypad and Display

Flow Range
Infinite settings between (0.5 and 10) m/s

Accuracy
≤ 1 % of rate

Reproducibility
≤ 0.2 % of rate

Minimum Conductivity
20 μ S/cm

Response Time
For a 0–99 % step jump (corresponds to 5 τ) ≥ 2s

Supply Power
Operating voltage U_B
Ripple ≤ 5 %
DT43F (std.) (14 – 42) V DC
DT47F (Ex-"d" „e") (14 – 42) V DC
DT47F (Ex-"d" „ib") (14 – 20) V DC
Operating current I_o = (4 – 20) mA

Magnetic Field Supply
Pulse DC field

Power
≤ 0.5 W flowmeter primary incl. converter

Ambient Temperature
(-20 to +60) °C see Temperature Diagram Page 7

Electrical Connections
Screwless spring loaded clamps,
DN 10 to DN 100 [3/8" to 4"] cable connectors M20x1.5

Protection Class per EN 60529
IP 67

Forward/Reverse Flow Metering
The flow direction is indicated in the display by arrows and as an external signal over an optocoupler output.
The forward flow direction is signalled.

Display

Attention:
When the housing cover is removed, the EMC-Protection is voided.

With Display Option
Data can be entered directly by either using the 3 buttons or, from the outside without opening the housing, using the Magnet Stick.

In the DT47F the data is entered in an explosion hazardous area exclusively using the Magnet Stick.

2x16 character LCD-Dot-Matrix display. The internal flow totalizer integrate the flow in each direction separately in one of 15 different units. The flowrate is displayed in percent or one of 42 different direct reading units.

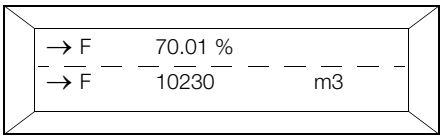
The converter housing can be rotated 90°. The display can be plugged in 3 different positions assuring optimal readability. In multiplex operation the following variables can alternately be displayed in addition to those selected for the 1st and 2nd display lines: flowrate in %, direct reading units or as a bargraph, totalizer values, forward or reverse, TAG No. or current output value.

Information:
The instruments satisfy the NAMUR-Recommendations NE21. Electromagnetic Compatibility of Electrical Equipment in Processes and Laboratories and EMC-Guideline 89/336/EWG (EN 61000-6-3 and EN 61000-6-2).
Attention: The EMC-Protection is restricted and the Ex-Protection is voided when the cover is removed.

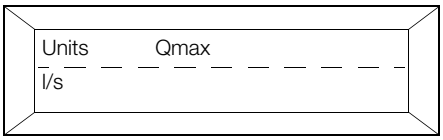
Data Security
All data is stored in an EEPROM when the power is turned off or when a power outage occurs. The parameter settings, process information and flowmeter primary specific calibration data are stored in a serial EEPROM as well as in an external EEPROM. Therefore, after a converter module with its serial EEPROM module are exchanged, all the stored data in the external EEPROM can be uploaded whenever desired.

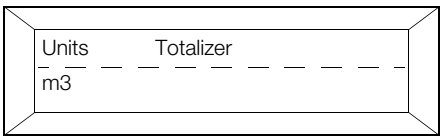
Display

When exchanging the converter and EEPROM modules all previously stored parameters can be uploaded.

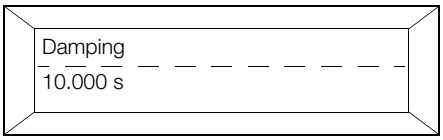


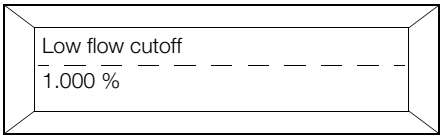
In the 1st line of he display the instantaneous flowrate value is shown in % of the selected flow range or in direct reading units. In the 2nd line the integrated volume flow (with units).





The flowrate values are displayed in percent or one of 42 different direct reading units. The flow is totalized in one of 15 different units including gallon, liter, hectoliter, cubic meter, tons (if a density value was entered). It is also possible to configure user defined units.
The damping can be set from 5 s to 99 s.

