Data Sheet DS/FEP500-EN Rev. B

ProcessMaster FEP500
Electromagnetic Flowmeter

The process industry's first choice

Intuitive operation
- Softkey-based functionality
- “Easy Set-up” function

Diagnostics for real-life situations
- Status messages in accordance with NAMUR
- Help texts in the display

Extended diagnostic functions
- Electrode deposit detection
- Gas bubble detection
- Partial filling detection
- Conductivity monitoring
- Sensor temperature monitoring
- Trend analysis

Batch functionality
- Presetting counter, overrun correction, external start/stop, batch end contact

Maximum measuring accuracy
- Maximum measuring error: 0.2 % of rate

Universal transmitter
- Reduces spare parts inventory costs and storage costs

Flowmeter sensor featuring state-of-the-art memory technology
- Prevents errors and enables quick and reliable commissioning

Approvals for explosion protection
- In accordance with ATEX, IECEx
- In accordance with FM, cFM

HART, PROFIBUS PA, FOUNDATION fieldbus
- Access to all status information

Power and productivity
for a better world™

ABB

ABB is an established world force in the design and manufacture of instrumentation for industrial process control.

Worldwide presence, comprehensive service and application-oriented know-how make ABB a leading supplier of flow measurement products.

Introduction

The industrial standard

ProcessMaster is designed specifically to meet the increased requirements on advanced flowmeters. The modular design concept offers flexibility, cost-saving operation and reliability whilst providing a long service life and exceptionally low maintenance.

Integration into ABB asset management systems and usage of the self-monitoring and diagnostic functions increase the plant availability and reduce downtimes.

Advanced diagnostic functions

Using its advanced diagnostic functions, the device monitors both its own operability and the process.

Limit values for the diagnostic parameters can be set locally. When these limits are exceeded, an alarm is tripped.

For further analysis, the diagnostic data can be read out via an advanced DTM. Critical states can, thus, be recognized early and appropriate measures can be taken.

As a result, productivity is increased and downtimes are avoided.

The status messages are classified in accordance with the NAMUR recommendations.

In the event of an error, a diagnostic-dependent help text appears on the display which considerably simplifies and accelerates the troubleshooting procedure. The gives maximum safety for the process.

Superior and reliable new flowmeter sensor design

Self-cleaning, double-sealed polished measuring electrodes enhance the device's reliability and performance.

Using a higher excitation frequency for the transmitter, ProcessMaster is a flowmeter with an especially short response time. With its advanced filtering methods, the device improves accuracy even under difficult conditions by separating the noise from the measuring signal. This leads to a max. measuring error of 0.2 % of rate.

Easy and quick commissioning

Advanced data storage inside the sensor eliminates the need to match sensor and transmitter in the field. The on-board sensor memory automatically identifies the transmitter. On power-on, the transmitter self-configuration function is run. and replicates all sensor data and TAG-specific parameters into the transmitter. This eliminates the opportunity for errors and leads to an increased startup speed and reliability.

Intuitive, convenient navigation

The factory-set parameters can be modified quickly and easily via the user-friendly display and the non-contact buttons, without opening the housing. The "Easy Set-up" function reliably guides unpracticed users through the menu step by step.

The softkey-based functionality makes handling a breeze - it's just like using a cell phone. During the configuration, the permissible range of each parameter is indicated on the display and invalid entries are rejected.

Universal transmitter - powerful and flexible

The backlit display can be easily rotated without the need for any tools. The contrast is adjustable and the display fully configurable. The character size, number of lines and display resolution (number of decimals) can be set as required. In multiplex mode, several different display options can be pre-configured and invoked one after the other.

The smart modular design of the transmitter unit allows for easy disassembly without the need to unscrew cables or unplug connectors.

Whether count pulses, 20 mA signals or the status output are active or passive, the universal transmitter always delivers the correct signal. HART is used as the standard protocol.

Optionally, the transmitter is available with PROFIBUS PA or FOUNDATION fieldbus communication.

The universal transmitter simplifies the spare parts inventory and reduces the stockholding costs.

ScanMaster - the diagnostic tool

Can I rely on the measured values?

How can I determine the technical condition of my device?

ScanMaster can answer these frequently asked questions.

And ScanMaster allows you to easily check the device for proper functioning.

ProcessMaster - always the first choice

ProcessMaster sets the standard for the process industry. It meets the various requirements of NAMUR. ProcessMaster is a universal device according to the Pressure Equipment Directive. In compliance with the requirements of NAMUR, the devices are categorized under category III for pipelines. As a result, ProcessMaster can be used universally. This reduces costs and increases safety.

Overview of the ProcessMaster series

ProcessMaster is available in two series.

ProcessMaster 300 with basic functionality and ProcessMaster 500 with extended functions and options. The following table gives an overview.

	ProcessMaster	
	FEP300	**FEP500**
Measuring accuracy 0.4 % (optionally 0.2 %) of rate	**X**	**-**
Measuring accuracy 0.3 % (optionally 0.2 %) of rate	**-**	**X**
Batch functions Presetting counter, overrun correction, external start/stop, batch end contact	**-**	**X**
Other software functions Mass units, editable counter,	**X**	**X**
Two measuring ranges	**-**	**X**
Graphic display Line recorder function	**X**	**X**
Diagnostic functions Detection of gas bubbles or deposits on electrodes, conductivity monitoring, temperature monitoring, finger print, trend	**-**	**X**
Partially filled Recognition through partial filling electrode (TFE)	**X**	**X**
Hardware options Versions for extremely abrasive fluids: • Ceramic carbide liner, • Tungsten carbide electrodes, • Double layer electrodes	**-**	**X**
Startup functions Grounding check	**-**	**X**
Fieldbus PROFIBUS PA, FOUNDATION fieldbus	**X**	**X**
Verifications / Diagnostic tool ScanMaster	**X**	**X**

This data sheet describes ProcessMaster 500.

For ProcessMaster 300 refer to data sheet DS/FEP300.

Contents

1 ProcessMaster 500 - Overview of technology

Model overview (compact design)		
FEP511 (without explosion protection)	**FEP515 (explosion protection Zone 2 / Div. 2)**	**FEP515 (explosion protection Zone 1 / Div. 1)**
 G01082 Single-compartment housing | Dual-compartment housing	 G00487	 G00886
	ATEX / IEC Gases Zone 2 Dust Zone 21, 22	**ATEX / IEC** Gases Zone 1 Dust Zone 21, 22
	FM / cFM CL I Div 2 (NI, DIP)	**FM / cFM** CL I Div 1, 2 (XP, NI, DIP)
	For further information about the instruments' explosion protection approval please refer to the Ex test certificates (available on the product CD or under www.abb.com/flow).	

Model number	**FEP511, FE515**
Measured value error	Standard: 0.3 % of rate Optional: 0.2 % of rate
Nominal size range	DN 3 ... 2000 (1/10 " ... 80 ")
Process connection	Flange in accordance with DIN 2501 / EN 1092-1, ASME B16.5 / B16.47, JIS 10K
Nominal pressure	PN 10 … 100, ASME CL 150, 300, 600
Lining	Hard rubber (DN 15 ... 2000), soft rubber (DN 50 ... 2000), PTFE (DN 10 ... 600), PFA (DN 3 ... 200), ETFE (DN 25 ... 600), elastomer (DN 50 ... 600), Ceramic Carbide (DN 25 ... 1000)
Conductivity	> 5 µS/cm (20 µS/cm for demineralized water)
Electrodes	Stainless steel, Hastelloy B, Hastelloy C, platinum-iridium, tantalum, titanium, Double Layer, tungsten carbide
Process connection material	Steel, stainless steel
Degree of protection	IP 65, IP 67
Medium temperature	-25 ... 180 °C (-13 ... 356 °F)
Approvals	
Explosion protection approvals	ATEX / IECEx Zone 1, 2 , 21, 22 FM / cFM Cl 1 Div 1, Cl 1 Div 2
Pressure Equipment Directive 97/23/EC	Conformity assessment in accordance with category III, fluid group 1
CRN (Canadian Reg. Number)	On request
Transmitter	
Power supply	AC 100 ... 230 V (-15 / +10%), AC 24 V (-30 / +10%), DC 24 V (-30 / +30%)
Current output	4 ... 20 mA, active or passive
Pulse output	Can be configured locally as active or passive using software
Switch output	Optocoupler, programmable function
Contact input	Optocoupler, programmable function
Display	Graphical display, configurable
Housing	Integral mount design, choice of single-compartment housing or dual-compartment housing
Communication	HART protocol (standard), PROFIBUS PA, FOUNDATION fieldbus (option)

For food and beverage and pharmaceutical applications, refer to the HygienicMaster 500 data sheet

Model overview (remote mount design)		
Flowmeter sensor		
FEP521 (without explosion protection)	**FEP525 (explosion protection Zone 2 / Div. 2)**	**FEP525 (explosion protection Zone 1 / Div. 1)**
 G01083 Terminal box Aluminum Plastic	 G00489	 G00862
	ATEX / IEC Gases Zone 2 Dust Zone 21, 22	**ATEX / IEC** Gases Zone 1 Dust Zone 21, 22
	FM / cFM CL I Div 2 (NI, DIP)	**FM / cFM** CL I Div 1, 2 (XP, NI, DIP)
	For further information about the instruments' explosion protection approval please refer to the Ex test certificates (available on the product CD or under www.abb.com/flow).	

Transmitter					
FET521 (without explosion protection)	**FET525 (explosion protection Zone 2, Div. 2)**	**FET521 (without explosion protection)**	**FET525 (explosion protection Zone 1, Div. 1)**	**FET525 (explosion protection Zone 2, Div. 2)**	**FET521 (without explosion protection)**
 G01084	 G00490	 G01084	 G00863	 G00490	 G01084
	ATEX / IEC Gases Zone 2 Dust Zone 21, 22		**ATEX / IEC** Gases Zone 1 Dust Zone 21, 22	**ATEX / IEC** Gases Zone 2 Dust Zone 21, 22	
	FM / cFM CL I Div 2 (NI, DIP)		**FM / cFM** CL I Div 1, 2 (XP, NI, DIP)	**FM / cFM** CL I Div 2 (NI, DIP)	
	For further information about the instruments' explosion protection approval please refer to the Ex test certificates (available on the product CD or under www.abb.com/flow).				

Housing variants for transmitter FET321:

1 Single-compartment housing
2 Dual-compartment housing

Flowmeter sensor	**FEP521, FEP525**
Measured value error	Standard: 0.3 % of rate Optional: 0.2 % of rate).
Nominal size range	DN 3 ... 2000 (1/10 " ... 80 ")
Process connection	Flange in accordance with DIN 2501 / EN 1092-1, ASME B16.5 / B16.47, JIS 10K
Nominal pressure	PN 10 … 100, ASME CL 150, 300, 600
Lining	Hard rubber (DN 15 ... 2000), soft rubber (DN 50 ... 2000), PTFE (DN 10 ... 600), PFA (DN 3 ... 200), ETFE (DN 25 ... 600), elastomer (DN 50 ... 600), Ceramic Carbide (DN 25 ... 1000)
Conductivity	> 5 µS/cm (20 µS/cm for demineralized water)
Electrodes	Stainless steel, Hastelloy B, Hastelloy C, platinum-iridium, tantalum, titanium, Double Layer, tungsten carbide
Process connection material	Steel, stainless steel
Degree of protection	IP 65, IP 67, IP 68, (NEMA 4X)
Medium temperature	-25 ... 180 °C (-13 ... 356 °F)
Approvals	
Explosion protection approvals	ATEX / IECEx Zone 1, 2, 21, 22 FM / cFM Cl 1Div 1, Cl 1 Div 2
Pressure Equipment Directive 97/23/EC	Conformity assessment in accordance with category III, fluid group 1
CRN (Canadian Reg. Number)	On request
Transmitter	**FET521, FET525**
Power supply	AC 100 ... 230 V (-15 / +10%), AC 24 V (-30 / +10%), DC 24 V (-30 / +30%)
Current output	4 ... 20 mA, active or passive
Pulse output	Can be configured locally as active or passive using software
Switch output	Optocoupler, programmable function
Contact input	Optocoupler, programmable function
Display	Graphical display, configurable
Housing	Field-mount housing: choice of single-compartment housing or dual-compartment housing
Communication	HART protocol (standard), PROFIBUS PA, FOUNDATION fieldbus (option)

For food and beverage and pharmaceutical applications, refer to the HygienicMaster 500 data sheet

2 Performance specifications

2.1 General

2.1.1 Reference conditions according to EN 29104

Fluid temperature	20 °C (68 °F) ± 2 K
Ambient temperature	20 °C (68 °F) ± 2 K
Supply power	Nominal voltage acc. to name plate U_n ± 1 %, frequency f ± 1 %
Installation conditions	- Upstream >10 x DN, straight section - Downstream >5 x DN, straight section
Warm-up phase	30 min.

2.1.2 Maximum measuring error

Impulse output

- Standard calibration:
  ± 0.3 % of measured value, ± 0.02 % $Qmax_{DN}$
  (DN 3 … 600, 800)
  ± 0,4 % of measured value, ± 0,02 % $Qmax_{DN}$
  (DN 700, DN 900 … 2000)
- Optional calibration:
  ± 0.2 % of measured value, ± 0.02 % $Qmax_{DN}$
  (DN 10 … 600, 800)

$Qmax_{DN}$: See table in Section 2.4, "Flowmeter sizes, flow range".

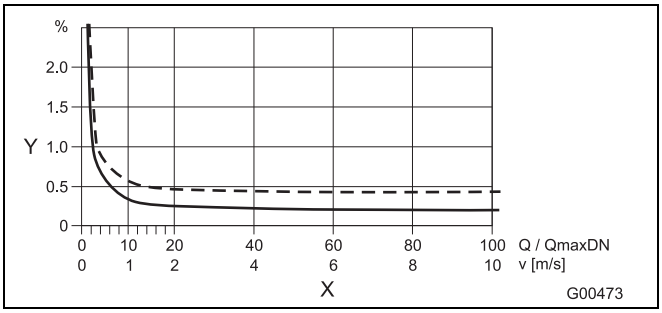


Fig. 1

Y Accuracy ± of measured value in [%]
X Flow velocity v in [m/s], Q / QmaxDN [%]

Analog output effects

Same as pulse output plus ± 0.1 % of measured value ± 0.01 mA

2.2 Reproducibility, response time

Reproducibility	≤ 0.11 % of measured value, t_{meas} = 100 s, v = 0.5 ... 10 m/s
Response time of current output with damping of 0.02 seconds	As step function 0 ... 99 % 5 τ ≥ 200 ms at 25 Hz excitation frequency 5 τ ≥ 400 ms at 12.5 Hz excitation frequency 5 τ ≥ 500 ms at 6.25 Hz excitation frequency

2.3 Transmitter

2.3.1 Electrical properties

Supply power	**AC** 100 ... 230 V (-15 % / +10 %) **AC** 24 V (-30 % / +10 %) **DC** 24 V (-30 % / +30 %), ripple: < 5 %
Line frequency	47 ... 64 Hz
Excitation frequency	6 1/4 Hz, 7 1/2 Hz, 12 1/2 Hz, 15 Hz, 25 Hz, 30 Hz (50 / 60 Hz power supply)
Power consumption	(flowmeter sensor including transmitter) **AC** S ≤ 20 VA **DC** P ≤ 12 W (switch-on current 5.6 A)
Electrical connection	Screw terminals

2.3.1.1 Isolation of input/outputs

The current output, digital outputs DO1 and DO2, and digital input are electrically isolated from the flowmeter sensor input circuit and from each other. The same is valid for the signal outputs of the versions with PROFIBUS PA and FOUNDATION fieldbus.

2.3.1.2 Empty pipe detection

The "empty pipe detection" function requires:

A conductivity of the measured fluid ≥ 20 µS/cm, a signal cable length ≤ 50 m (164 ft), a nominal diameter DN ≥ DN 10, and the flowmeter sensor must not be provided with a preamplifier.

2.3.2 Mechanical properties

Integral mount design (transmitter mounted directly on the flowmeter sensor)	
Housing	Cast aluminum, painted
Paint	Paint coat ≥ 80 µm thick, RAL 9002 (light gray)
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))
Remote mount design	
Housing	Cast aluminum, painted
Paint	Paint coat ≥ 80 µm thick, mid-section RAL 7012 (dark gray), front cover / rear cover RAL 9002 (light gray)
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))
Weight	4.5 kg (9.92 lb)

2.3.2.1 Storage temperature, ambient temperature

Ambient temperature

-20 ... 60 °C (-4 ... 140 °F) Standard range
-40 ... 60 °C (-40 ... 140 °F) Extended range

Storage temperature

-40 ... 70 °C (-40 ... 158 °F)

2.3.2.2 Protection class for transmitter housing

IP 65, IP 67, NEMA 4X

2.3.2.3 Vibration according to EN 60068-2

Transmitter

- In the range 10 ... 58 Hz with max. 0.15 mm (0.006 inch) deflection*
- In the range 58 ... 150 Hz max. 2 g acceleration*

* = Peak load

2.4 Flowmeter sizes, flow range

The flow range end value can be set between 0.02 x Q_{max}DN and 2 x Q_{max}DN.

Nominal diameter		Min. flow range end value	$Qmax_{DN}$	Max. flow range end value
DN	"	0.02 x Q_{max}DN (≈ 0.2 m/s)	0 … ≈ 10 m/s	2 x Q_{max}DN (≈ 20 m/s)
3	1/10	0.08 l/min (0.02 US gal/min)	4 l/min (1.06 US gal/min)	8 l/min (2.11 US gal/min)
4	5/32	0.16 l/min (0.04 US gal/min)	8 l/min (2.11 US gal/min)	16 l/min (4.23 US gal/min)
6	1/4	0.4 l/min (0.11 US gal/min)	20 l/min (5.28 US gal/min)	40 l/min (10.57 US gal/min)
8	5/16	0.6 l/min (0.16 US gal/min)	30 l/min (7.93 US gal/min)	60 l/min (15.85 US gal/min)
10	3/8	0.9 l/min (0.24 US gal/min)	45 l/min (11.9 US gal/min)	90 l/min (23.78 US gal/min)
15	1/2	2 l/min (0.53 US gal/min)	100 l/min (26.4 US gal/min)	200 l/min (52.8 US gal/min)
20	3/4	3 l/min (0.79 US gal/min)	150 l/min (39.6 US gal/min)	300 l/min (79.3 US gal/min)
25	1	4 l/min (1.06 US gal/min)	200 l/min (52.8 US gal/min)	400 l/min (106 US gal/min)
32	1 1/4	8 l/min (2.11 US gal/min)	400 l/min (106 US gal/min)	800 l/min (211 US gal/min)
40	1 1/2	12 l/min (3.17 US gal/min)	600 l/min (159 US gal/min)	1200 l/min (317 US gal/min)
50	2	1.2 m^3/h (5.28 US gal/min)	60 m^3/h (264 US gal/min)	120 m^3/h (528 US gal/min)
65	2 1/2	2.4 m^3/h (10.57 US gal/min)	120 m^3/h (528 US gal/min)	240 m^3/h (1057 US gal/min)
80	3	3.6 m^3/h (15.9 US gal/min)	180 m^3/h (793 US gal/min)	360 m^3/h (1585 US gal/min)
100	4	4.8 m^3/h (21.1 US gal/min)	240 m^3/h (1057 US gal/min)	480 m^3/h (2113 US gal/min)
125	5	8.4 m^3/h (37 US gal/min)	420 m^3/h (1849 US gal/min)	840 m^3/h (3698 US gal/min)
150	6	12 m^3/h (52.8 US gal/min)	600 m^3/h (2642 US gal/min)	1200 m^3/h (5283 US gal/min)
200	8	21.6 m^3/h (95.1 US gal/min)	1080 m^3/h (4755 US gal/min)	2160 m^3/h (9510 US gal/min)
250	10	36 m^3/h (159 US gal/min)	1800 m^3/h (7925 US gal/min)	3600 m^3/h (15850 US gal/min)
300	12	48 m^3/h (211 US gal/min)	2400 m^3/h (10567 US gal/min)	4800 m^3/h (21134 US gal/min)
350	14	66 m^3/h (291 US gal/min)	3300 m^3/h (14529 US gal/min)	6600 m^3/h (29059 US gal/min)
400	16	90 m^3/h (396 US gal/min)	4500 m^3/h (19813 US gal/min)	9000 m^3/h (39626 US gal/min)
450	18	120 m^3/h (528 US gal/min)	6000 m^3/h (26417 US gal/min)	12000 m^3/h (52834 US gal/min)
500	20	132 m^3/h (581 US gal/min)	6600 m^3/h (29059 US gal/min)	13200 m^3/h (58117 US gal/min)
600	24	192 m^3/h (845 US gal/min)	9600 m^3/h (42268 US gal/min)	19200 m^3/h (84535 US gal/min)
700	28	264 m^3/h (1162 US gal/min)	13200 m^3/h (58118 US gal/min)	26400 m^3/h (116236 US gal/min)
760	30	312 m^3/h (1374 US gal/min)	15600 m^3/h (68685 US gal/min)	31200 m^3/h (137369 US gal/min)
800	32	360 m^3/h (1585 US gal/min)	18000 m^3/h (79252 US gal/min)	36000 m^3/h (158503 US gal/min)
900	36	480 m^3/h (2113 US gal/min)	24000 m^3/h (105669 US gal/min)	48000 m^3/h (211337 US gal/min)
1000	40	540 m^3/h (2378 US gal/min)	27000 m^3/h (118877 US gal/min)	54000 m^3/h (237754 US gal/min)
1050	42	616 m^3/h (2712 US gal/min)	30800 m^3/h (135608 US gal/min)	61600 m^3/h (271217 US gal/min)
1100	44	660 m^3/h (3038 US gal/min)	33000 m^3/h (151899 US gal/min)	66000 m^3/h (290589 US gal/min)
1200	48	840 m^3/h (3698 US gal/min)	42000 m^3/h (184920 US gal/min)	84000 m^3/h (369841 US gal/min)
1400	54	1080 m^3/h (4755 US gal/min)	54000 m^3/h (237755 US gal/min)	108000 m^3/h (475510 US gal/min)
1500	60	1260 m^3/h (5548 US gal/min)	63000 m^3/h (277381 US gal/min)	126000 m^3/h (554761 US gal/min)
1600	66	1440 m^3/h (6340 US gal/min)	72000 m^3/h (317006 US gal/min)	144000 m^3/h (634013 US gal/min)
1800	72	1800 m^3/h (7925 US gal/min)	90000 m^3/h (396258 US gal/min)	180000 m^3/h (792516 US gal/min)
2000	80	2280 m^3/h (10039 US gal/min)	114000 m^3/h (501927 US gal/min)	228000 m^3/h (1003853 US gal/min)

2.5 Filling function (batch)

The integrated filling function of the device allows you to record filling processes >3 seconds.
For this purpose, the filling quantity is given via an adjustable totalizer.
Filling can be started via either the digital input or the fieldbus.
The valve is triggered via one of the digital outputs and closed again once the preset filling quantity is reached.
The transmitter measures the overrun quantity and calculates the overrun correction from this.
Additionally, the low flow cut-off can be activated if required.