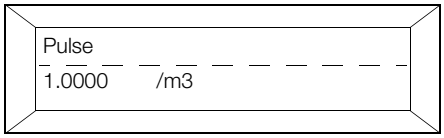




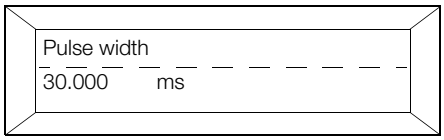
A low flow cutoff value from 0.5 to 10 % of max. can be set (applies to the current an pulse outputs). The minimum low flow cutoff value is calculated as follows:

$$\frac{Q_{RangeMax}}{Q\ (\text{flow range setting})} \times 0.5 \quad \%$$

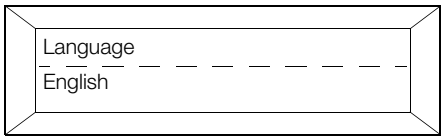
A pulse factor between 0.001 and 1000 can be set by which the value in the display is multiplied for the pulse output.

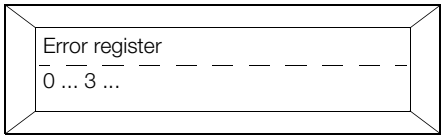


A pulse width from 0.1 ms to 2000 ms can be set with an automatic feasibility check.

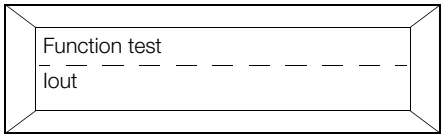


Data can be entered in one of 2 languages, English/German.





Automatic self monitoring with error diagnostics in the display and an error signal over the contact output. All detected errors are stored in the error register.



The function test can be used to test the individual internal assemblies. All outputs can be simulated for start-up and test purposes.

Supply power

A voltage supply of 14 – 42V DC from either a central voltage supply or from a transmitter power supply is required for connection to the 2-Wire instrument (terminals TW-, TW+). The peripherals are connected to the power supply, Specifications see Fig. 12, and the current output (4 – 20) mA.

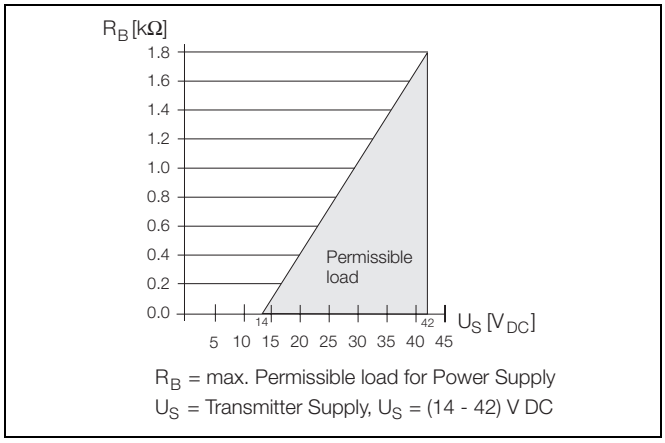


Fig. 12: Load Diagram

Binary output

The binary output can be configured as a pulse or alarm output. It meets the requirements in the Standard VDI/VDE 2188.

Contact output (terminals V8, V9)

The following functions can be assigned in the software:
System monitor: Normally open or normally closed contact
Forward/reverse flow direction: closed for forward direction
Max-Alarm, Min-Alarm: Normally open or normally closed contact

External voltage supply

Input from an SPC etc. with U_o = (19 – 33) V DC

Scaled pulse output (terminals V8, V9)

Scaled pulse output max. 100 Hz, pulse factor between 0.001 and 1000 for multiplying the values in the display (1 pulse/m^3 * 1000). The pulse width can be set from 0.100 ms to 2000 ms.

Design	Optocoupler passive (standard)
Function terminals	V8, V9
Operating voltage	19 V ≤ U_{CEH} ≤ 33 V 0 V ≤ U_{CEL} ≤ 2 V
Operating current and frequency	0 mA ≤ U_{CEH} ≤ 2 mA 20 mA ≤ U_{CEL} ≤ 110 mA f_{max} ≤ 100 Hz

Installation of the binary output

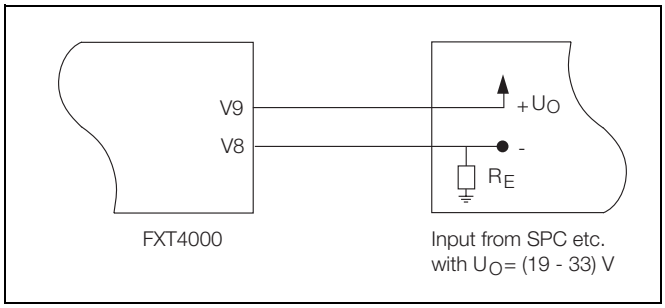


Fig. 13: Installation of the Binary Output

The load R_E is calculated as a function of the available supply voltage U_o, the lead resistance R_L and the selected signal current within the desired Category using the following equation:

$$R_E = \frac{(U_O - 3V)}{I_O} \cdot R_L \text{ where } R_L = \frac{2 \cdot L}{56\ m/\Omega mm^2 \cdot A}$$

L = Lead length [m]
A = Lead cross-sectional area [mm^2]

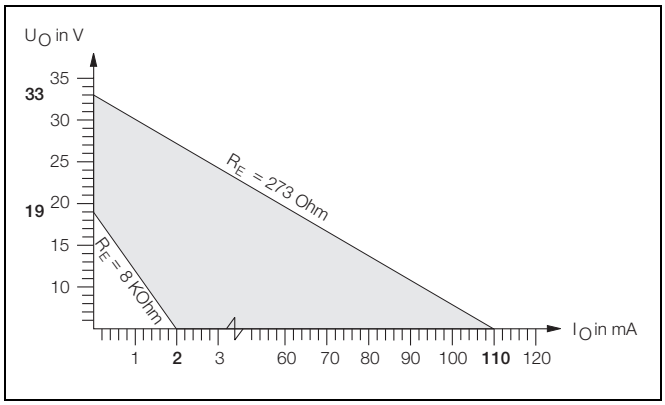


Fig. 14: Load Resistance as a Function of the Current and Voltage (see Equation)

Communication, Interconnection Diagram DT43F (Std.)

HART-Protocol
The HART-Protocol is used to communicate between a process control system or handheld terminal and the EMF field instrument. The digital communication utilizes an ac signal superimposed on the current output, which does not affect any of the connected instruments. This option is only available with a 4-20 mA current output. terminals: +/–.

The SMART VISION program can be used to operate the flowmeter.

SMART VISION is a universal communication software program for intelligent field instruments, and includes a number of different communications methods for interchanging data between a complete field instrument palette. The main sections include parameter display, configuration, diagnostics, documentation and data management for all intelligent field instruments, which are satisfy its communication requirements.

The following communication methods are available:
HART-Communication
1. over a FSK-Modem in Point-to-Point or Multidrop operation.

SMART VISION is compatible with modern, standard PCs or Notebooks which use MS Windows 98 or MS Windows NT, MS Windows 2000.

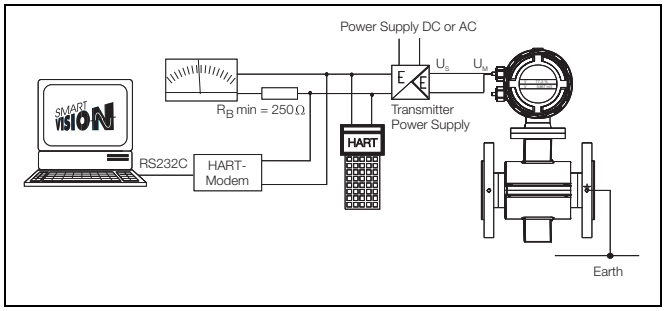


Fig. 15: Communication using HART-Protocol

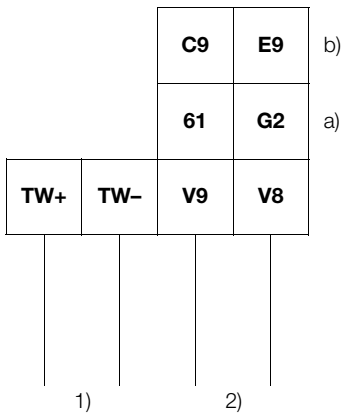
Transmission mode
FSK-Modulation on the current output (4–20) mA per Bell 202 Standard. Max. signal ampl. 1.2 mA_{pp}