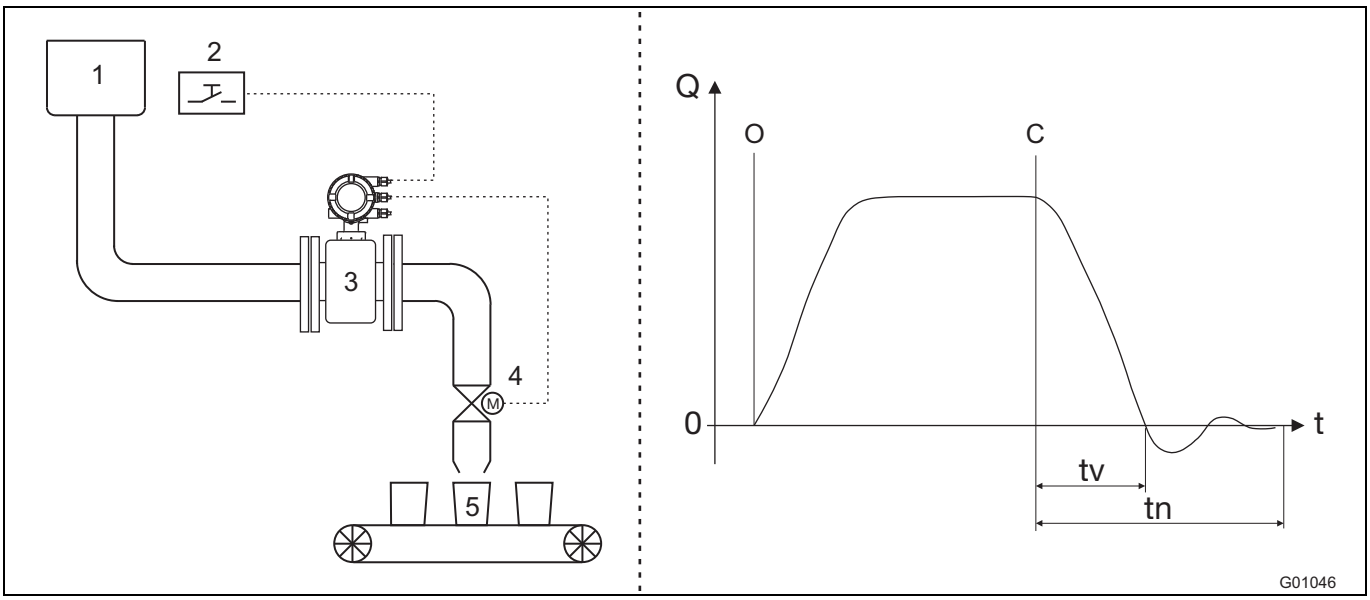


Fig. 2:

1 Supply tank
2 Start/stop contact (digital input)
3 Flowmeter sensor
4 Motor valve
5 Tank to be filled

O Valve open (filling started)
C Valve closed (fill quantity reached)
t_v Valve closing time
t_n Overrun time

3 Extended diagnostic functions

3.1 General

Important (Note)

- When using the extended diagnostic functions the external flowmeter sensor must not be provided with a preamplifier.

3.1.1 Detection of partial filling

Optionally, a measuring electrode (TFE electrode) is available for detecting a partially filled flowmeter sensor. The alarm for partial filling is output via the programmable digital output.

Conditions for using the function:

- Nominal diameter from DN 50 (2“)
- Max. signal cable length for version with external transmitter 200 m (656 ft).
- Conductivity of the fluid: 20 µS/cm ... 20,000 µS/cm
- The function is only available for ProcessMaster 300 / 500 without explosion protection or with explosion protection for Zone 2 / Div 2.

Additional installation conditions:

- The flowmeter sensor must be installed horizontally with the terminal box pointing upward.

3.1.2 Detection of gas bubbles

Gas bubbles in the fluid are detected by using an adjustable maximum limit value. When this limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- The flowmeter sensor can be installed either horizontally or vertically. Vertical installation is preferred.

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

3.1.3 Electrode coating detection

This function provides the opportunity to detect coatings on the measuring electrodes by using an adjustable maximum limit value.

When the set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [2)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.

3.1.4 Conductivity monitoring

The conductivity of the fluid is monitored by using an adjustable minimum / maximum limit value.

When the value falls below or exceeds the set limit value, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.
- There must not be any deposits on the measuring electrodes.

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

3.1.5 Electrode impedance monitoring

The impedance between the electrode and ground is monitored by using a minimum / maximum limit value. This enables the transmitter to detect an electrode fine short or leakage.

When the value falls below or exceeds the set limit value, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.
- There must not be any deposits on the measuring electrodes.
- The measuring tube must always be completely full, and the fluid must feature only minor conductivity variations.

3.1.6 Sensor measurements

This function includes the monitoring of the sensor temperature and the monitoring of the resistance of the flowmeter sensor's coils.

3.1.6.1 Sensor temperature monitoring

The temperature of the coils in the flowmeter sensor can be monitored by using adjustable minimum / maximum limit values. When a set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

The coil temperature is a factor of the ambient and fluid temperatures. The measurement can, e.g., be used to monitor overtemperature due to the fluid. The coil temperature is measured indirectly via the coil DC resistance.

3.1.6.2 Monitoring of the sensor coil resistance

The coils in the flowmeter sensor can be monitored by using adjustable minimum / maximum limit values for the coil resistance. When a set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

3.1.7 Trend

The device has an internal memory where the measured value for the electrode deposits and the conductivity are cyclically stored as a data set with an adjustable time (1 min ... 45000 min). A maximum of 12 data sets is stored. When the thirteenth record is stored, the oldest data set is overwritten automatically.

The data sets can be read out or analyzed as a trend using the external diagnostic tool (ScanMaster).

3.1.8 Fingerprint

The “fingerprint” database integrated in the transmitter allows you to compare the values at the time of factory calibration or commissioning with the currently recorded values.

3.1.9 Checking the grounding

This function allows you to check the electrical grounding of the device.

While the check is in progress, no flow measurement can take place.

Conditions for using the function:

- The measuring tube must be completely full.
- No flow must occur in the flowmeter sensor.

Additional installation conditions:

- The flowmeter sensor must not be provided with a preamplifier.

4 Functional specifications

4.1 Flowmeter sensor

4.1.1 Protection type according to EN 60529

IP 65, P 67, NEMA 4X

IP 68 (for external flowmeter sensors only)

4.1.2 Pipeline vibration according to EN 60068-2-6

The following applies to compact devices:

(transmitter mounted directly on the flowmeter sensor)

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

The following applies to devices with a separate transmitter:

Transmitter

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

Flowmeter sensor

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

4.1.3 Installation length

The flange devices comply with the installation lengths specified in VDI/VDE 2641, ISO 13359, or according to DVGW (process sheet W420, design WP, ISO 4064 short).

4.1.4 Signal cable (for external transmitters only)

A 5 m (16.4 ft) cable is supplied.

If you require more than 5 m (16.4 ft), a cable can be purchased using order number D173D027U01.

In the case of the transmitter designed for use in Zone 1, Div 1 (model FET525), 10 m (32.8 ft) of signal cable is permanently connected to the transmitter.

Alternatively, the cable with order number D173D031U01 can be used for transmitters without explosion protection (model FEP521, FEH521) from DN15 and for transmitters for use in Zone 2 (model FEP525, FEH525) from DN15.

Preamplifier

Max. signal cable length between flowmeter sensor and transmitter:

a) Without preamplifier:

- Max. 50 m (164 ft) for conductivity ≥ 5 µS/cm

A preamplifier is required for cables > 50 m (164 ft).

b) With preamplifier

- Max. 200 m (656 ft) for conductivity ≥ 5 µS/cm

Important (Note)

The preamplifier is only available for transmitters with an aluminum terminal box.

4.1.5 Temperature range

Storage temperature

-40 ... 70 °C (-40 ... 158 °F)

Min. permissible pressure as a function of fluid temperature

Lining	Nominal diameter	$P_{Operating}$ at mbar abs.	$T_{Operating}$ [1]
Hard rubber	15 ... 2000 (1/2 ... 80")	0	< 90 °C (194 °F) < 80 °C (176 °F) [2]
Soft rubber	50 ... 2000 (2 ... 80")	0	< 60 °C (140 °F)
PTFE KTW-approved	10 ... 600 (3/8 ... 24")	270 400 500	< 20 °C (68 °F) < 100 °C (212 °F) < 130 °C (266 °F)
Thick PTFE, high-temp. design	25 … 80 100 … 250 300	0 67 27	< 180 °C (356 °F) < 180 °C (356 °F) < 180 °C (356 °F)
PFA	3 ... 200 (1/10 ... 8")	0	< 180 °C (356 °F)
Elastomer [3]	50 .. 600 (2 … 24“)	100	< 130 °C (266 °F)
ETFE	25 ... 600 (1 ... 24")	100	< 130 °C (266 °F)
Ceramic Carbide	25 ... 1000 (1 ... 40"	0	< 80 °C (176 °F)

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table titled "Maximum permissible cleaning temperature“.
2) Only China production site.
3) Only USA production site.

Max. permissible cleaning temperature

CIP cleaning	Sensor lining	T_{max}	T_{max} minutes	$T_{amb.}$
Steam cleaning	PTFE, PFA	150 °C (302 °F)	60	25 °C (77 °F)
Fluids	PTFE, PFA	140 °C (284 °F)	60	25 °C (77 °F)

If the ambient temperature is > 25 °C, the difference must be subtracted from the max. cleaning temperature. T_{max} - Δ °C.

(Δ °C = T_{amb} - 25 °C)

Maximum ambient temperature as a function of fluid temperature

Important (Note)

When using the device in potentially explosive areas, the additional temperature specifications in the section titled "Ex relevant specifications" on the data sheet or in the the separate Ex safety instructions (SM/FEX300/FEX500/ATEX/IECEX) or (SM/FEX300/FEX500/FM/CSA) must be observed.

Models FEP511, FEP515 (standard temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
Hard rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Soft rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
PTFE	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
PFA 1)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
PFA 1)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
Thick PTFE 2)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
Thick PTFE 2)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
ETFE 3)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
ETFE 3)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
Elastomer	Steel	-10 °C (14 °F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	130 °C (266 °F)
Elastomer	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F) 45 °C (113 °F)	-20 °C (-4 °F)	130 °C (266 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F) 45 °C (113 °F)	-20 °C (-4 °F)	80 °C (176 °F)

Models FEP511, FEP515 (high-temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
PFA 1)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	180 °C (356 °F)
PFA 1)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-20 °C (-13 °F)	180 °C (356 °F)
Thick PTFE 2)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	180 °C (356 °F)
Thick PTFE 2)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-20 °C (-13 °F)	180 °C (356 °F)
ETFE 3)	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
ETFE 3)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-20 °C (-13 °F)	130 °C (266 °F)

1) PFA (high-temperature version) available for nominal diameters ≥ DN 10
2) Thick PTFE available for nominal diameters ≥ DN 25
3) ETFE available for nominal diameters ≥ DN 25
4) Only China production site
5) For (optional) low-temperature version, only

Important (Note)
When using the device in potentially explosive areas, the additional temperature specifications in the section titled "Ex relevant specifications" on the data sheet or in the the separate Ex safety instructions (SM/FEX300/FEX500/ATEX/IECEX) or (SM/FEX300/FEX500/FM/CSA) must be observed.

Models FEP521, FEP525 (standard temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
Hard rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Soft rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
PFA 1)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
PFA 1)	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
Thick PTFE 2)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
Thick PTFE 2)	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
ETFE 3)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
ETFE 3)	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
Elastomer	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
Elastomer	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	130 °C (266 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14°F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-20 °C (-4 °F)	80 °C (176 °F)

Models FEP521, FEP525 (high-temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
PFA 1)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	180 °C (356 °F)
PFA 1)	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
Thick PTFE 2)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	180 °C (356 °F)
Thick PTFE 2)	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
ETFE 3)	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
ETFE 3)	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)

1) PFA (high-temperature version) available for nominal diameters ≥ DN 10
2) Thick PTFE available for nominal diameters ≥ DN 25
3) ETFE available for nominal diameters ≥ DN 25
4) Only China production site
5) For (optional) low-temperature version, only

Important (Note)
In the case of model FEP521 with plastic terminal box, a reduced minimum ambient temperature of -20 °C (-4 °F) applies.

4.1.6 Material load

Limits for the permissible fluid temperature (TS) and permissible pressure (PS) are calculated on the basis of the lining and flange material used in the device (refer to the name plate on the device).

DIN flange stainless steel to DN 600 (24")

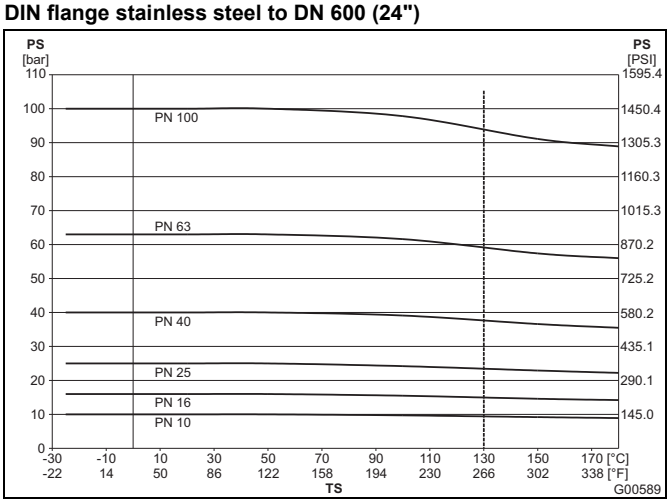


Fig. 3

ASME flange, stainless steel, up to DN 400 (16") (CL150/300) up to DN 1000 (40") (CL150)

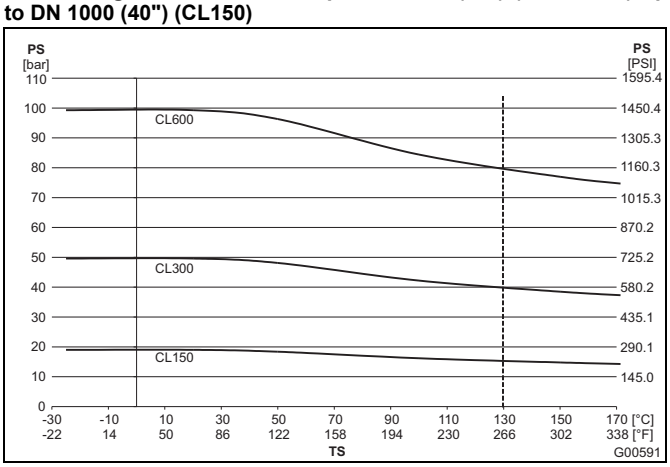


Fig. 4

DIN flange, steel, up to DN 600 (24")

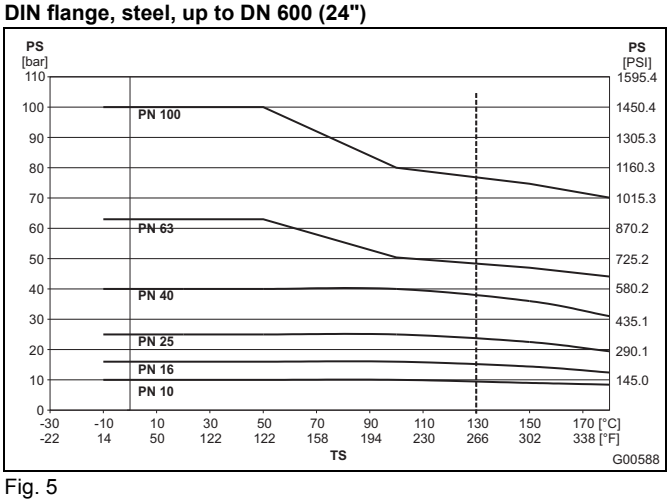


Fig. 5

ASME flange, steel, up to DN 400 (16") (CL150/300); up to DN 1000 (40") (CL150)

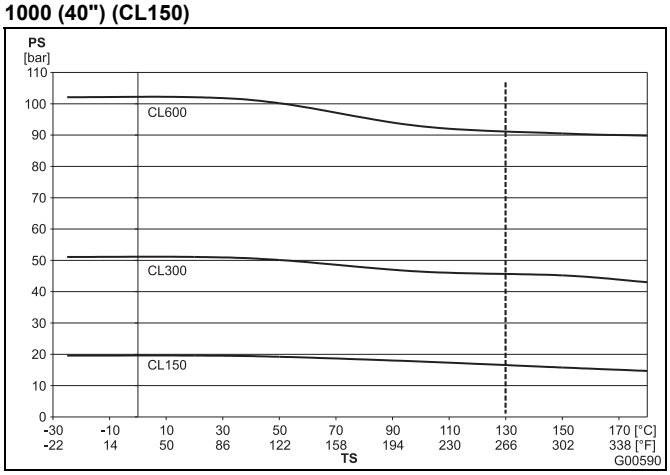


Fig. 6

JIS 10K-B2210 flange

Nominal diameter	Material	PN	TS	PS
32 ... 400 (1 1/4 ... 16")	Stainless steel	10	-25 ... 180 °C (-13 ... 356 °F)	10 bar (145 psi)
32 ... 400 (1 1/4 ... 16")	Steel	10	-25 ... 180 °C (14 ... 356 °F)	10 bar (145 psi)

DIN flange, stainless steel, DN 700 (28") up to DN 1000 (40")

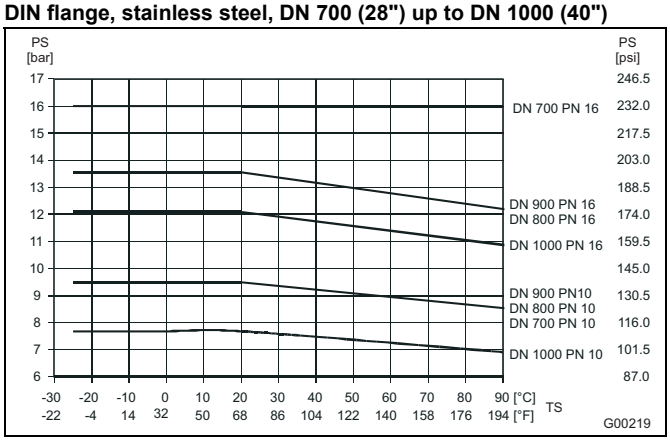


Fig. 7

DIN flange, steel, DN 700 (28") up to DN 1000 (40")