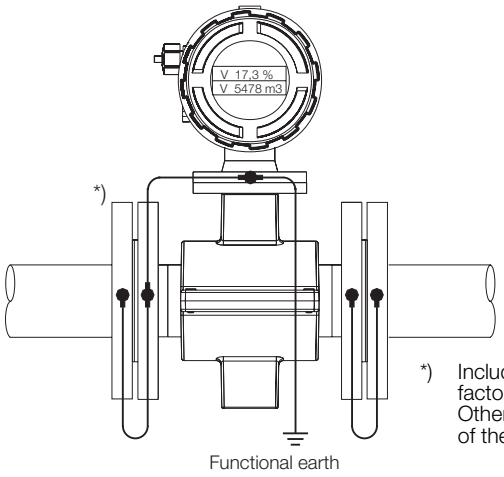
Load (current output)
Min.: 250Ω , max. see Fig. 12

Cable
AWG 24 twisted

Max. cable length
1500 m

Baudrate
1200 Baud. Logic 1: 1200 Hz; Logic 0: 2200 Hz





*) Included with shipment from the factory.
Other connections are the responsibility of the customer.

1) Supply power TW+, TW–, (14–42) V DC
2a) Binary output: function selectable in the software as System Monitor, or F/R signal*). Output closes for alarm. Function C9, E9 or
b) Scaled pulse output, passive, pulse width can be set from 0.1 ms to 2000 ms, terminals: V8, V9 Function 61, G2, Optocoupler, fmax 100 Hz

Optocoupler passive terminals V8, V9.
0 V ≤ U_{CEL} ≤ 2 V, 19 V ≤ U_{CEH} ≤ 33 V
0 mA ≤ I_{CEH} ≤ 2 mA, 20 mA ≤ I_{CEL} ≤ 110 mA

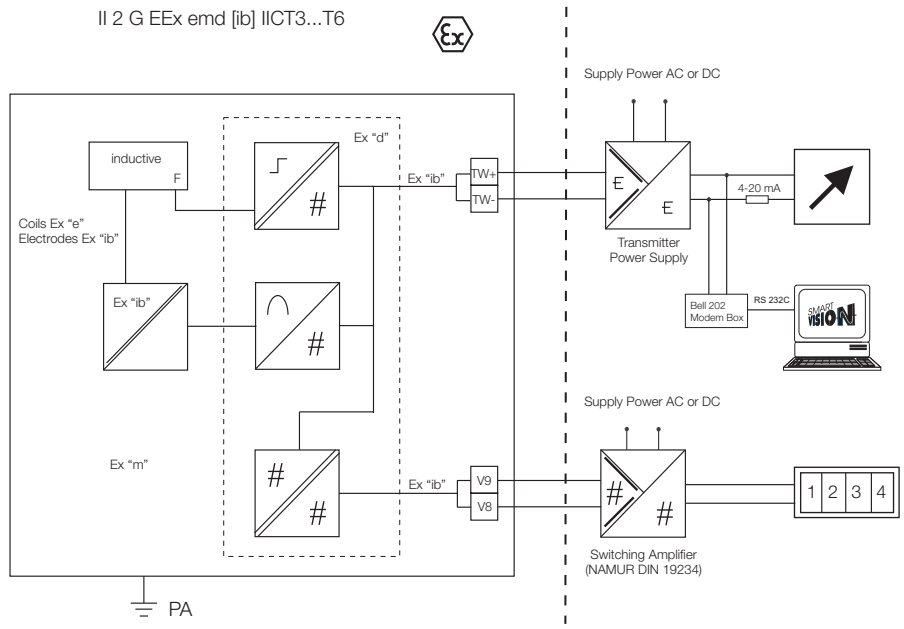
*) The factory setting is the forward/reverse flow direction signal.
Note: To maintain the EMC-Requirements the instrument is to be connected to earth.