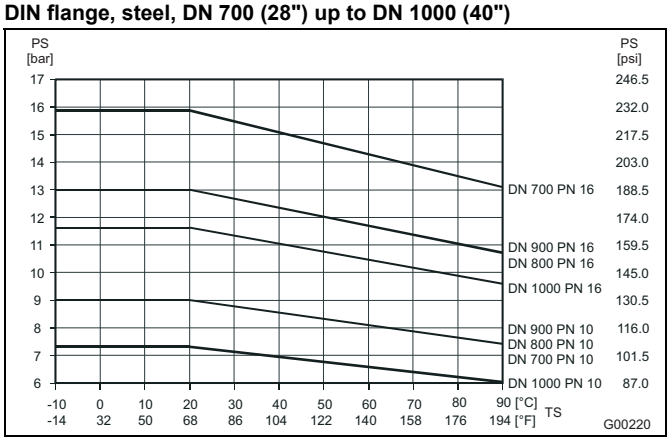


Fig. 8

4.1.7 Flowmeter sensor

Parts that come into contact with fluid

Part	Standard	Option
Lining	PTFE, PFA, ETFE, hard rubber, soft rubber	Ceramic Carbide, Elastomer
Measurement and grounding electrode for: - Hard rubber - Soft rubber	CrNi steel 1.4571 (AISI 316Ti)	Hastelloy B-3 (2.4600), Hastelloy C-4 (2.4610), titanium, tantalum, platinum-iridium, 1.4539 (AISI 904L)
- PTFE, PFA, ETFE	CrNi steel 1.4539 (AISI 904L)	CrNi steel 1.4571 (AISI 316Ti) Hast. C-4 (2.4610) Hast. B-3 (2.4600) Titanium, tantalum, platinum-iridium
Grounding plate	Stainless steel	On request
Protection plate	Stainless steel	On request

Parts that do not come into contact with fluid (process connection)

	Standard	Option
DN 3 ... 15 (1/10 ... 1/2")	Stainless steel [1)]	-
DN 20 ... 400 (3/4 ... 16")	Steel (galvanized)[2)]	Stainless steel [1)]
DN 450 ... 2000 (18 ... 80")	Steel (painted) [2)]	-

The process connections are made of one of the materials listed below:

1) 1.4301 (AISI 304), 1.4307, 1.4404 (AISI 316L) 1.4435 (AISI 316L), 1.4541 (AISI 321) 1.4571 (AISI 316Ti), ASTM A182 F304, ASTM A182 F304L, ASTM A182 F316L, ASTM A182 F321, ASTM A182 F316TI, ASTM A182 F316, 0Cr18Ni9, 0Cr18Ni10, 0Cr17Ni13Mo2, 0Cr27Ni12Mo3, 1Cr18Ni9Ti, 0Cr18Ni12Mo2Ti
2) 1.0038, 1.0460, 1.0570, 1.0432, ASTM A105, Q255A, 20#, 16Mn

Flowmeter sensor housing

	Standard
Housing	
DN 3 ... 400 (1/10 ... 16")	Dual-shell casing, cast aluminum, painted, paint coat, ≥ 80 µm thick, RAL 9002
DN 450 ... 2000 (18 ... 80")	Welded steel design, painted, paint coat, ≥ 80 µm thick, RAL 9002
Terminal box	Aluminum alloy, painted, ≥ 80 µm thick, light gray, RAL 9002
or	Plastic, light gray, RAL 9002
Meter tube	Stainless steel [3)]
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))

The meter tube is made of one of the materials listed below:

3) 1.4301, 1.4307, 1.4404, 1.4435, 1.4541, 1.4571
ASTM materials:
Grade TP304, TP304L, TP316L, TP321, TP316Ti, TP317L,0Cr18Ni9, 00Cr18Ni10, 0CR17Ni14Mo2, 0Cr27Ni12Mo3, 0Cr18Ni10Ti

4.2 Electrical connection

4.2.1 Models FEP511, FEP521, FET521 with HART protocol

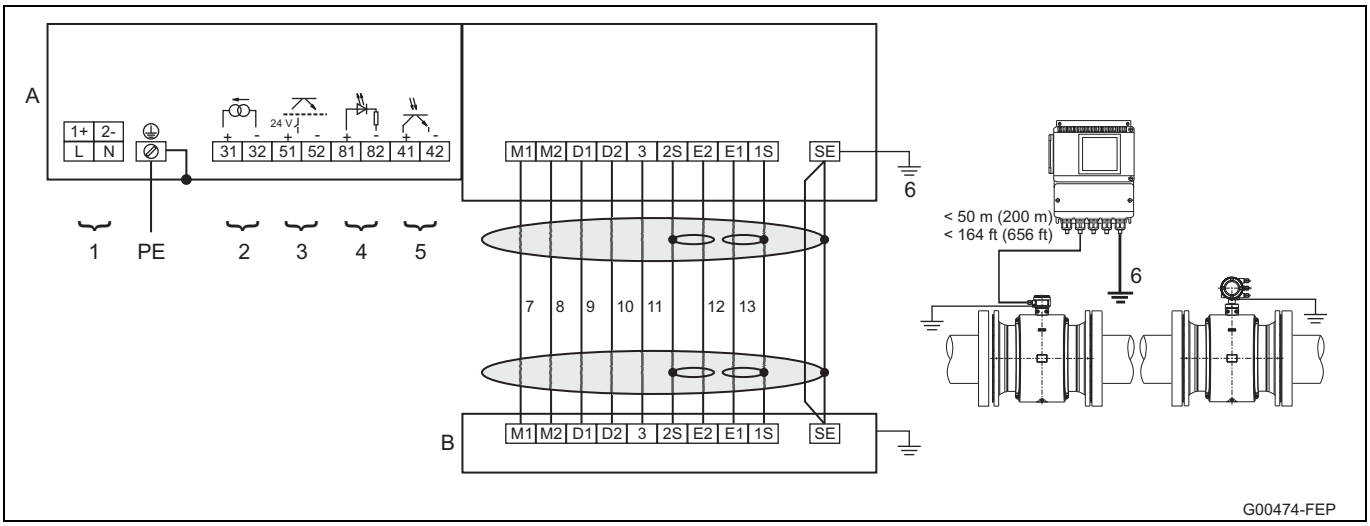


Fig. 9

A **Transmitter**
B **Flowmeter sensor**
1 **Power supply**
See name plate
2 **Current output (terminals 31 / 32)**
The current output can be operated in "active" or "passive" mode.
- Active: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
- Passive: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
  Supply voltage for the current output: minimum 11 V, maximum 30 V at terminals 31 / 32.

3 **Digital output DO1 (terminals 51 / 52) (pulse output or digital output)**
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Pulse Output".
The output can be configured as an "active" or "passive" output (in the case of the transmitter with the dual-compartment housing, the output is configured using the software; in the case of the transmitter with the single-compartment housing, it is configured by means of jumpers on the transmitter backplane).
Configuration using software.
- Configuration as pulse output.
  Max. pulse frequency: 5250 Hz.
  Pulse width: 0.1 … 2000 ms.
  The pulse factor and pulse width are interdependent and are calculated dynamically.
- Configuration as contact output
  Function: System alarm, empty pipe alarm, max. / min. alarm, flow direction signaling, other
- Configuration as "active" output
  U = 19 ... 21 V, I_{max} = 220 mA , f_{max} ≤ 5250 Hz
- Configuration as "passive" output
  U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz

4 **Digital input (terminals 81 / 82) (contact input)**
Function can be configured locally using software:
External output switch-off, external totalizer reset, external totalizer stop, other

Data for the optocoupler: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

5 **Digital output DO2 (terminals 41 / 42) (pulse output or digital output)**
Function can be configured locally as "Pulse Output" or "Digital Output" using software.
Factory setting is "Digital Output", flow direction signaling.
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz

6 Functional ground
7 Yellow
8 Brown
9 Green
10 Red
11 Blue
12 Orange
13 Violet

4.2.2 Models FEP511, FEP521, FET521 with PROFIBUS PA, FOUNDATION fieldbus

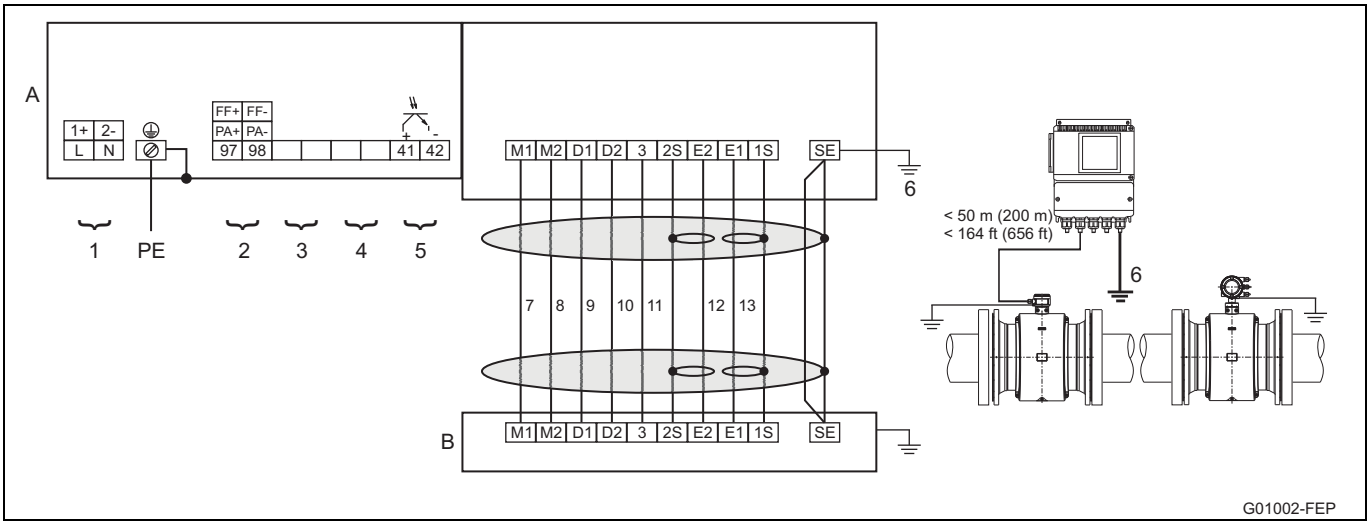


Fig. 10

A **Transmitter**
B **Flowmeter sensor**
1 **Power supply**
See name plate
2 **Digital communication (terminal 97 / 98)**
- **PROFIBUS PA in acc. with IEC 61158-2 (PA+ / PA-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
Bus connection with integrated protection against polarity reversal
The bus address can be set via the DIP switches in the device (with dual-compartment transmitter housing only), the transmitter display or the fieldbus.

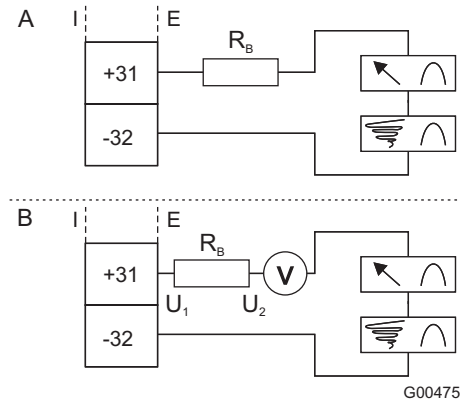
or

- **FOUNDATION fieldbus in acc. with IEC 61158-2 (FF+ / FF-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
Bus connection with integrated protection against polarity reversal

3 Not assigned
4 Not assigned
5 **Digital output DO2 (terminals 41 / 42) (pulse output or digital output)**
Function can be configured locally as "Pulse Output" or "Digital Output" using software.
Factory setting is "Digital Output", flow direction signaling.
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz
6 Functional ground
7 Brown
8 Red
9 Orange
10 Yellow
11 Green
12 Blue
13 Violet

4.2.3 Connection examples for the peripherals

Current output



A = "Active" configuration:
4 ... 20 mA, HART
Load: 0 =R = 650 Ω (300 Ω for Ex Zone 1 / Div. 1)
Min. load with HART: 250 Ω

B = "Passive" configuration:
4 ... 20 mA, HART
Load: 0 =R = 650 Ω
Min. load with HART: 250 Ω
Supply voltage for the current output, terminals 31 / 32:
U1: Min. 11 V, max. 30 V

I = internal, E = external

Max. permissible load (R_B) as a function of the source voltage (U_2)

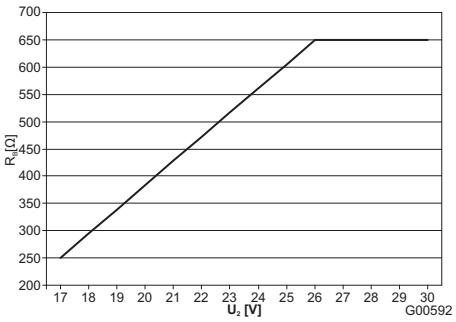
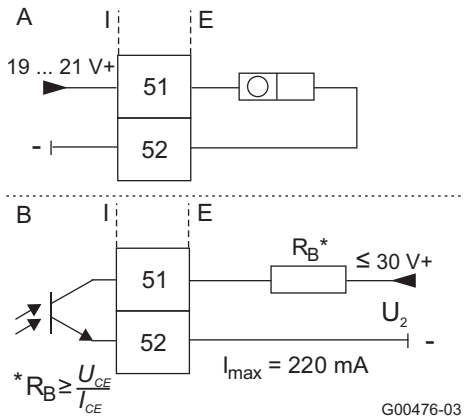


Fig. 11

Digital output DO1

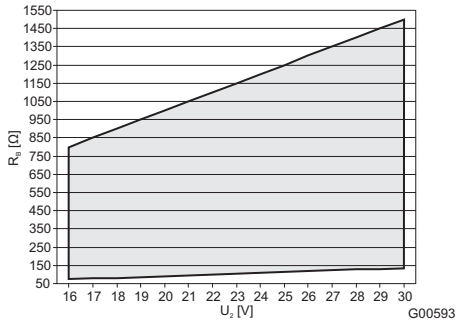


A = "Active" configuration

B = "Passive" configuration

I = internal, E = external

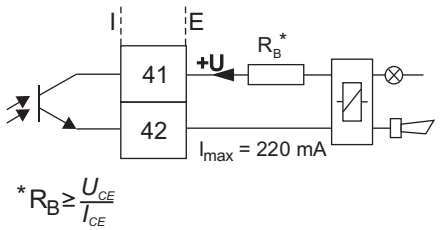
Max. permissible load (R_B) as a function of the source voltage (U_2)



= Permissible range

Fig. 12

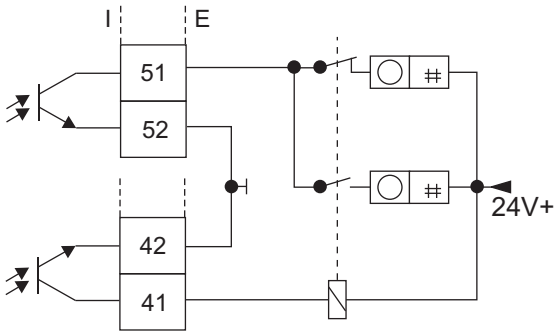
Digital output DO2, e.g., for system monitoring, max. / min. alarm, empty meter tube or forward / reverse signal, or counting pulses (function can be configured using software)



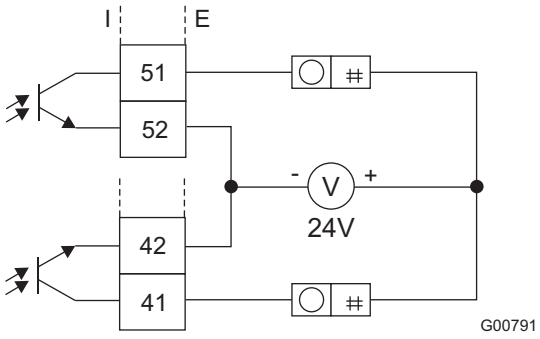
I = internal, E = external

Fig. 13

Digital outputs DO1 and DO2, separate forward and reverse pulses



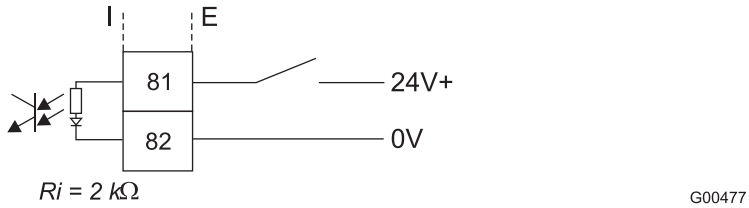
Digital outputs DO1 and DO2, separate forward and reverse pulses (alternative connection)



I = internal, E = external

Fig. 14

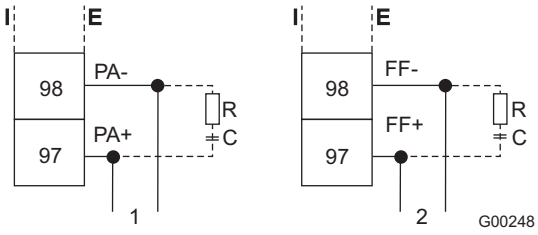
Digital input for external output switch-off or external totalizer reset



I = internal, E = external

Fig. 15

PROFIBUS PA and FOUNDATION fieldbus



The resistance R and condenser C form the bus termination. They must be installed when the device is connected to the end of the entire bus cable.

R = 100 Ω; C = 1 µF

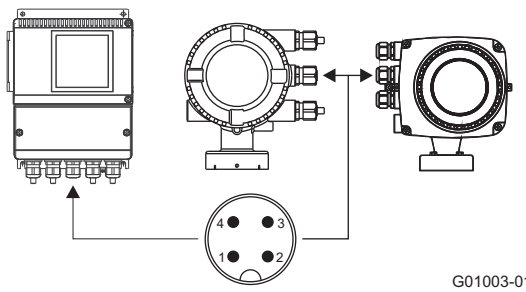
1 PROFIBUS PA

2 FOUNDATION fieldbus

I = internal, E = external

Fig. 16

Connection via M12 plug (only for PROFIBUS PA in non-hazardous areas)



Pin assignment

(Front view showing pin insert and pins)

PIN 1 = PA+

PIN 2 = nc

PIN 3 = PA-

PIN 4 = shield

Fig. 17

Digital communication

The transmitter has the following options for digital communication:

HART protocol

The unit is registered with the HART Communication Foundation.

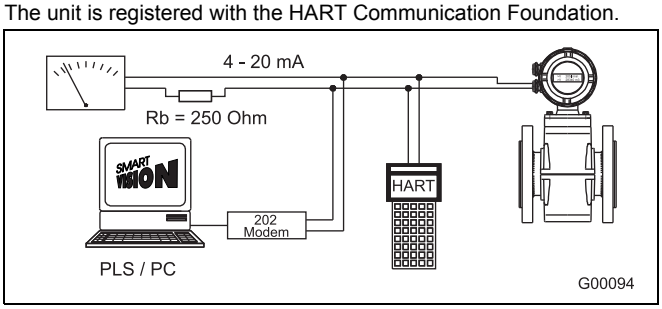


Fig. 18

HART protocol	
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ HART-DTM)
Transmission	FSK modulation on current output 4 ... 20 mA acc. to Bell 202 standard
Max. signal amplitude	1.2 mA_{ss}
Current output load	Min. 250 Ω, max. = 560 Ω
Cable	AWG 24 twisted
Max. cable length	1500 m
Baud rate	1,200 baud
Display	Log. 1: 1,200 Hz Log. 0: 2200 Hz

For additional information, see the separate interface description.

System integration

In conjunction with the DTM (Device Type Manager) available for the device, communication (configuration, parameterization) can occur with the corresponding framework applications according to FDT 1.21 (DAT200 Asset Vision Basic).

Other tool/system integrations (e.g., Emerson AMS/Siemens PCS7) are available upon request.

A free of charge version of the DAT200 Asset Vision Basic framework application for HART® or PROFIBUS is available upon request.

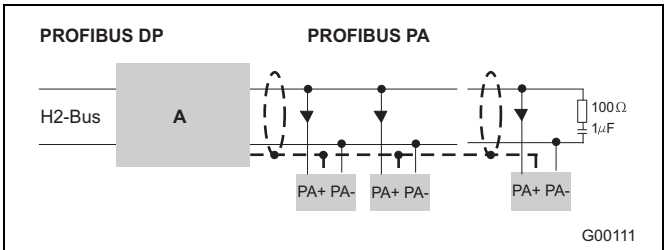
The required DTMs are contained on the DAT200 Asset Vision Basic DVD or in the DTM Library.

They can also be downloaded from www.abb.com/flow.

PROFIBUS PA protocol

The interface conforms to profile 3.01 (PROFIBUS standard, EN 50170, DIN 19245 [PRO91]).

PROFIBUS PA ID no.:	0x3430
Alternative standard ID no.:	0x9700 or 0x9740
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ PROFIBUS PA-DTM)
Transmission signal	Acc. to IEC 61158-2
Cable	Shielded, twisted cable (acc. to IEC 61158-2, types A or B are preferred)



A = Segment coupler (incl. bus supply and termination)

Fig. 19: Example for PROFIBUS PA interface connection

Bus topology

- Tree and/or line structure
- Bus termination: passive at both ends of the main bus line (RC element R = 100 Ω, C = 1 µF)

Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the integrated FDE function (=Fault Disconnection Electronic) integrated in the device is ensures that the current consumption can rise to a maximum of 13 mA.
- The upper current limit is restricted electronically.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

For additional information, see the separate interface description.

System integration

ABB provides three different GSD files (equipment master data) which can be integrated in the system.

Users decide at system integration whether to install the full range of functions or only part.

The change-over is done using the “ID-number selector” parameter.

ID number 0x9700, GSD file name: PA139700.gsd

ID number 0x9740, GSD file name: PA139740.gsd

ID number 0x3430, GSD file name: ABB_3430.gsd

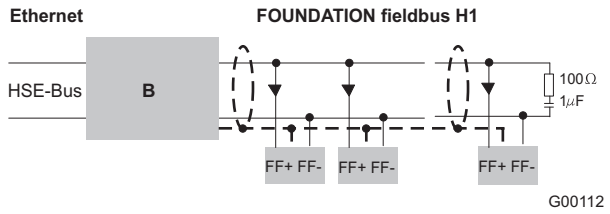
The interface description appears on the CD included in the scope of supply.

The GSD files can also be downloaded from www.abb.com/flow.

The files required for operation can be downloaded from www.profibus.com.

FOUNDATION fieldbus (FF)

Interoperability test campaign no.	ITK 5.20
Manufacturer ID	0x000320
Device ID	0x0124
Configuration	• Directly on the device • Via services integrated in the system • National configurator
Transmission signal	Acc. to IEC 61158-2



B = Linking device (incl. bus supply and termination)

Fig. 20: Example for FOUNDATION fieldbus interface connection

Bus topology

- Tree and/or line structure
- Bus termination: passive at both ends of the main bus line (RC element R = 100 Ω, C = 1 µF)

Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the integrated FDE function (=Fault Disconnection Electronic) integrated in the device is ensures that the current consumption can rise to a maximum of 13 mA.
- Upper current limit: electronically restricted.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

Bus address

The bus address is automatically assigned or can be set in the system manually.

The identifier (ID) is formed using a unique combination of manufacturer ID, device ID, and device serial number.

System integration

The following are required:

- DD (Device Description) file, which includes the device description.
- The CFF (Common File Format) file is required for engineering the segment. Engineering can be performed online or offline.

The interface description appears on the CD included in the scope of supply.

The files can also be downloaded from www.abb.com/flow.

The files required for operation can also be downloaded from http://www.fieldbus.org.

5 Ex-relevant specifications for operation in zones 1, 21, 22 / Div. 1

5.1 General

Devices with dual-compartment transmitter housing (model names FEP515 and FEP525) are approved for operation in the following potentially explosive areas:

- ATEX / IECEx Zone 1, 21, 22
- FM Div.1
- cFM Div.1

Important (Note)
For detailed information on the individual approvals, refer to Section **1** „**ProcessMaster 500 - Overview of technology**“.

Important (Note)
The housing for the transmitter and flowmeter sensor must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE) no potential differences can occur between protective conductor and potential equalization (PA).

A temperature of 70 °C (158 °F) at the cable entry is assumed for the Ex calculations. Therefore, the cables used for the supply power and the signal inputs and outputs must have a minimum specification of 70 °C (158 °F).

For devices with remote mount design for use in FM / cFM Div. 1 or FM / cFM Div. 2 the signal cable between the flowmeter sensor and the transmitter must have a minimum length of 5 m (16.4 ft).

5.2 Electrical connection

5.2.1 Models FEP515, FEP525 and FET525 in Zone 1 / Div. 1 with HART protocol

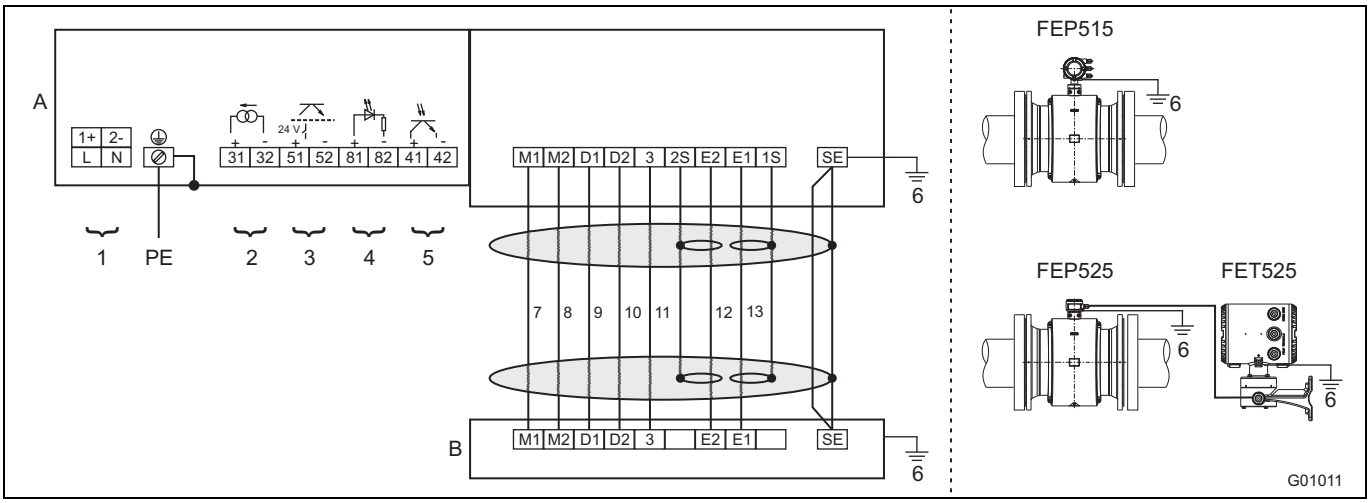


Fig. 21

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power:**
See name plate
2 **Current output (terminals 31/32)**
Dependent upon the device design, an "active" or a "passive" output will be available.
For devices designed for use in Ex Zone 1, the current output cannot be reconfigured locally.
- Active: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 300 Ω
- Passive: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω,
Supply voltage for the current output: minimum 11 V, maximum 30 V at terminals 31/32.

3 **Digital output DO1 (terminal 51/52)**
The output is always a "passive" output (optocoupler).
- Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA,

Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Pulse Output".
- Configuration as pulse output. Maximum pulse frequency: 5,250 Hz, pulse width: 0.1 … 2,000 ms. The pulse factor and pulse width are interdependent and are calculated dynamically.
- Configuration as contact output. Function: System alarm, empty pipe alarm, max./min. alarm, flow direction signaling, other

4 **Digital input: (terminal 81/82)**
Only available in conjunction with "passive" current output.
Function can be configured locally using software: External output switch-off, external totalizer reset, external totalizer stop, other
Data for the optocoupler: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

5 **Digital output DO2 (terminal 41/42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.

6 **Equipotential bonding**
7 **Brown**
8 **Red**
9 **Orange**
10 **Yellow**
11 **Green**
12 **Blue**
13 **Violet**

All inputs and outputs are electrically isolated from each other and from the supply power.
The electrical specifications given are operating values.

5.2.2 Models FEP515, FEP525 and FET525 in Zone 1 / Div. 1 with PROFIBUS PA or FOUNDATION fieldbus

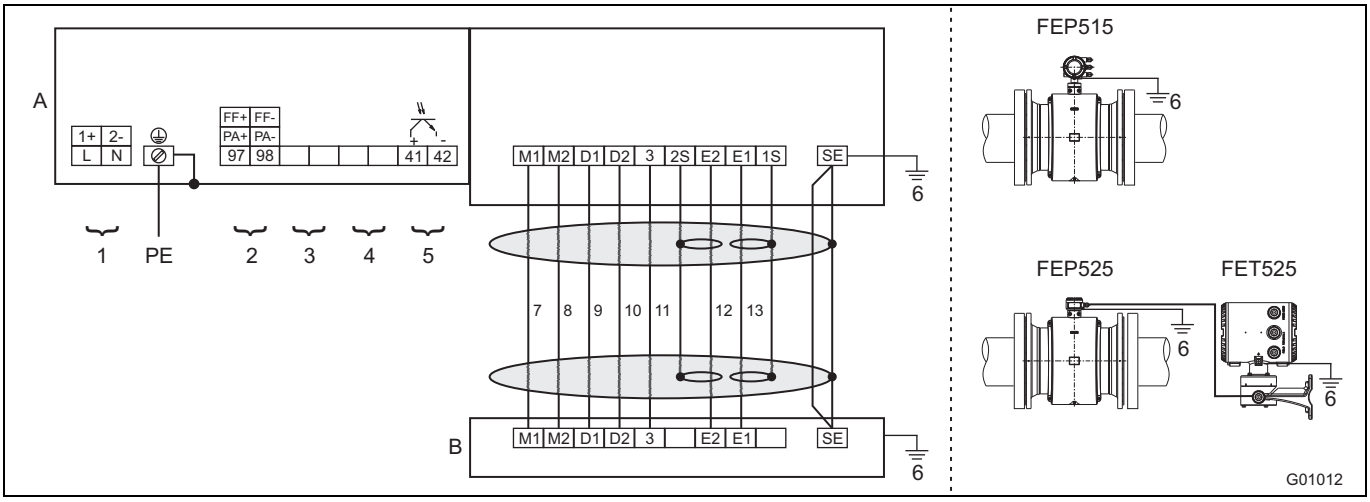


Fig. 22

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power:**
See name plate
2 **Digital communication (terminal 97 / 98)**
- **PROFIBUS PA in acc. with IEC 61158-2 (PA+ / PA-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error)
Bus connection with integrated protection against polarity reversal
The bus address can be set via the DIP switches in the device (with dual-compartment transmitter housing only), the transmitter display or the fieldbus.

or

- **FOUNDATION fieldbus in acc. with IEC 61158-2 (FF+ / FF-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
Bus connection with integrated protection against polarity reversal

3 **Not assigned**
4 **Not assigned**
5 **Digital output DO2 (terminal 41 / 42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.
6 **Equipotential bonding**
7 **Brown**
8 **Red**
9 **Orange**
10 **Yellow**
11 **Green**
12 **Blue**
13 **Violet**

All inputs and outputs are electrically isolated from each other and from the supply power.

The electrical specifications given are operating values.

For devices with PROFIBUS PA or FOUNDATION fieldbus the bus termination must conform to the FISCO model or the explosion protection regulations, respectively.

5.2.3 Model FEP525 in Zone 1 / Div. 1 and FET525 transmitter in Zone 2 / Div. 2 or FET521 outside the hazardous area with HART protocol

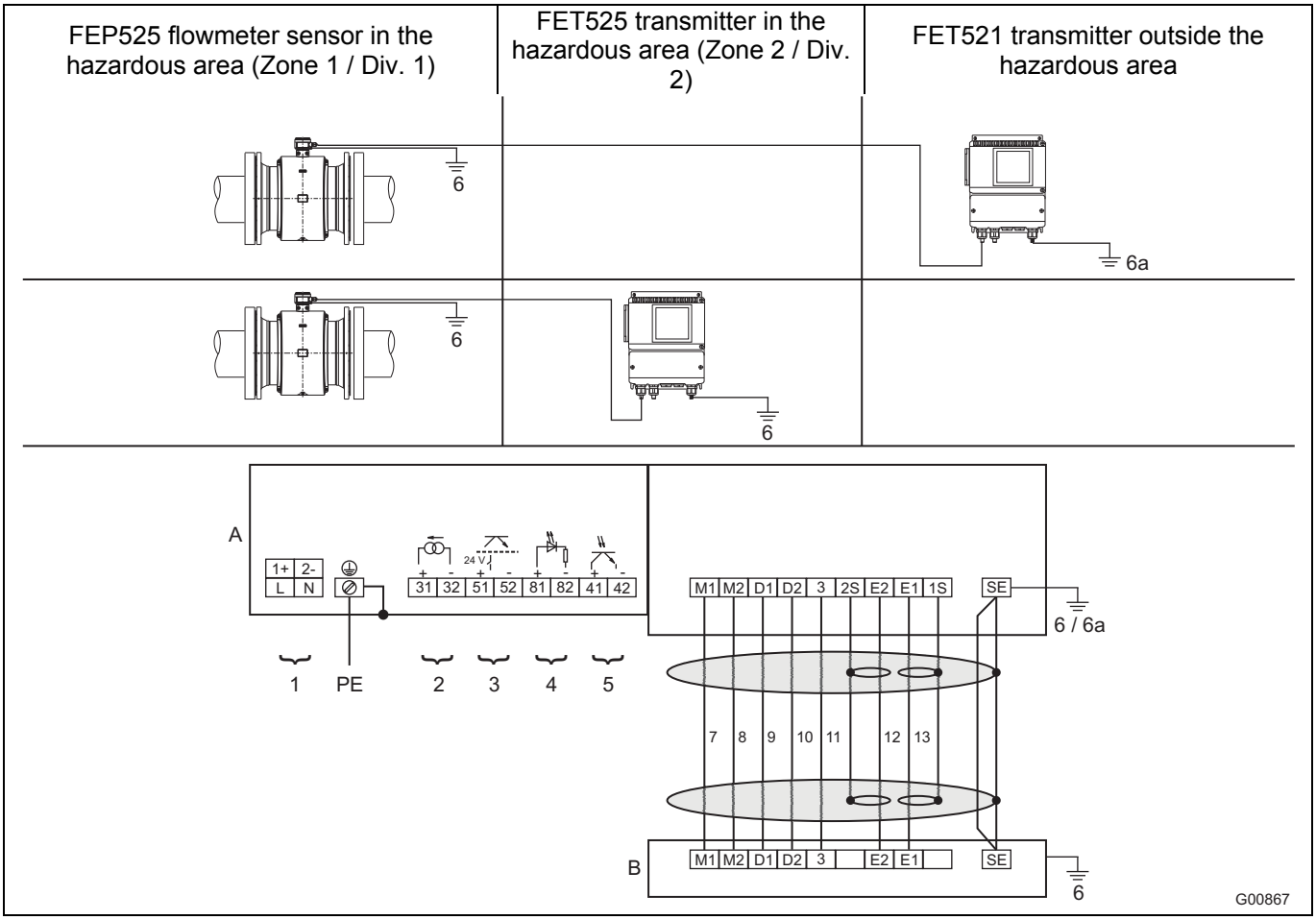


Fig. 23

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power**:
See name plate
2 **Current output (terminals 31 / 32)**
The current output can be configured locally as an "active" or "passive" output.
- Active: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
- Passive: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω,
Supply voltage for the current output: minimum 11 V, maximum 30 V at terminals 31 / 32.

3 **Digital output DO1 (terminal 51 / 52)**
The digital output can be configured locally as an "active" or "passive" output (in the case of the transmitter with the dual-compartment housing, the output is configured using the software; in the case of the transmitter with the single-compartment housing, it is configured by means of jumpers on the transmitter backplane).
- Active: U = 19 ... 21 V. I_{max} = 220 mA, f_{max} ≤ 5250 Hz
- Passive: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz

Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Pulse Output".
- Configuration as pulse output. Maximum pulse frequency: 5250 Hz, pulse width: 0.1 … 2000 ms. The pulse factor and pulse width are interdependent and are calculated dynamically.
- Configuration as contact output. Function: System alarm, empty pipe alarm, max. / min. alarm, flow direction signaling, other

4 **Digital input: (terminal 81 / 82)**
Function can be configured locally using software: External output switch-off, external totalizer reset, external totalizer stop, other
Data for the optocoupler: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

5 **Digital output DO2 (terminal 41 / 42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz,
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.

6 **Equipotential bonding**
6a **Functional ground** (only with flowmeter sensor FET321 outside the hazardous area)
7 Brown
8 red
9 Orange
10 yellow
11 Green
12 blue
13 Violet

All inputs and outputs are electrically isolated from each other and from the supply power. The electrical specifications given are operating values.

5.2.4 Model FEP525 in Zone 1 / Div. 1 and FET525 transmitter in Zone 2 / Div. 2 or FET521 outside the hazardous area with PROFIBUS PA or FOUNDATION fieldbus

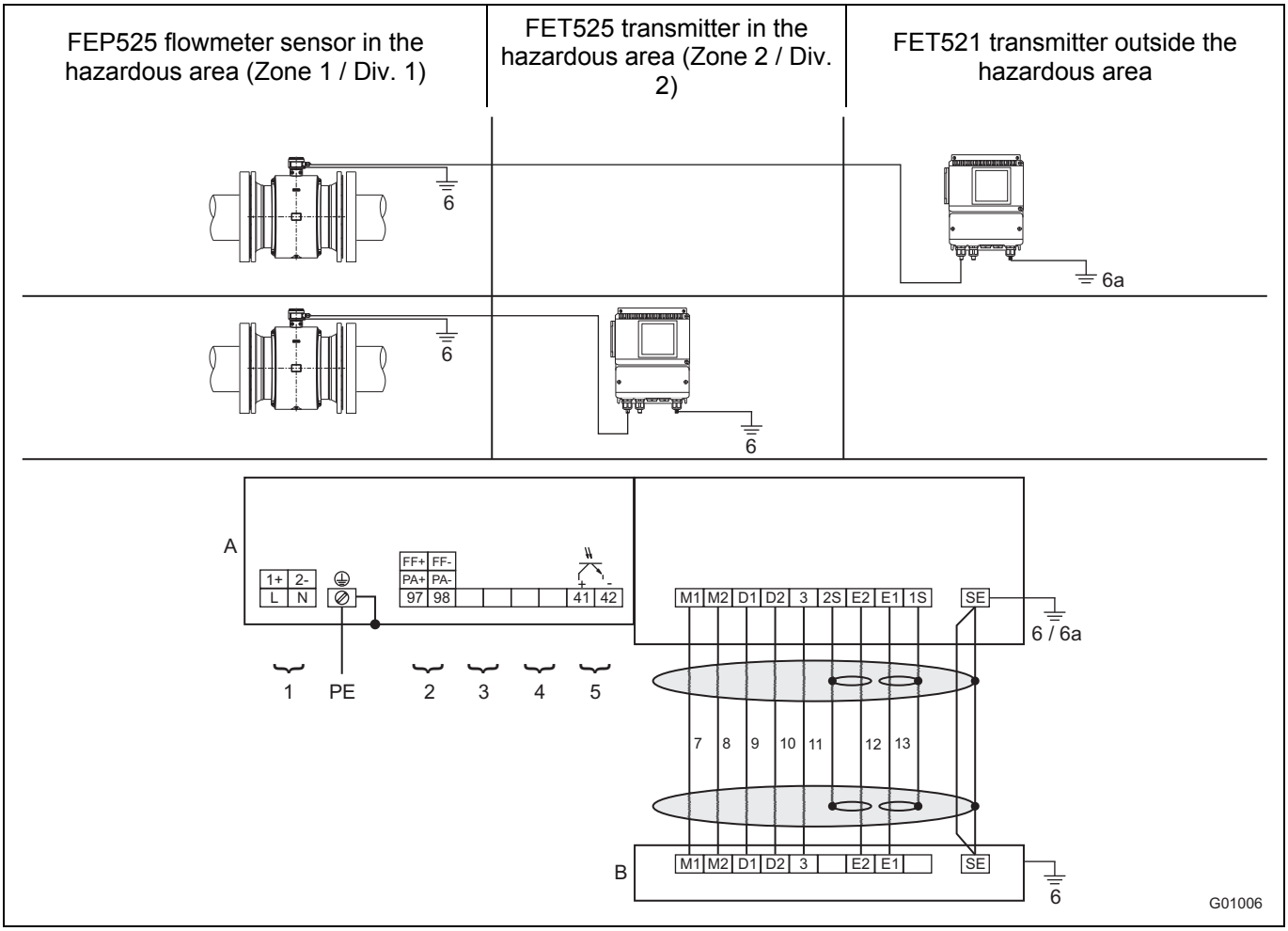


Fig. 24

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power:**
See name plate
2 **Digital communication (terminal 97 / 98)**
- **PROFIBUS PA in acc. with IEC 61158-2 (PA+ / PA-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error)
Bus connection with integrated protection against polarity reversal
The bus address can be set via the DIP switches in the device (with dual-compartment transmitter housing only), the transmitter display or the fieldbus.

or

- **FOUNDATION fieldbus in acc. with IEC 61158-2 (FF+ / FF-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
Bus connection with integrated protection against polarity reversal

3 **Not assigned**
4 **Not assigned**
5 **Digital output DO2 (terminal 41 / 42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, $f_{max} \leq 5250$ Hz,
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.
6 **Equipotential bonding**
6a **Functional ground** (only with flowmeter sensor FET321 outside the hazardous area)
7 Brown
8 red
9 Orange
10 yellow
11 Green
12 blue
13 Violet

All inputs and outputs are electrically isolated from each other and from the supply power.

The electrical specifications given are operating values.

For devices with PROFIBUS PA or FOUNDATION fieldbus in Zone 2 / Div 2 the bus termination must conform to the FNICO model or the explosion protection regulations, respectively.

5.3 Electrical data for operation in Zone 1 / Div. 1

5.3.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct current output design (active/passive), see the marking contained in the device's terminal box.