Information:
Current and pulses outputs are galvanically isolated from each other.

Fig. 16: Interconnection Diagram DT43F

Interconnection Diagram DT47F: Ex

Supply power from transmitter power supply „Intrinsic Safety“



Explosion hazardous area Zone 1 **Non-explosion hazardous area**

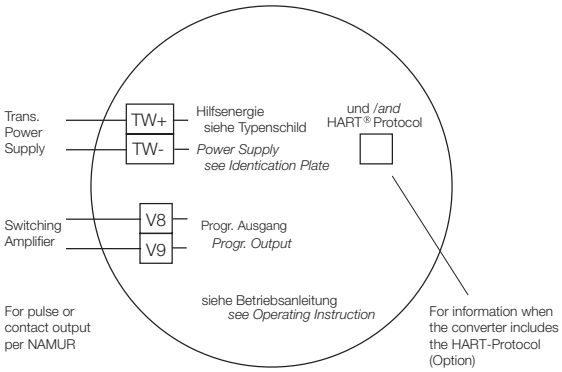
Ex-Approval Specifications	
Ambient temperature	-20 °C ... +60 °C
Fluid temperature	-25 °C ... + see Temperature Class & liner
Electrical specifications:	
Supply circuit	EEx ib IIC / IIB U_B = 14–20 V DC U_i = 30 V I_i = 100 mA P_i = 760 mW C_i = 13 nF terminal TW- is connected internally to PA
Cable connector	blue
Recommended Transmitter Power Supplies	
ABB	TZN 128-Ex, electronic current limiting, Contrans I V 17151-62
Digitable	CS3/420, CS5/420
Apparatebau Hundsbach	AH 90270, AH 77270
MTL	MTL 3046B, 3047, E 02009
Pepperl + Fuchs	KHD3-IST/Ex1, KFD2-STC1-Ex, KSD2-CI-S-Ex
Recommended Transmitter Power Supplies (HART-Capable)	
ABB	TZN 128-Ex
Digitable	CS3/420, CS5/420
MTL	MTL E 02009 - 203_ _ 1/203_ _ 1S
Binary Output (NAMUR per DIN 19234)	EEx ib IIC / IIB U_i = 20 V I_i = 30 mA P_i = 150 mW C_i = 2.4 nF L_i = 67 µH terminal V8 is connected internally to PA
Recommended Switch Amplifiers	
ABB	V17131-51...53, V17131-54...56
Digitable	ci 1/941, ci 1/942
Apparatebau Hundsbach	AH TS 920, AH 90 924
Pepperl + Fuchs	various types

The specified transmitter power supplies or power sources are to be connected so that the terminal voltage at the converter is $U_{TW-/TW+} \geq$ 14 V. The voltage drop through the leads and across the load must be considered.
Voltage drop in the leads:

$$\Delta U_{max} = \frac{22{,}8 mA \cdot (2 \cdot L)}{56 m/\Omega mm^2 \cdot A}$$

L = Lead length [m]
A = Lead cross-sectional area [mm^2]