Model: FEP515 or FET525

	Operating values		Ex data Explosion protection type Ex i, IS					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_O [V]**	**I_O [mA]**	**P_O [mW]**	**C_O [nF]**	**C_{OPA} [nF]**	**L_O [mH]**
Active current output Terminal 31 / 32	30	30	20	100	500	210	195	6
			U_I [V]	**I_I [mA]**	**P_I [mW]**	**C_I [nF]**	**C_{IPA} [nF]**	**L_I [mH]**
			60	425 4)	2000 4)	8,4	24	0,065
Passive current output Terminal 31 / 32	30	30	**U_I [V]**	**I_I [mA]**	**P_I [mW]**	**C_I [nF]**	**C_{IPA} [nF]**	**L_I [nH]**
			60	500 4)	2000 4)	8,4	24	170
Passive digital output DO2 Terminal 41 / 42	30	220	**U_I [V]**	**I_I [mA]**	**P_I [mW]**	**C_I [nF]**	**C_{IPA} [nF]**	**L_I [nH]**
			60	425 1) 4) 500 2) 4)	2000 4)	3,6	3,6	170
Passive digital output DO1 Terminal 51 / 52	30	220	60	425 1) 4) 500 2) 4)	2000 4)	3,6	3,6	170
Passive digital input DI 3) Terminal 81/82	30	10	60	500 4)	2000 4)	3,6	3,6	170

1) For "active" current output
2) For "passive" current output
3) Only available in conjunction with passive current output
4) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

All inputs and outputs are electrically isolated from each other and from the supply power.

Special connection conditions:

The output circuits are designed in such a way that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits. It is not permitted to combine intrinsically safe and non-intrinsically safe circuits. In the case of intrinsically safe circuits, equipotential bonding is required.

The rated voltage of the non-intrinsically safe circuits is U_M = 60 V.

Provided that rated voltage U_M = 60 V is not exceeded if connections are established to non-intrinsically safe external circuits, intrinsic safety is still guaranteed.

5.3.2 Devices with PROFIBUS PA or FOUNDATION fieldbus

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct design (PROFIBUS PA or FOUNDATION fieldbus), see the marking contained in the device's terminal box.

Model: FEP515 or FET525

The fieldbus (terminal 97 / 98) and the digital output (terminal 41 / 42) can be connected in Zone 1 / Div. 1 in three different variants.

Variant 1 Intrinsically safe fieldbus connection in acc. with FISCO, intrinsically safe connection of the digital output

	Operating values		Ex data Explosion protection type Ex i, IS and FISCO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Passive digital output DO2 Terminal 41 / 42	30	220	60	200 1)	5000 1)	3,6	3,6	0,17
Fieldbus Terminal 97 / 98	32	30	17	380	5320	1	1	5

1) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

Variant 2 Intrinsically safe fieldbus connection (not in acc. with FISCO!), intrinsically safe connection of the digital output

	Operating values		Ex data Explosion protection type Ex i, IS					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Passive digital output DO2 Terminal 41 / 42	30	220	60	200 1)	5000 1)	3,6	3,6	0,17
Fieldbus Terminal 97 / 98	32	30	60	500	5000	1	1	5

1) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

Variant 3 Fieldbus connection in acc. with FNICO (Zone 2, Div. 2), connection of digital output (Zone 2, Div. 2)

	Operating values		Ex data Explosion protection type Ex n, NI and FNICO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Passive digital output DO2 Terminal 41 / 42	30	220	-	-	-	-	-	-
Fieldbus Terminal 97 / 98	32	30	60	500 1)	5000 1)	1	1	5

1) Single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

All inputs and outputs are electrically isolated from each other and from the supply power.

Special connection conditions:

The output circuits are designed in such a way that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits. It is not permitted to combine intrinsically safe and non-intrinsically safe circuits. In the case of intrinsically safe circuits, equipotential bonding is required.

The rated voltage of the non-intrinsically safe circuits is UM = 60 V.

Provided that rated voltage UM = 60 V is not exceeded if connections are established to non-intrinsically safe external circuits, intrinsic safety is still given.

5.4 Temperature values

Model name	Surface temperature
FEP515	70 °C (158 °F)
FEP525	85 °C (185 °F)
FET525	70 °C (158 °F)

The surface temperature depends on the fluid temperature.

With increasing fluid temperature > 70 °C (158 °F) or > 85 °C (185 °F) the surface temperature also increases to the level of the fluid temperature.

Important (Note)

The maximum permissible fluid temperature depends on the lining and flange material, and is limited by the operating values in Table 1 and the explosion protection specifications in Tables 2 ... n.

Table 1: Fluid temperature as a function of lining and flange material

Models FEP515/FEP525

Materials		Fluid temperature (operating values)	
Lining	**Flange**	**Minimum**	**Maximum**
Hard rubber	Steel	-10 °C (14 °F) -5 °C (23 °F) 1)	90 °C (194 °F) 80 °C (176 °F) 1)
Hard rubber	Stainless steel	-15 °C (5 °F) -5 °C (23 °F) 1)	90 °C (194 °F) 80 °C (176 °F) 1)
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
PFA	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
ETFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

1) Only China production site

Table 2: Fluid temperature (Ex data) for ProcessMaster model FEP515

Nominal diameter	Design	Temperature class	Ambient temperature											
			(- 40 °C)[1] - 20 °C ... + 40 °C				(- 40 °C)[1] - 20 °C ... + 50 °C				(- 40 °C)[1] - 20 °C ... + 60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
DN 3 ... DN 100	NT	T1	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T2	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T3	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T4	120 °C								90 °C	30 °C	80 °C	40 °C
	HT		120 °C								120 °C	20 °C	120 °C	20 °C
	NT	T5	85 °C								70 °C	30 °C	80 °C	40 °C
	HT		85 °C								85 °C	20 °C	85 °C	20 °C
	NT	T6	70 °C								70 °C	30 °C	70 °C	40 °C
	HT		70 °C								70 °C	20 °CC	70 °C	20 °C
DN 125 ... DN 2000	NT	T1	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T2	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T3	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T4	125 °C								90 °C	30 °C	80 °C	40 °C
	HT		125 °C								120 °C	20 °C	120 °C	20 °C
	NT	T5	90 °C								90 °C	30 °C	80 °C	40 °C
	HT		90 °C								90 °C	20 °C	90 °C	20 °C
	NT	T6	75 °C								75 °C	30 °C	75 °C	40 °C
	HT		75 °C								75 °C	20 °C	75 °C	20 °C

1) Low-temperature version (option)

NT standard version, T_{medium} maximum 130 °C (266 °F)

HT high-temperature version, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Important (Note)

The standard version includes explosion protection for gases and dust. Explosion protection for dust is only available for devices featuring a transmitter in a dual-compartment housing.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" column in the table must be taken into consideration.

Table 3: Fluid temperature (Ex data) for ProcessMaster Model FEP525

Nominal diameter	Design	Temperature class	Ambient temperature											
			(- 40 °C)[1] - 20 °C ... + 40 °C				(- 40 °C)[1] - 20 °C ... + 50 °C				(- 40 °C)[1] - 20 °C ... + 60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
DN 3 ... DN 100	NT	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T2	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T4	120 °C								110 °C	110 °C	110 °C	110 °C
	HT		120 °C								120 °C	120 °C	120 °C	120 °C
	NT	T5	85 °C								85 °C	85 °C	85 °C	85 °C
	HT		85 °C								85 °C	85 °C	85 °C	85 °C
	NT	T6	70 °C								70 °C	70 °C	70 °C	70 °C
	HT		70 °C								70 °C	70 °C	70 °C	70 °C
DN 125 ... DN 2000	NT	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T2	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T4	125 °C								110 °C	110 °C	110 °C	110 °C
	HT		125 °C								125 °C	125 °C	125 °C	125 °C
	NT	T5	90 °C								90 °C	90 °C	90 °C	90 °C
	HT		90 °C								90 °C	90 °C	90 °C	90 °C
	NT	T6	75 °C								75 °C	75 °C	75 °C	75 °C
	HT		75 °C								75 °C	75 °C	75 °C	75 °C

1) Low-temperature version (option)

NT standard version, T_{medium} maximum 130 °C (266 °F).

HT high temperature version, T_{medium} maximum 180 °C (356 °F).

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Important (Note)

The standard version includes explosion protection for gases and dust.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" columns in the table must be taken into consideration.

5.5 Special features of version designed for operation in Ex zone 1 / Div. 1

5.5.1 Configuring the current output

For devices designed for use in Ex Zone 1 / Div.1, the current output cannot be reconfigured subsequently.

The configuration required for the current output (active/passive) must be specified when the order is placed.

For the correct current output design (active/passive), see the marking contained in the device's terminal box.

5.5.2 Configuration of the digital outputs

For version designed for operation in Ex zone 1 / Div. 1, the digital outputs DO1 (51/52) and DO2 (41/42) can be configured on a NAMUR switching amplifier. On leaving the factory, the device is configured with the standard wiring (non-NAMUR).

Devices with PROFIBUS PA or FOUNDATION fieldbus only have the digital output DO2 (41 / 42).

Important (Note)

The outputs' type of protection remains unaffected by this. The devices connected to these outputs must conform to the applicable regulations for explosion protection.

The jumpers are located on the backplane in the transmitter housing.

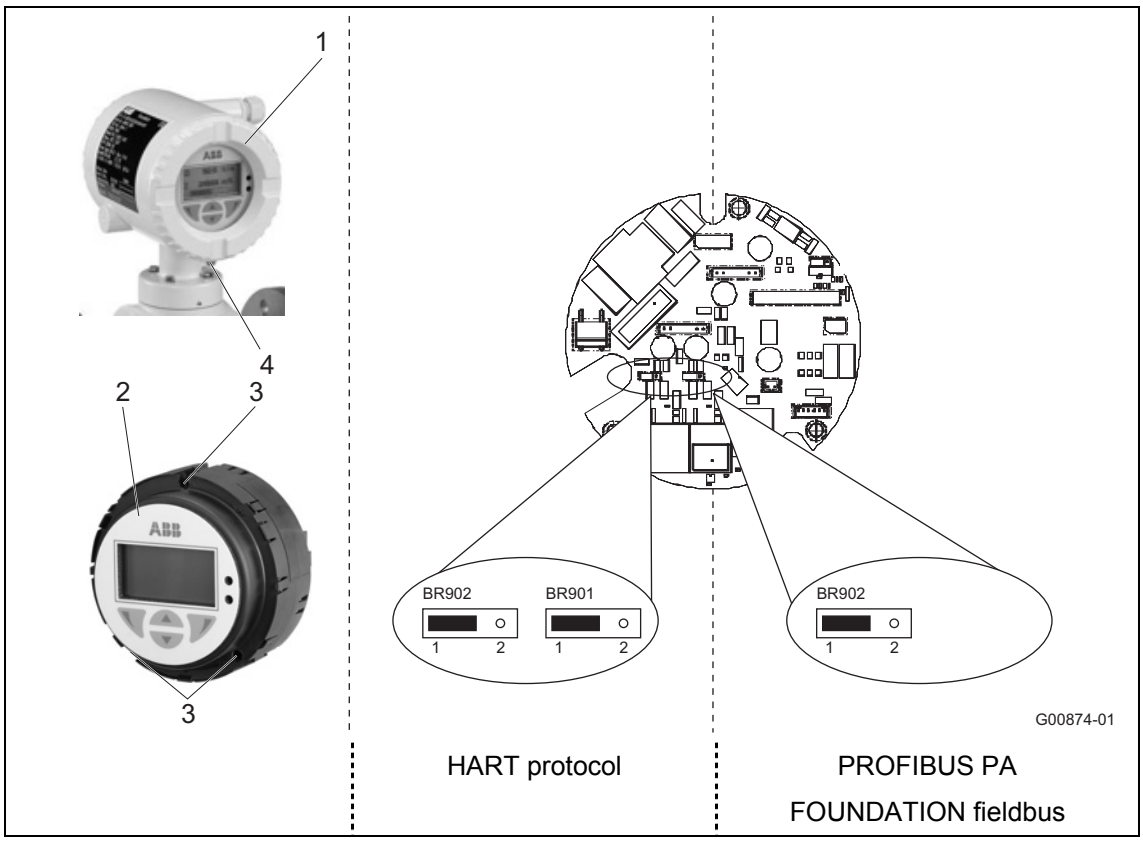


Fig. 25

BR902 for digital output DO1	**BR901 for digital output DO2**
BR902 in position 1: Standard (non-NAMUR) BR902 in position 2: NAMUR	BR901 in position 1: Standard (non-NAMUR) BR901 in position 2: NAMUR

Configure the digital outputs as described:

1. Switch off the supply power and wait at least 20 minutes before the next step.
2. Open the cover safety device (4) and housing cover (1).
3. Loosen screws (3) and pull out transmitter plug-in (2).
4. Insert the jumpers in the required positions.
5. Put the transmitter plug-in (2) back into the housing and retighten the screws (3).
6. Close the housing cover (1) and lock the cover by unscrewing the screw (4).

6 Ex-relevant specifications for operation in zones 2, 21, 22 / Div. 2

6.1 General

Devices with dual-compartment transmitter housing (model names FEP515 and FEP525) are approved for operation in the following potentially explosive areas:

- ATEX / IECEx Zone 2, 21, 22
- FM Div.2
- cFM Div.2

Important (Note)
For detailed information on the individual approvals, refer to Section **1** „**ProcessMaster 500 - Overview of technology**“.

A temperature of 70 °C (158 °F) at the cable entry is assumed for the Ex calculations. Therefore, the cables used for the supply power and the signal inputs and outputs must have a minimum specification of 70 °C (158 °F).

For devices with remote mount design for use in FM / cFM Div. 1 or FM / cFM Div. 2 the signal cable between the flowmeter sensor and the transmitter must have a minimum length of 5 m (16.4 ft).

6.2 Electrical connection

6.2.1 Model FEP515, FET525 in Zone 2 / Div. 2, 2, FET521 outside the hazardous area with HART protocol

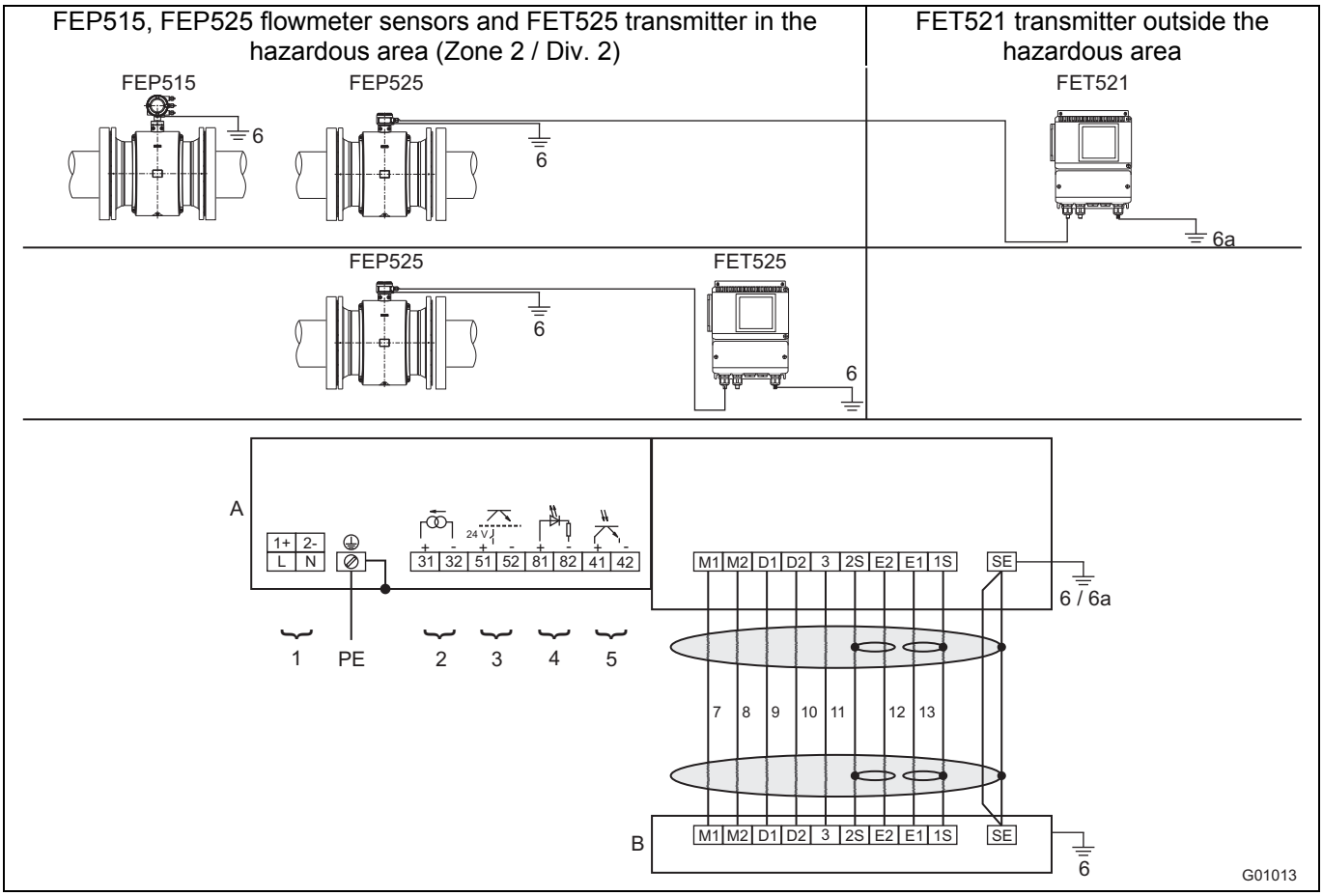


Fig. 26

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power**:
See name plate
2 **Current output (terminals 31 / 32)**
The current output can be configured locally as an "active" or "passive" output.
- Active: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
- Passive: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
Supply voltage for the current output: minimum 11 V, maximum 30 V at terminals 31 / 32.

3 **Digital output DO1 (terminal 51 / 52)**
The digital output can be configured locally as an "active" or "passive" output (in the case of the transmitter with the dual-compartment housing, the output is configured using the software; in the case of the transmitter with the single-compartment housing, it is configured by means of jumpers on the transmitter backplane).
- Active: U = 19 ... 21 V. I_{max} = 220 mA, f_{max} ≤ 5250 Hz
- Passive: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz

Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Pulse Output".
- Configuration as pulse output. Maximum pulse frequency: 5250 Hz, pulse width: 0.1 … 2000 ms. The pulse factor and pulse width are interdependent and are calculated dynamically.
- Configuration as contact output. Function: System alarm, empty pipe alarm, max. / min. alarm, flow direction signaling, other

4 **Digital input: (terminal 81 / 82)**
Function can be configured locally using software: External output switch-off, external totalizer reset, external totalizer stop, other
Data for the optocoupler: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

5 **Digital output DO2 (terminal 41 / 42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.

6 **Equipotential bonding**
6a **Functional ground** (only with transmitter FET321 outside the hazardous area)
7 Brown
8 red
9 Orange
10 yellow
11 Green
12 blue
13 Violet

All inputs and outputs are electrically isolated from each other and from the supply power. The electrical specifications given are operating values.

6.2.2 Model FEP515, FET525 in Zone 2 / Div. 2, FET521 outside the hazardous area with PROFIBUS PA or FOUNDATION fieldbus

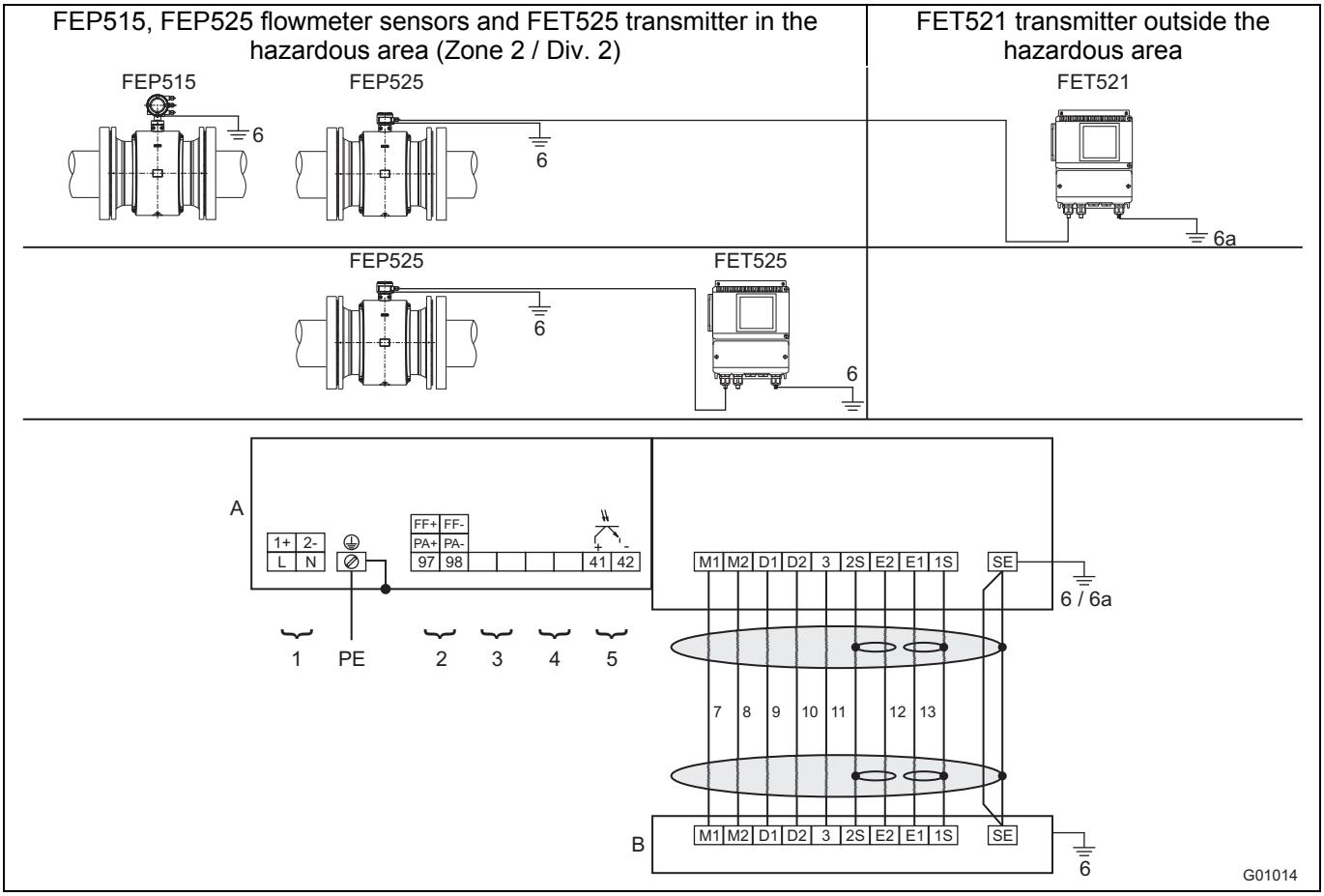


Fig. 27

A **Transmitter**
B **Flowmeter sensor**
1 **Supply power:**
See name plate
2 **Digital communication (terminal 97 / 98)**
- **PROFIBUS PA in acc. with IEC 61158-2 (PA+ / PA-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error)
Bus connection with integrated protection against polarity reversal
The bus address can be set via the DIP switches in the device (with dual-compartment transmitter housing only), the transmitter display or the fieldbus.

or

- **FOUNDATION fieldbus in acc. with IEC 61158-2 (FF+ / FF-)**
U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
Bus connection with integrated protection against polarity reversal

3 **Not assigned**
4 **Not assigned**
5 **Digital output DO2 (terminal 41 / 42)**
The output is always a "passive" output (optocoupler).
Data for the optocoupler: U_{max} = 30 V, I_{max} = 220 mA, $f_{max} \leq$ 5250 Hz,
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Digital Output", flow direction signaling.
6 **Equipotential bonding**
6a **Functional ground** (only with flowmeter sensor FET321 outside the hazardous area)
7 Brown
8 red
9 Orange
10 yellow
11 Green
12 blue
13 Violet

All inputs and outputs are electrically isolated from each other and from the supply power.

The electrical specifications given are operating values.

For devices with PROFIBUS PA or FOUNDATION fieldbus in Zone 2 / Div 2 the bus termination must conform to the FNICO model or the explosion protection regulations, respectively.

6.3 Electrical data for operation in Zone 2 / Div. 2

6.3.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct current output design (active/passive), see the marking contained in the device's terminal box.

Model: FEP515 or FET525

	Ex data		Operating values	
	Ex n/NI			
Signal inputs and outputs	**U_i [V]**	**I_i [mA]**	**U_i [V]**	**I_i [mA]**
Current output Active/passive Terminal 31/32	30	30	30	30
Digital output DO1 Active/passive Terminal 51/52	30	220	30	220
Digital output DO2 passive Terminal 41/42	30	220	30	220
Digital input DI Terminal 81/82	30	10	30	10

All inputs and outputs are electrically isolated from each other and from the supply power.

6.3.2 Devices with PROFIBUS PA or FOUNDATION fieldbus

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct design (PROFIBUS PA or FOUNDATION fieldbus), see the marking contained in the device's terminal box.

Model: FEP515 or FET525

	Operating values		Ex data Explosion protection type Ex n, NI and FNICO					
Inputs and outputs	**U_N [V]**	**I_N [mA]**	**U_i [V]**	**I_i [mA]**	**P_i [mW]**	**C_i [nF]**	**C_{iPA} [nF]**	**L_i [µH]**
Passive digital output DO2 Terminal 41/42	30	220	-	-	-	-	-	-
Fieldbus Terminal 97/98	32	30	32	500 [1)]	7000 [1)]	1	1	5

1) Single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

6.4 Temperature values

Model name	Surface temperature
FEP515	70 °C (158 °F)
FEP525	85 °C (185 °F)
FET525	70 °C (158 °F)

The surface temperature depends on the fluid temperature.

With increasing fluid temperature > 70 °C (> 158 °F) or > 85 °C (> 185 °F) the surface temperature also increases to the level of the fluid temperature.

Table 1: Fluid temperature as a function of lining and flange material

Models FEP515/FEP525

Materials		Fluid temperature (operating values)	
Lining	**Flange**	**Minimum**	**Maximum**
Hard rubber	Steel	-10 °C (14 °F) -5 °C (23 °F) [1)]	90 °C (194 °F) 80 °C (176 °F) [1)]
Hard rubber	Stainless steel	-15 °C (5 °F) -5 °C (23 °F) [1)]	90 °C (194 °F) 80 °C (176 °F) [1)]
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
PFA	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
Elastomer [2)]	Steel	-10 °C (14 °F)	130 °C (266 °F)
Elastomer [2)]	Stainless steel	-20 °C (-4 °F)	130 °C (266 °F)
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
ETFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

1) Only China production site
2) USA production site, only (only for FM / cFM Div 2)

Table 2: Fluid temperature (Ex data) for ProcessMaster model FEP515

Nominal diameter		Design	Temperature class	Ambient temperature											
				- 20 °C ... + 40 °C				- 20 °C ... + 50 °C				- 20 °C ... + 60 °C			
				- 40 °C ... + 40 °C [1]				- 40 °C ... + 50 °C [1]				- 40 °C ... + 60 °C [1]			
				Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
				Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
ProcessMaster DN 3 ... DN 2000	HygienicMaster DN 3 ... DN 100	NT	T1	130 °C	130 °C	- - -	- - -	130 °C	100 °C [2] 110 °C [3]	- - -	- - -	80 °C	40 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
		NT	T2	130 °C	130 °C	- - -	- - -	130 °C	100 °C [2] 110 °C [3]	- - -	- - -	80 °C	40 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
		NT	T3	130 °C	130 °C	- - -	- - -	130 °C	100 °C [2] 110 °C [3]	- - -	- - -	80 °C	40 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
		NT	T4	130 °C	130 °C	- - -	- - -	130 °C	100 °C [2] 110 °C [3]	- - -	- - -	80 °C	40 °C	- - -	- - -
		HT		130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	40 °C	130 °C	40 °C

1) Low-temperature version (option)
2) Temperature values for ProcessMaster
3) Temperature values for HygienicMaster

NT standard version, T_{medium} maximum 130 °C (266 °F)

HT high-temperature version, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Important (Note)

The standard version includes explosion protection for gases and dust. Explosion protection for dust is only available for devices featuring a transmitter in a dual-compartment housing.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" column in the table must be taken into consideration.

Table 3: Fluid temperature (Ex data) for ProcessMaster Model FEP525

Nominal diameter		Design	Temperature class	Ambient temperature											
				- 20 °C ... + 40 °C				- 20 °C ... + 50 °C				- 20 °C ... + 60 °C			
				- 40 °C ... + 40 °C [1]				- 40 °C ... + 50 °C [1]				- 40 °C ... + 60 °C [1]			
				Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
				Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
ProcessMaster DN 3 ... DN 2000	HygienicMaster DN 3 ... DN 100	NT	T1	130 °C	130 °C	- - -	- - -	130 °C	130 °C	- - -	- - -	110 °C [2] 120 °C [3]	110 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
		NT	T2	130 °C	130 °C	- - -	- - -	130 °C	130 °C	- - -	- - -	110 °C [2] 120 °C [3]	110 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
		NT	T3	130 °C	130 °C	- - -	- - -	130 °C	130 °C	- - -	- - -	110 °C [2] 120 °C [3]	110 °C	- - -	- - -
		HT		180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
		NT	T4	130 °C	130 °C	- - -	- - -	130 °C	130 °C	- - -	- - -	110 °C [2] 120 °C [3]	110 °C	- - -	- - -
		HT		130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C
		NT	T5	95 °C	95 °C	- - -	- - -	95 °C	95 °C	- - -	- - -	95 °C	95 °C	- - -	- - -
		HT		95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C
		NT	T6	80 °C	80 °C	- - -	- - -	80 °C	80 °C	- - -	- - -	80 °C	80 °C	- - -	- - -
		HT		80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C

1) Low-temperature version (option)
2) Temperature values for ProcessMaster
3) Temperature values for HygienicMaster

NT standard version, T_{medium} maximum 130 °C (266 °F)

HT high-temperature version, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Important (Note)

The standard version includes explosion protection for gases and dust.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" columns in the table must be taken into consideration.

7 Explosion protection specifications for operation in areas with combustible dust

7.1 Information about using the device in areas with combustible dust

The device with dual-compartment transmitter housing is approved for use in potentially explosive areas (gas and dust).

The Ex certification is provided on the name plate.

Risk of explosion!

The dust explosion protection is also provided by the housing.
Modifications to the housing are not allowed (e.g., removing or omitting parts).

7.1.1 Maximum Allowable Surface Temperature

Model name	Maximum surface temperature
FEP525	T 85 °C (185 °F) ... T_{medium}
FEP515	T 70 °C (158 °F) ... T_{medium}
FET525	T 70 °C (158 °F)

The maximum surface temperature is applicable to dust layers of up to 5 mm (0.20 inch) in thickness. The minimum permissible ignition and smoldering temperatures of the dust atmosphere should be calculated in accordance with IEC61241ff.

With thicker dust layers, the maximum permissible surface temperature must be reduced. The dust can be conductive or non-conductive. IEC61241ff must be observed.

7.1.2 Min. signal cable length

In explosion protection areas, the signal cable cannot be shorter than 5 m (16.4 ft).

8 Installation requirements

8.1 Grounding

The flowmeter sensor must be connected to ground potential. For technical reasons, this potential should be identical to the potential of the metering fluid.

For plastic or insulated lined pipelines, the fluid is grounded by installing ground plates. When there are stray potentials present in the pipeline, a ground plate is recommended on both ends of the meter sensor.

8.2 Mounting

The following points must be observed for the installation:

- The meter tube must always be completely full.
- The flow direction must correspond to the identification if present.
- The maximum torque for all flange connections must be complied with. The max torque depends on the temperature, pressure, material of the flange bolts and gaskets and has to be choosen accordingly.
- The devices must be installed without mechanical tension (torsion, bending).
- Flowmeters with coplanar counter flanges may only be installed with suitable seals.
- Use flange seals made from a compatible material for the fluid and fluid temperatures.
- Seals must not extend into the flow area since possible turbulence could influence the device accuracy.
- The pipeline may not exert any unallowable forces and torques on the device.
- Do not remove the plugs in the cable connectors until you are ready to install the electrical cable.
- Install the separate converter at a largely vibration-free location.
- Do not expose the converter to direct sunlight or provide for appropriate sun protection where necessary.

8.2.1 Flow direction

The device measures the flowrate in both directions. Forward flow is the factory setting, as shown in Fig. 28.

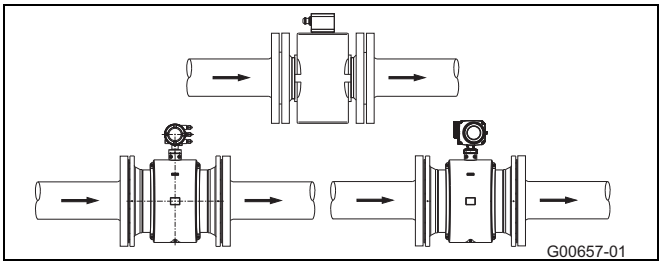


Fig. 28

8.2.2 Electrode axis

Electrode axis (1) should be horizontal if at all possible or no more that 45° from horizontal.

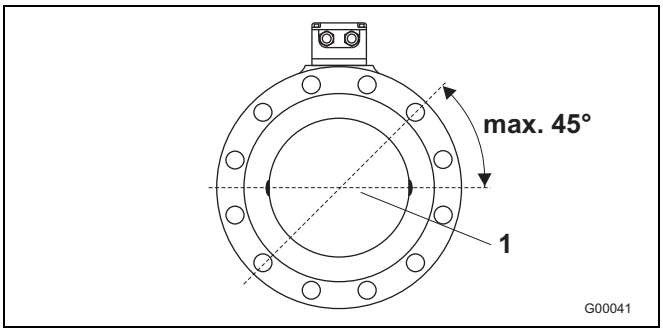


Fig. 29

8.2.3 In- and outlet pipe sections

The metering principle is independent of the flow profile as long as standing eddies do not extend into the metering section, such as may occur after double elbows (1), in the event of tangential inflow, or where half-open gate valves are located upstream of the flowmeter sensor.

In such cases, measures must be put in place to normalize the flow profile.

- Do not install fittings, manifolds, valves, etc., directly in front of the flowmeter sensor (1).
- Butterfly valves must be installed so that the valve plate does not extend into the flowmeter sensor.
- Valves or other turn-off components should be installed in the outlet pipe section (2).

Experience has shown that, in most installations, straight inlet sections 3 x DN long and straight outlet sections 2 x DN long are sufficient (DN = nominal diameter of the sensor Fig. 30).

For test stands, the reference conditions of 10 x DN straight inlet and 5 x DN straight outlet must be provided, in accordance with EN 29104 / ISO 9104.

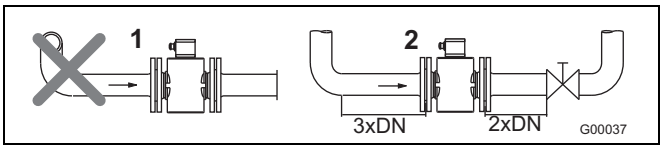


Fig. 30

8.2.4 Vertical connections

- Vertical installation for measuring abrasive fluids, preferably with flow in upward direction.

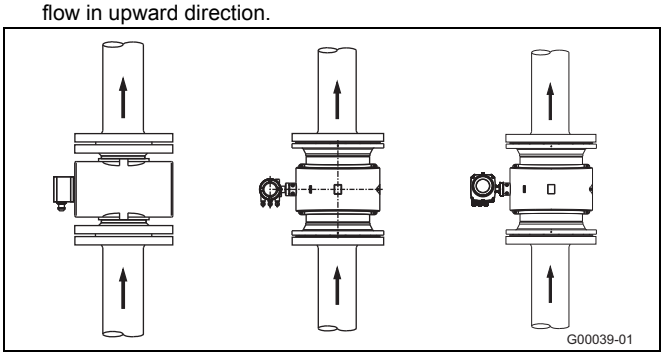


Fig. 31

8.2.5 Horizontal connections

- Meter tube must always be completely full.
- Provide for a slight incline of the connection for degassing.

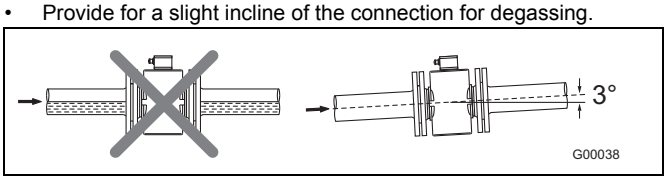


Fig. 32

8.2.6 Free inlet or outlet

- Do not install the flowmeter at the highest point or in the draining-off side of the pipeline, flowmeter runs empty, air bubbles can form (1).
- Provide for a siphon fluid intake for free inlets or outlets so that the pipeline is always full (2).

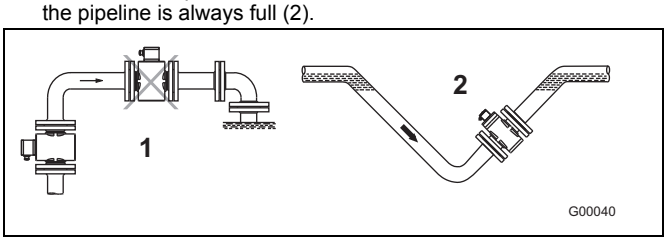


Fig. 33

8.2.7 Strongly contaminated fluids

- For strongly contaminated fluids, a bypass connection according to the figure is recommended so that operation of the system can continue to run without interruption the during the mechanical cleaning.

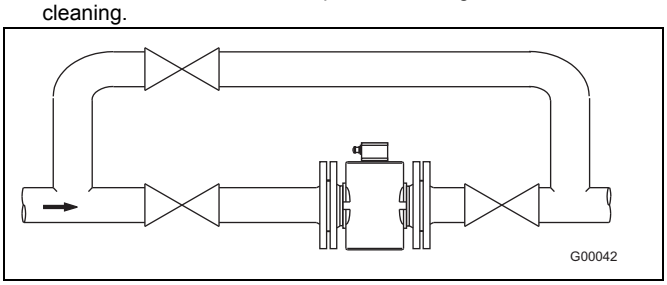


Fig. 34

8.2.8 Installation in the vicinity of pumps

- For flowmeter primaries which are to be installed in the vicinity of pumps or other vibration generating equipment, the utilization of mechanical snubbers is advantageous.

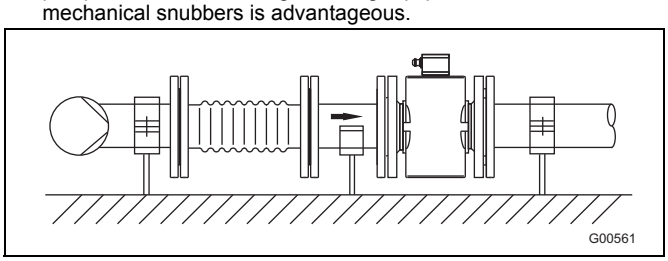


Fig. 35

8.2.9 Installing the high temperature design

The high temperature design allows for complete thermal insulation of the sensor. The pipeline and sensor must be insulated after installing the unit according to the following illustration.

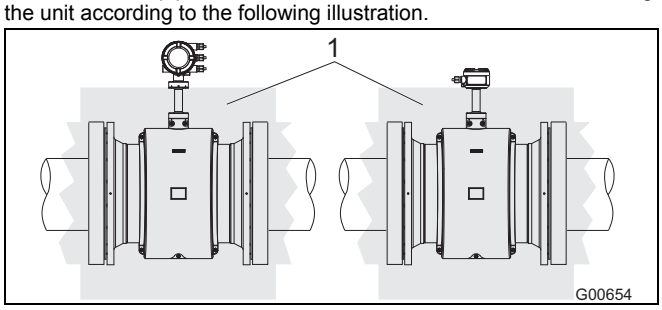


Fig. 36
1 Insulation

8.2.10 Devices with extended diagnostic functions

For devices with extended diagnostic functions different installation conditions may be valid.

For further information read and observe chapter **3** “**Extended diagnostic functions**”.

8.2.11 Installation in pipelines with larger nominal diameters

Determine the resulting pressure loss when using reduction pieces (1):

1. Calculate the diameter ratio d/D.
2. Determine the flow velocity based on the flow range nomograph (Fig. 38).
3. Read the pressure drop on the Y-axis in Fig. 38.