Ex “ib” Interconnection Diagram



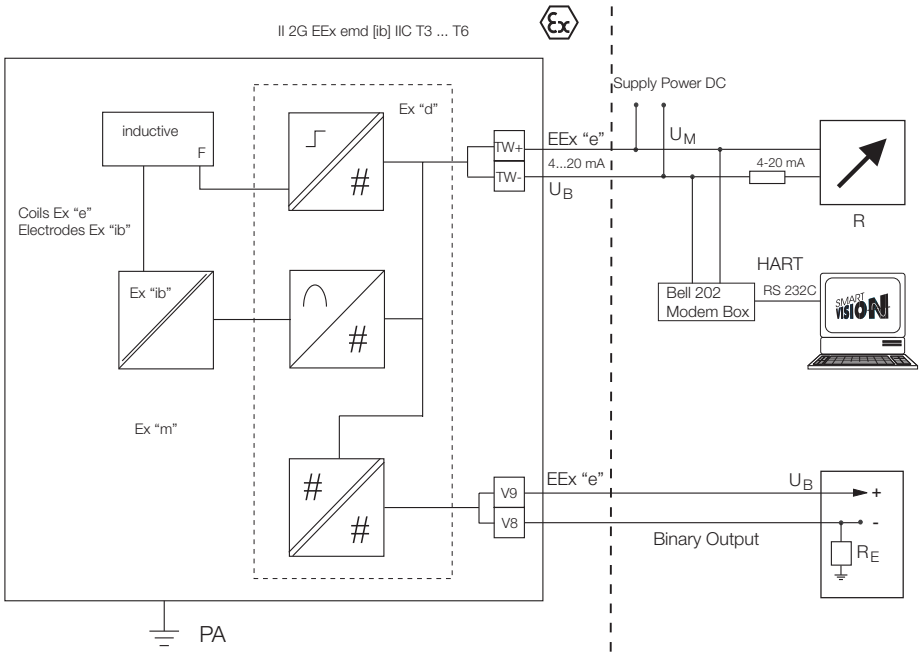
Care should be exercised when replacing the cover and tightening the screws. Check that the gasket is properly seated. Otherwise Protection Class IP 67will not be maintained.

Information:
Terminals TW- and V8 are internally connected to PA. PA is to maintained along the entire intrinsically safe circuit.

Fig. 17: Interconnection Diagram DT47F: Supply Power from Transmitter Power Supply „Intrinsic Safety“

Interconnection Diagram DT47F: ⟨Ex⟩

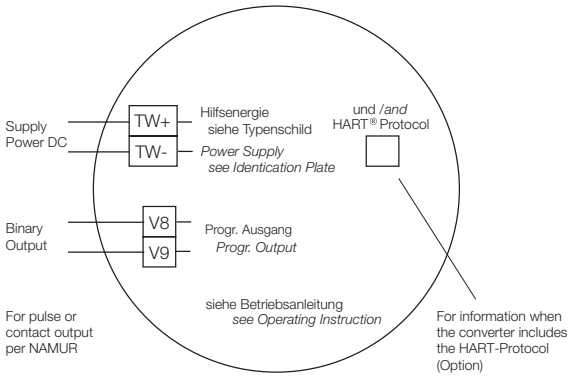
Supply power for central power supply „Non-Intrinsic Safety“



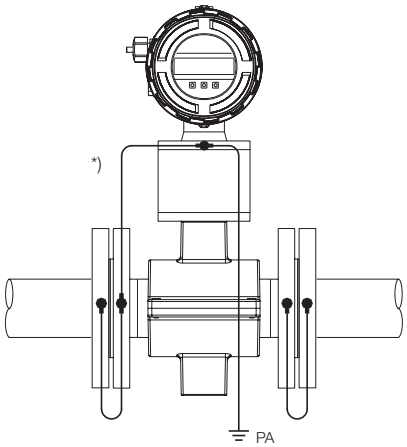
Ex-Approvals	
Ambient temperature	-20 °C ... +60 °C
Fluid temperature	-25 °C ... + see Temperature Class & liner
Electrical specifications:	
Supply circuit	U_m = 60 V 14 V ≤ U_B ≤ 42 V 3.8 mA ≤ I_B ≤ 22 mA
Binary output	U_m = 60 V 19 V ≤ U_B ≤ 33 V 2 mA ≤ I_B ≤ 110 mA
Cable connector	black

Information:
The current and pulse outputs are galvanically isolated from each other and from PA

Ex “e” Interconnection Diagram



Care should be exercised when replacing the cover and tightening the screws. Check that the gasket is properly seated. Otherwise Protection Class IP 67will not be maintained.



*) Installed at factory. Other connections are the responsibility of the customer.

PA Potential equalization per EN 60079-14

Fig. 18: Interconnection Diagram DT47F: Supply Power from a Central Power Supply „Non-Intrinsic Safety“

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