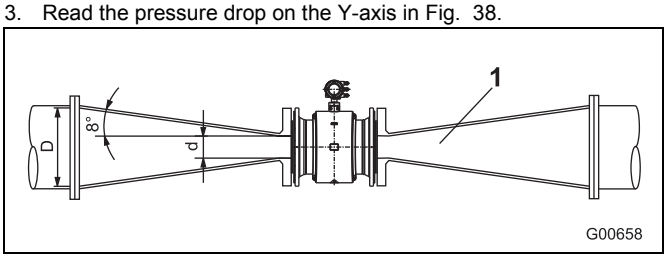


Fig. 37

1 = Flange transition piece
d = Inside diameter of the flowmeter
V = flow velocity [m/s]
Δp = pressure loss [mbar]
D = Inside diameter of the pipeline

Nomograph for pressure drop calculations

For flange transition piece with $\alpha/2 = 8°$

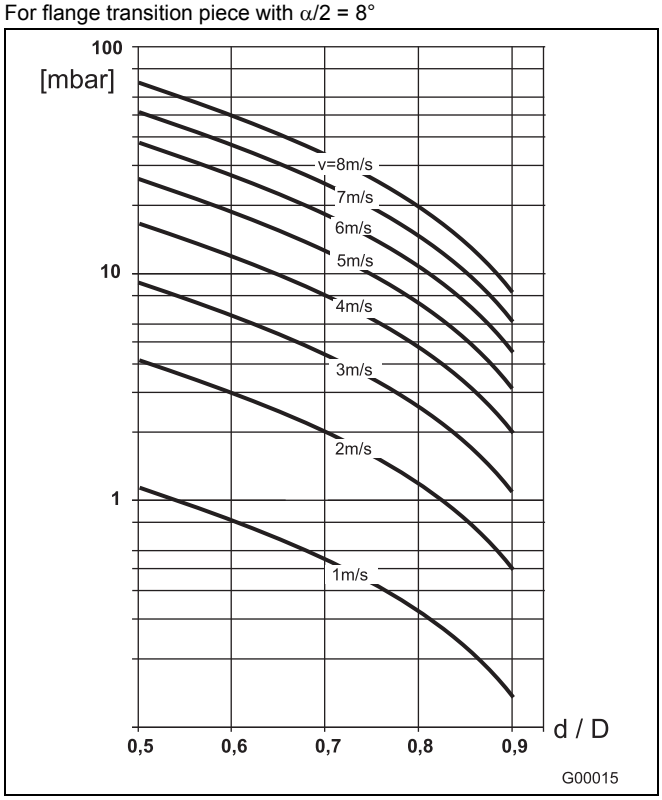


Fig. 38

9 Dimensions

9.1 Flange, DN 3 ... 125 (1/10 ... 5")

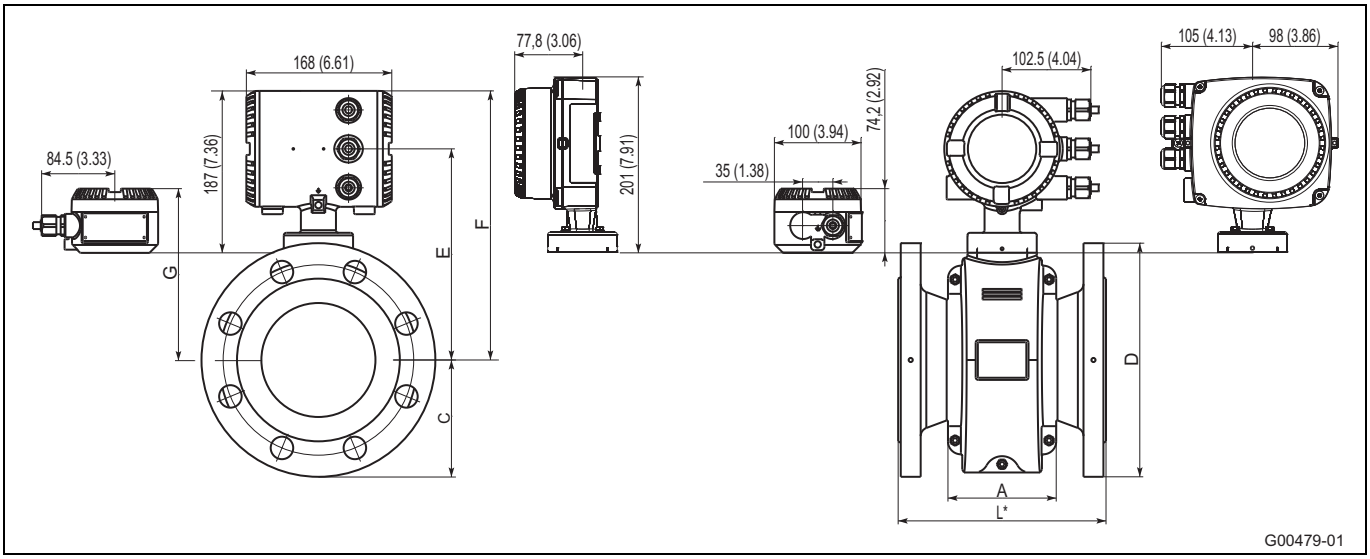


Fig. 39: Dimensions in mm (inch)

Flange in acc. with DIN/EN 1092-1 [7]

Dimensions [mm]									Approx. weight [kg]	
DN	PN [1]	D	L [2] [3]	F [4]	C	E [4]	G [4]	A	Integral mount design	Remote mount design
3 ... 8 [5]	10 ... 40	90	200	255	82	188	143	113	7	5
10	10 ... 40	90	200	255	82	188	143	113	7	5
15	10 ... 40	95	200	255	82	188	143	113	8	6
20	10 ... 40	105	200	255	82	188	143	113	8	6
25	10 ... 40	115	200	255	82	188	143	113	9	7
32	10 ... 40	140	200	262	92	195	150	113	10	8
40	10 ... 40	150	200	262	92	195	150	113	11	9
50	10 ... 40	165	200	268	97	201	156	115	12	10
65	10 ... 40	185	200	279	108	212	167	104	15	13
80	10 ... 40	200	200	279	108	212	167	104	17	15
100	10 ... 16	220	250	301	122	234	189	125	19	17
	25 ... 40	235	250	301	122	234	189	125	23	21
125	10 ... 16	250	250	311	130	244	199	125	22	20
	25 ... 40	270	250	311	130	244	199	125	29	27

Tolerance L: +0 / -3 mm

Dimensions [inch]									Approx. weight [lb]	
DN (inch)	PN [1]	D	L [2] [3]	F [4]	C	E [4]	G [4]	A	Integral mount design	Remote mount design
3 ... 8 [5] (1/8 ... 5/16)	10 ... 40	3.54	7.87	10.04	3.23	7.40	5.63	4.45	15.4	11
10 (3/8)	10 ... 40	3.54	7.87	10.04	3.23	7.40	5.63	4.45	15.4	11
15 (1/2)	10 ... 40	3.74	7.87	10.04	3.23	7.40	5.63	4.45	17.6	13.2
20 (3/4)	10 ... 40	4.13	7.87	10.04	3.23	7.40	5.63	4.45	17.6	13.2
25 (1)	10 ... 40	4.53	7.87	10.04	3.23	7.40	5.63	4.45	19.8	15.4
32 (1 1/4)	10 ... 40	5.51	7.87	10.31	3.62	7.68	5.91	4.45	22	17.6
40 (1 1/2)	10 ... 40	5.91	7.87	10.31	3.62	7.68	5.91	4.45	24.3	19.8
50 (2)	10 ... 40	6.50	7.87	10.55	3.82	7.91	6.14	4.53	26.5	22
65 (2 1/2)	10 ... 40	7.28	7.87	10.98	4.25	8.35	6.57	4.09	33.1	28.7
80 (3)	10 ... 40	7.87	7.87	10.98	4.25	8.35	6.57	4.09	37.5	33.1
100 (4)	10 ... 16	8.66	9.84	11.85	4.80	9.21	7.44	4.92	41.9	37.5
	25 ... 40	9.25	9.84	11.85	4.80	9.21	7.44	4.92	50.7	46.3
125 (5)	10 ... 16	9.84	9.84	12.24	5.12	9.61	7.83	4.92	48.5	44.1
	25 ... 40	10.63	9.84	12.24	5.12	9.61	7.83	4.92	63.9	59.5

Tolerance L: +0 / -0.018 inch

Flange in acc. with ASME B16.5

Dimensions [mm]													Approx. weight [kg]	
		CL150			CL300								Integral mount design	Remote mount design
			ISO 133359	US installation length		ISO 133359	US installation length							
DN	Inch	D	L 2) 3) 9)	L 2) 3)	D	L 2) 3) 9)	L 2) 3)	F 4)	C	E 4)	G 4)	A		
3 ... 8	1/8 ... 5/16 6)	89	200	-	96	200	-	255	82	188	143	113	7	5
10	3/8 6)	89	200	-	96	200	-	255	82	188	143	113	7	5
15	1/2	89	200	200	96	200	229	255	82	188	143	113	8	6
20	3/4	98	200	-	118	200	-	255	82	188	143	113	8	6
25	1	108	200	200	124	200	229	255	82	188	143	113	9	7
32	1 1/4	118	200	-	134	200	-	262	92	195	150	113	10	8
40	1 1/2	127	200	200	156	200	229	262	92	195	150	113	11	9
50	2	153	200	200	165	200	254	268	97	201	156	115	12	10
65	2 1/2	178	200	-	191	200	-	279	108	212	167	104	13 / 15 8)	11 / 13 8)
80	3	191	200	200	210	200	229	279	108	212	167	104	17 / 19 8)	15 / 17 8)
100	4	229	250	250	254	250	280	301	122	234	189	125	21 / 30 8)	19 / 28 8)
125	5	254	250	-	280	250	-	311	130	244	199	125	22 / 35 8)	20 / 33 8)

Tolerance L: +0 / -3 mm

Dimensions [inch]													Approx. weight [lb]	
		CL150			CL300								Integral mount design	Remote mount design
			ISO 133359	US installation length		ISO 133359	US installation length							
DN	Inch	D	L 2) 3) 9)	L 2) 3)	D	L 2) 3) 9)	L 2) 3)	F 4)	C	E 4)	G 4)	A		
3 ... 8	1/8 ... 5/16 6)	3.5	7.87	-	3.78	7.87	-	10.04	3.23	7.4	5.63	4.45	15	11
10	3/8 6)	3.5	7.87	-	3.78	7.87	-	10.04	3.23	7.4	5.63	4.45	15	11
15	1/2	3.5	7.87	7.87	3.78	7.87	9.02	10.04	3.23	7.4	5.63	4.45	18	13
20	3/4	3.86	7.87	-	4.65	7.87	-	10.04	3.23	7.4	5.63	4.45	18	13
25	1	4.25	7.87	7.87	4.88	7.87	9.02	10.04	3.23	7.4	5.63	4.45	20	15
32	1 1/4	4.65	7.87	-	5.28	7.87	-	10.31	3.62	7.68	5.91	4.45	22	18
40	1 1/2	5	7.87	7.87	6.14	7.87	9.02	10.31	3.62	7.68	5.91	4.45	24	20
50	2	6.02	7.87	7.87	6.5	7.87	10	10.55	3.82	7.91	6.14	4.53	16	22
65	2 1/2	7.01	7.87	-	7.52	7.87	-	10.98	4.25	8.35	6.57	4.09	29 / 33 8)	24 / 29 8)
80	3	7.52	7.87	7.87	8.27	7.87	9.02	10.98	4.25	8.35	6.57	4.09	38 / 42 8)	33 / 38 8)
100	4	9.02	9.84	9.84	10	9.84	11.02	11.85	4.8	9.21	7.44	4.92	46 / 66 8)	42 / 62 8)
125	5	10	9.84	-	11.02	9.84	-	12.24	5.12	9.61	199	4.92	49 / 77 8)	44 / 73 8)

Tolerance L: +0 / -0.118 inch

1) Other pressure ratings upon request.
2) If a grounding plate is installed (attached to one side of the flange), this increases dimension L as follows: DN 3 ... 100 by 3 mm (0.118 inch; DN 125 by 5 mm (0.197 inch).
3) If protection plates are installed (attached to both sides of the flange), this increases dimension L as follows: DN 3 ... 100 by 6 mm (0.236 inch; DN 125 by 10 mm (0.394 inch).
4) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

5) Connection flange DN 10
6) Connection flange 1/2"
7) Connecting dimensions in acc. with EN 1092-1. For DN 65, PN 16 in acc. with EN 1092-1, please order PN 40.
8) Weights for CL150 / CL300.
9) For devices with ordering code “Installation length JN” (China production site) the installation length corresponds to the ISO installation length.

9.2 Flange DN 150 ... 400 (6 ... 16")

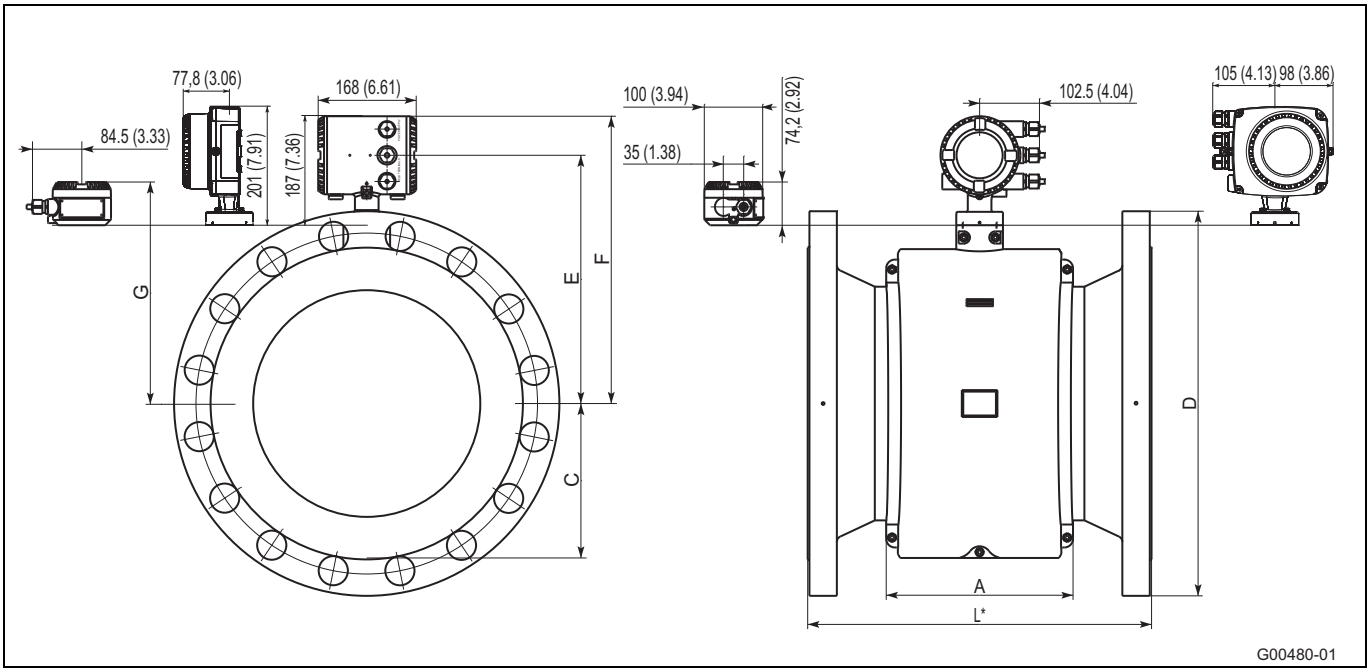


Fig. 40: Dimensions in mm (inch)

Flange in acc. with DIN/EN 1092-1

Dimensions [mm]									Approx. weight [kg]	
DN	PN [1]	D	L [2) 3)]	F [4]	C	E [4]	G [4]	A	Integral mount design	Remote mount design
150	10 ... 16	285	300	358	146	291	246	166	33	31
	25 ... 40	300	300	358	146	291	246	166	39	37
200	10	340	350	399	170	331	286	200	41	39
	16	340	350	399	170	331	286	200	43	41
250	10	395	450	413	198	346	301	235	61	59
	16	405	450	413	198	346	301	235	65	63
300	10	445	500	436	228	369	324	272	74	72
	16	460	500	436	228	369	324	272	80	78
350	10	505	550	451	265	384	339	322	95	93
	16	520	550	451	265	384	339	322	110	108
400	10	565	600	493	265	426	381	322	103	101
	16	580	600	493	265	426	381	322	126	124

Tolerance L: DN 150 ... 200 +0 / -3 mm, DN 250 ... 400 +0 / -5 mm

Dimensions [inch]									Approx. weight [lb]	
DN (inch)	PN [1]	D	L [2) 3)]	F [4]	C	E [4]	G [4]	A	Integral mount design	Remote mount design
150 (6)	10 ... 16	11.22	11.81	14.09	5.75	11.46	9.69	6.54	73	68
	25 ... 40	11.81	11.81	14.09	5.75	11.46	9.69	6.54	86	82
200 (8)	10	13.39	13.78	15.71	6.69	13.03	11.26	7.87	90	86
	16	13.39	13.78	15.71	6.69	13.03	11.26	7.87	95	90
250 (10)	10	15.55	17.72	16.26	7.80	13.62	11.85	9.25	135	130
	16	15.94	17.72	16.26	7.80	13.62	11.85	9.25	143	139
300 (12)	10	17.52	19.68	17.17	8.98	14.53	12.76	10.71	163	159
	16	18.11	19.68	17.17	8.98	14.53	12.76	10.71	176	172
350 (14)	10	19.88	21.65	17.76	10.43	15.12	13.35	12.68	209	203
	16	20.47	21.65	17.76	10.43	15.12	13.35	12.68	243	238
400 (16)	10	22.24	23.62	19.41	10.43	16.77	15.00	12.68	227	223
	16	22.83	23.62	19.41	10.43	16.77	15.00	12.68	278	273

Tolerance L: DN 150 ... 200 +0 / -0.118 inch, DN 250 ... 400 +0 / -0.197 inch

Flange in acc. with ASME B16.5

Dimensions [mm]													Approx. weight [kg]	
		CL150			CL300								Integral mount design	Remote mount design
			ISO 13359	US installation length		ISO 13359	US installation length							
DN	Inch	D	L 2) 3) 6)	L 2) 3)	D	L 2) 3) 6)	L 2) 3)	F 4)	C	E 4)	G 4)	A		
150	6	280	300	300	318	300	300	358	146	291	246	166	33 / 47 5)	31 / 45 5)
200	8	343	350	350	381	350	350	399	170	331	286	200	50 / 72 5)	48 / 70 5)
250	10	407	450	450	445	450	450	413	198	346	301	235	70 / 105 5)	68 / 103 5)
300	12	483	500	500	521	500	500	436	228	369	324	272	105 / 150 5)	103 / 148 5)
350	14	533	550	533	584	550	533	451	265	384	339	322	105 / 140 5)	103 / 138 5)
400	16	597	600	610	647	600	610	493	265	426	381	322	175 / 265 5)	173 / 263 5)

Tolerance L: DN 150 ... 200 +0 / -3 mm, DN 250 ... 400 +0 / -5 mm

Dimensions [inch]													Approx. weight [lb]	
		CL150			CL300								Integral mount design	Remote mount design
			ISO 13359	US installation length		ISO 13359	US installation length							
DN	Inch	D	L 2) 3) 6)	L 2) 3)	D	L 2) 3) 6)	L 2) 3)	F 4)	C	E 4)	G 4)	A		
150	6	11.02	11.81	11.81	12.52	11.81	11.81	14.09	5.75	11.46	9.69	6.54	73 / 104 5)	68 / 99 5)
200	8	13.5	13.78	13.78	15	13.78	13.78	15.71	6.69	13.03	11.26	7.87	110 / 158 5)	106 / 154 5)
250	10	16.02	17.72	17.72	17.52	17.72	17.72	16.26	7.8	13.62	11.85	9.25	154 / 232 5)	150 / 227 5)
300	12	19.02	19.69	19.69	20.51	19.69	19.69	17.17	8.98	14.53	12.76	10.71	232 / 150 5)	227 / 326 5)
350	14	20.98	21.65	20.98	22.99	21.65	20.98	17.76	10.43	15.12	13.35	12.68	232 / 140 5)	227 / 304 5)
400	16	23.5	23.62	24.02	25.47	23.62	24.02	19.41	10.43	16.77	15	12.68	386 / 584 5)	381 / 580 5)

Tolerance L: DN 150 ... 200 +0 / -0.118 inch, DN 250 ... 400 +0 / -0.197 inch

1) Other pressure ratings upon request.
2) If a grounding plate is installed (attached to one side of the flange), this increases dimension L by 5 mm (0.197 inch).
3) If protection plates are installed (attached to both sides of the flange), this increases dimension L by 10 mm (0.394 inch).
4) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

5) Weights for CL150 / CL300.
6) For devices with ordering code “Installation length JN” (China production site) the installation length corresponds to the ISO installation length.

9.3 Flange DN 450 ... 2000 (18 ... 80")

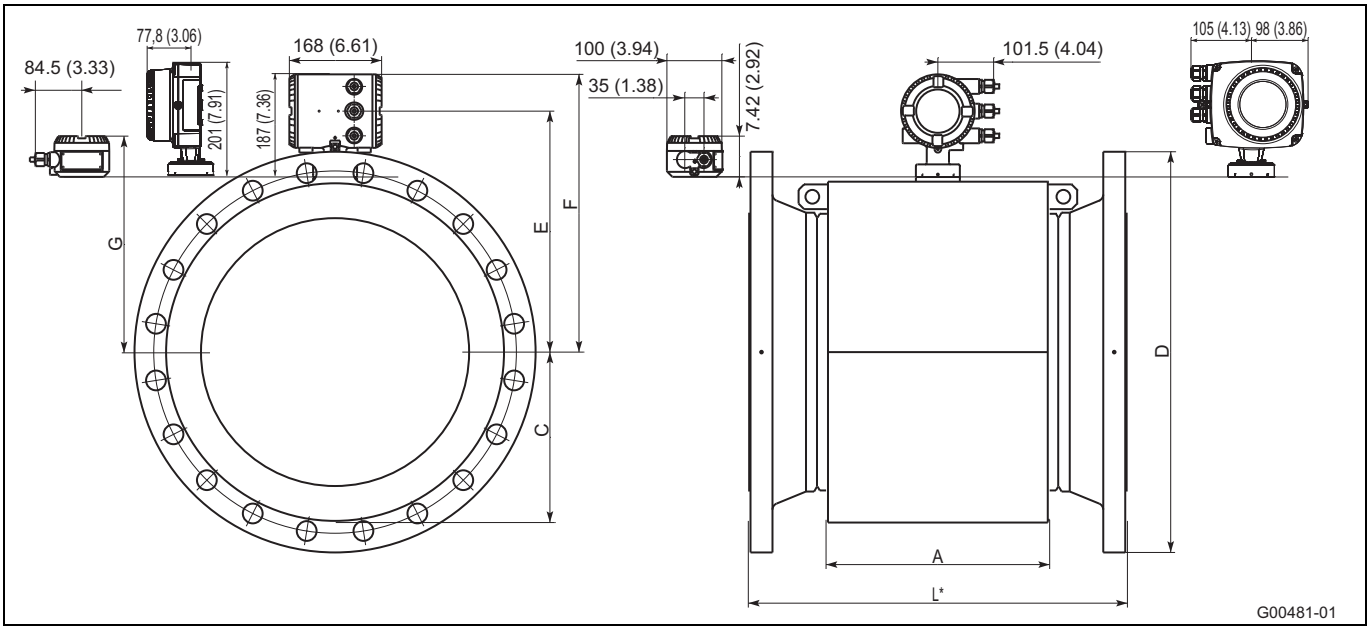


Fig. 41: Dimensions in mm (inch)

Flange in acc. with DIN/EN 1092-1

Dimensions [mm]									Approx. weight [kg]	
DN	PN [1]	D	L [2] [3]	F [4]	C	E [4]	G [4]	A	Integral mount design	Remote mount design
500	10	670	650	501	310	434	389	407	190	188
	16	715	650	501	310	434	389	407	240	238
600	10	780	780	552	361	485	440	469	246	244
	16	840	780	552	361	485	440	469	318	316
700	10	895	910	596	405	529	484	537	320	318
	16	910	910	596	405	529	484	537	440	438
800	10	1015	1040	646	455	579	534	605	420	418
	16	1025	1040	646	455	579	534	605	490	488
900	10	1115	1170	696	505	629	584	671	505	503
	16	1125	1170	696	505	629	584	671	590	588
1000	10	1230	1300	746	555	679	634	739	690	688
	16	1255	1300	746	555	679	634	739	850	848
1200	6	1405	1560	856	660	789	742	800	700	698
	10	1455	1560	856	660	789	742	800	930	928
1400	6	1630	1820	950	755	884	838	900	810	808
	10	1675	1820	950	755	884	838	900	1210	1208
1600	6	1830	2080	1060	865	994	948	990	1180	1178
	10	1915	2080	1060	865	994	948	990	1630	1628
1800	6	2045	2340	1176	980	1109	1062	1080	1490	1488
	10	2115	2340	1176	980	1109	1062	1080	2230	2228
2000	6	2265	2600	1286	1090	1219	1172	1170	1880	1878
	10	2325	2600	1286	1090	1219	1172	1170	2650	2648

Tolerance L: DN 450 ... 500 +0 / -5 mm, DN 600 ... 2000 +0 / -10 mm

Dimensions [inch]									Approx. weight [lb]	
DN (inch)	**PN 1)**	**D**	**L 2) 3)**	**F 4)**	**C**	**E 4)**	**G 4)**	**A**	**Integral mount design**	**Remote mount design**
500 (20)	10	26.38	25.59	19.72	12.20	17.09	15.31	16.02	432	428
	16	28.15	25.59	19.72	12.2	17.09	15.31	16.02	529	525
600 (24)	10	30.71	30.71	21.73	14.21	19.09	17.32	18.46	608	604
	16	33.07	30.71	21.73	14.21	19.09	17.32	18.46	701	697
700 (28)	10	35.24	35.83	23.46	15.94	20.83	19.06	21.14	703	699
	16	35.83	35.83	23.46	15.94	20.83	19.06	21.14	970	966
800 (32)	10	39.96	40.94	25.43	17.91	22.80	21.02	23.82	902	897
	16	40.35	40.94	25.43	17.91	22.8	21.02	23.82	1080	1076
900 (36)	10	43.90	46.06	27.40	19.88	24.76	22.99	26.42	1073	1069
	16	44.29	46.06	27.4	19.88	24.76	22.99	26.42	1300	1296
1000 (40)	10	48.43	51.18	29.37	21.85	26.73	24.96	29.09	1276	1272
	16	49.41	51.18	29.37	21.85	26.73	24.96	29.09	1874	1869
1200 (48)	6	55.31	61.42	33.7	25.98	31.06	29.21	31.5	1543	1538
	10	57.28	61.42	33.7	25.98	31.06	29.21	31.5	2050	2046
1400 (54)	6	64.17	71.65	37.4	29.72	34.8	32.99	35.43	1786	1781
	10	65.94	71.65	37.4	29.72	34.8	32.99	35.43	2668	2663
1600 (66)	6	72.05	81.89	41.73	34.06	39.13	37.32	38.98	2602	2597
	10	75.39	81.89	41.73	34.06	39.13	37.32	38.98	3593	3589
1800 (72)	6	80.51	92.13	46.3	38.58	43.66	41.81	42.52	3285	3280
	10	83.27	92.13	46.3	38.58	43.66	41.81	42.52	4916	4912
2000 (80)	6	89.17	102.36	50.63	42.91	47.99	46.14	46.06	4145	4140
	10	91.54	102.36	50.63	42.91	47.99	46.14	46.06	5842	5838

Tolerance L: DN 500 +0 / -0.197 inch, DN 600 ... 2000 +0 / -0.394 inch

1) Other pressure ratings available on request.
2) If a grounding plate is installed (attached to one side of the flange), this increases dimension L as follows: DN 400 ... 600 by 5 mm (0.197 inch).
3) If protection plates are installed (attached to both sides of the flange), this increases dimension L as follows: DN 400 ... 600 by 10 mm (0.394 inch).
4) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

5) For devices with ordering code “Installation length JN” (China production site) the installation length corresponds to the ISO installation length.

Flange up to DN 600 (24") in acc. with ASME B16.5, flange DN 700 ... 1500 (28 ... 60") in acc. with ASME B16.47, Series B

Dimensions [mm]										Approx. weight [kg]	
										Integral mount design	Remote mount design
		CL150	ISO installation length	US installation length						CL150	CL150
DN	Inch	D	L 2) 3) 5)	L 2) 3)	F 4)	C	E 4)	G 4)	A	Approx. kg	Approx. kg
450	18	635	686	686	501	310	434	389	-	260	258
500	20	699	762	762	501	310	434	389	407	300	298
600	24	813	914	914	552	361	485	440	469	425	423
700	28	837	910	-	596	405	529	484	537	350	348
760	30	888	990	-	606	435	539	494	-	230	228
800	32	942	1040	-	646	455	579	534	605	500	498
900	36	1057	1170	-	696	505	629	584	671	680	678
1000	40	1380	1300	-	746	555	679	634	739	880	878
1050	42	1067	1365	-	771	580	704	659	-	-	-
1100	44	1118	1430	-	-	-	-	-	-	-	-
1500	60	1676	1950	-	996	805	929	884	-	-	-

Tolerance L: DN 450 ... 500 +0 / -5 mm, DN 600 ... 2000 +0 / -10 mm

Dimensions [inch]										Approx. weight [lb]	
										Integral mount design	Remote mount design
		CL150	ISO installation length	US installation length						CL150	CL150
DN	Inch	D	L 2) 3) 5)	L 2) 3)	F 4)	C	E 4)	G 4)	A	Approx. lb	Approx. lb
450	18	25.0	27.01	27.01	19.72	12.20	17.09	15.31	-	573	569
500	20	27.52	30	30	19.72	12.20	17.09	15.31	407	661	657
600	24	32.01	35.98	35.98	21.73	14.21	19.09	17.32	469	937	933
700	28	32.95	35.83	-	23.46	15.94	20.83	19.06	537	772	767
760	30	34.96	38.98	-	23.86	17.13	21.22	19.45	-	507	503
800	32	37.09	40.94	-	25.43	17.91	22.80	21.02	605	1102	1098
900	36	41.61	46.06	-	27.40	19.88	24.76	22.99	671	1499	1495
1000	40	54.33	51.18	-	29.37	21.85	26.73	24.96	739	1940	1936
1050	42	42.01	53.74	-	30.35	22.83	72.72	25.94	-	-	-
1100	44	44.02	56.30	-	-	-	-	-	-	-	-
1500	60	65.98	76.77	-	39.21	31.69	36.57	34.80	-	-	-

Tolerance L: DN 450 ... 500 +0 / -0.197 inch, DN 600 ... 2000 +0 / -0.394 inch

1) Other pressure ratings available on request.
2) If a grounding plate is installed (attached to one side of the flange), this increases dimension L as follows: DN 400 ... 600 by 5 mm (0,197 inch).
3) If protection plates are installed (attached to both sides of the flange), this increases dimension L as follows: DN 400 ... 600 by 10 mm (0.394 inch).
4) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

5) For devices with ordering code “Installation length JN” (China production site) the installation length corresponds to the ISO installation length.

9.4 Flange DN 15 ... 200 (1/2 ... 8"), high-pressure versions PN 63 and PN 100

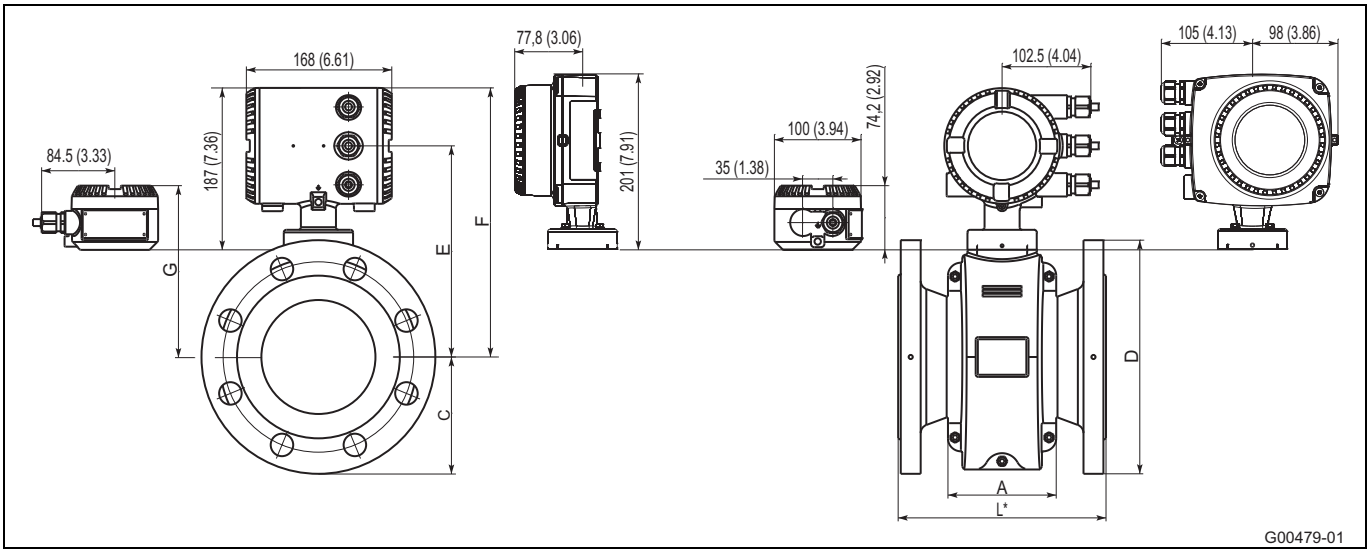


Fig. 42: Dimensions in mm (inch)

Flange in acc. with DIN 2636 (PN 63) and DIN 2637 (PN 100)

Dimensions [mm (inch)]									Approx. weight [kg (lb)]	
DN (inch)	PN	D	L [1) 2)]	F [4)]	C	E [3)]	G [3)]	A	Integral mount design	Remote mount design
15 (1/2)	63 ... 100	105 (4.13)	270 (10.63)	255 (10.04)	82 (3.23)	188 (7.4)	143 (5.63)	113 (4.45)	10 (22)	8 (18)
25 (1)	63 ... 100	140 (5.51)	270 (10.63)	255 (10.04)	82 (3.23)	188 (7.4)	143 (5.63)	113 (4.45)	12 (27)	10 (22)
40 (1 1/2)	63 ... 100	170 (6.69)	280 (11.02)	262 (10.31)	92 (3.62)	195 (7.68)	150 (5.91)	113 (4.45)	13 / 14 (29 / 31)	11 / 12 (24 / 27)
50 (2)	63	180 (7.09)	280 (11.02)	268 (10.55)	97 (3.82)	201 (7.91)	156 (6.14)	115 (4.53)	15 (33)	13 (29)
	100	195 (7.68)	280 (11.02)	268 (10.55)	97 (3.82)	201 (7.91)	156 (6.14)	115 (4.53)	18 (40)	16 (35)
65 (2 1/2)	63	205 (8.07)	330 (12.99)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	18 (40)	16 (35)
	100	220 (8.66)	330 (12.99)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	23 (51)	21 (46)
80 (3)	63	215 (8.46)	340 (13.39)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	22 (49)	20 (44)
	100	230 (9.06)	340 (13.39)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	26 (57)	24 (53)
100 (4)	63	250 (9.84)	400 (15.75)	301 (11.85)	122 (4.8)	234 (9.21)	189 (7.44)	125 (4.92)	29 (64)	27 (60)
	100	265 (10.43)	400 (15.75)	301 (11.85)	122 (4.8)	234 (9.21)	189 (7.44)	125 (4.92)	38 (84)	26 (57)

Continued on next page

Continued

Dimensions [mm (inch)]									Approx. weight [kg (lb)]	
DN	**PN**	**D**	**L 1) 2)**	**F 4)**	**C**	**E 3)**	**G 3)**	**A**	**Integral mount design**	**Remote mount design**
125 (5)	63	295 (11.61)	450 (17.72)	311 (12.24)	130 (5.12)	244 (9.61)	199 (7.83)	125 (4.92)	On request	On request
	100	315 (12.4)	450 (17.72)	311 (12.24)	130 (5.12)	244 (9.61)	199 (7.83)	125 (4.92)		
150 (6)	63	345 (13.58)	450 (17.72)	358 (14.09)	146 (5.75)	291 (11.46)	246 (9.69)	166 (6.54)		
	100	355 (13.98)	450 (17.72)	358 (14.09)	146 (5.75)	291 (11.46)	246 (9.69)	166 (6.54)		
200 (8)	63	415 (16.34)	500 (19.69)	399 (15.71)	170 (6.69)	331 (13.03)	286 (11.26)	200 (7.87)		
	100	430 (16.93)	500 (19.69)	399 (15.71)	170 (6.69)	331 (13.03)	286 (11.26)	200 (7.87)		

Tolerance L: +0 / -3 mm (+0 / -0.018 inch)

1) If a grounding plate is installed (attached to one side of the flange), this increases dimension L as follows: DN 3 ... 100 by 3 mm (0.118 inch; DN 125 by 5 mm (0.197 inch).
2) If protection plates are installed (attached to both sides of the flange), this increases dimension L as follows: DN 3 ... 100 by 6 mm (0.236 inch; DN 125 by 10 mm (0.394 inch).
3) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

9.5 Flange DN 15 ... 200 (1/2 ... 8"), high-pressure version CL 600

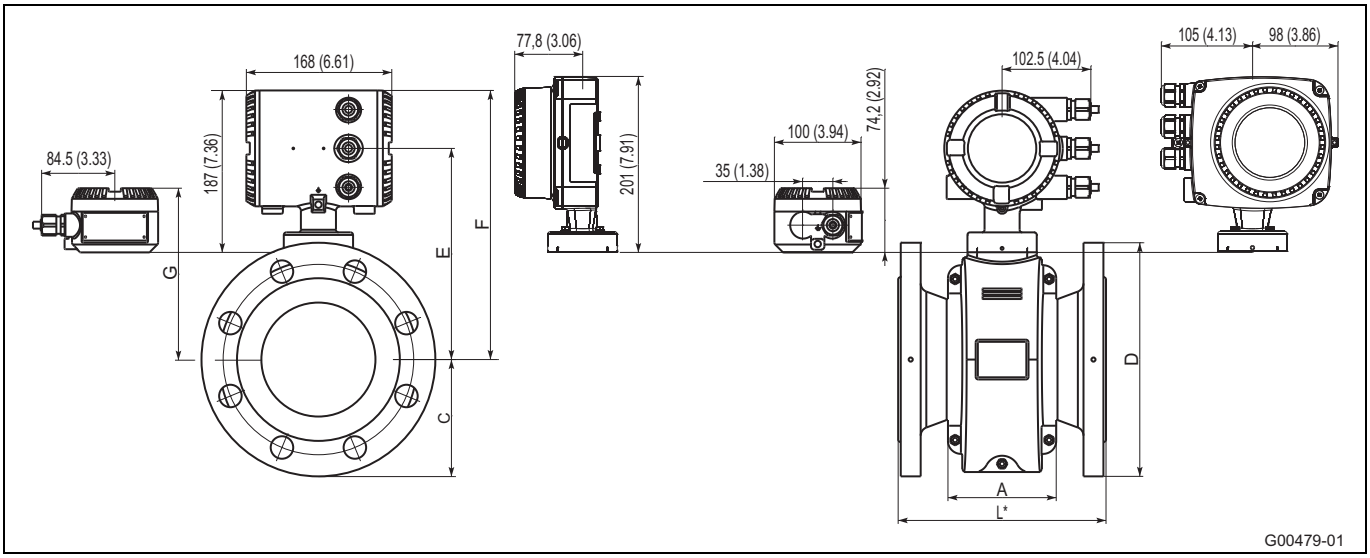


Fig. 43: Dimensions in mm (inch)

Flange in acc. with ASME B16.5, CL 600

Dimensions [mm (inch)]									Approx. weight [kg (lb)]	
DN	**PN 1)**	**D**	**L 1) 2)**	**F 4)**	**C**	**E 3)**	**G 3)**	**A**	**Integral mount design**	**Remote mount design**
15	CL 600	95 (3.74)	270 (10.63)	255 (10.04)	82 (3.23)	188 (7.4)	143 (5.63)	113 (4.45)	12 (26)	10 (22)
25	CL 600	124 (4.88)	270 (10.63)	255 (10.04)	82 (3.23)	188 (7.4)	143 (5.63)	113 (4.45)	12 (26)	10 (22)
40	CL 600	156 (6.14)	280 (11.02)	262 (10.31)	92 (3.62)	195 (7.68)	150 (5.91)	113 (4.45)	13 (29)	11 (24)
50	CL 600	165 (6.5)	280 (11.02)	268 (10.55)	97 (3.82)	201 (7.91)	156 (6.14)	115 (4.53)	15 (33)	13 (29)
65	CL 600	190 (7.48)	330 (12.99)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	20 (44)	18 (40)
80	CL 600	210 (8.27)	340 (13.39)	279 (10.98)	108 (4.25)	212 (8.35)	167 (6.57)	104 (4.09)	25 (55)	23 (51)
100	CL 600	273 (10.75)	400 (15.75)	301 (11.85)	122 (4.8)	234 (9.21)	189 (7.44)	125 (4.92)	46 (101)	44 (97)
125	CL 600	330 (12.99)	450 (17.72)	311 (12.24)	130 (5.12)	244 (9.61)	199 (7.83)	125 (4.92)	On request	On request
150	CL 600	355 (13.98)	450 (17.72)	358 (14.09)	146 (5.75)	291 (11.46)	246 (9.69)	166 (6.54)		
200	CL 600	420 (16.54)	500 (19.69)	399 (15.71)	170 (6.69)	331 (13.03)	286 (11.26)	200 (7.87)		

Tolerance L: +0 / -3 mm (+0 / -0.018 inch)

1) If a grounding plate is installed (attached to one side of the flange), this increases dimension L as follows: DN 3 ... 100 by 3 mm (0.118 inch; DN 125 by 5 mm (0.197 inch).
2) If protection plates are installed (attached to both sides of the flange), this increases dimension L as follows: DN 3 ... 100 by 6 mm (0.236 inch; DN 125 by 10 mm (0.394 inch).
3) Depending on the device design, the dimensions change according to the following table.

Device design		Dimension E, F	Dimension G
Without explosion protection	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)
Explosion protection Zone 1, Div. 1	Standard temperature design	+74 mm (+2.91 inch)	+47 mm (+1.85 inch)
	High temperature version	+127 mm (+5 inch)	+174 mm (+6.85 inch)
Explosion protection Zone 2, Div. 2	Standard temperature design	0	0
	High temperature version	+127 mm (+5 inch)	+127 mm (+5 inch)

9.6 Transmitter housing (dual-compartment housing) model FET521 and FET525 Zone 2, Div 2

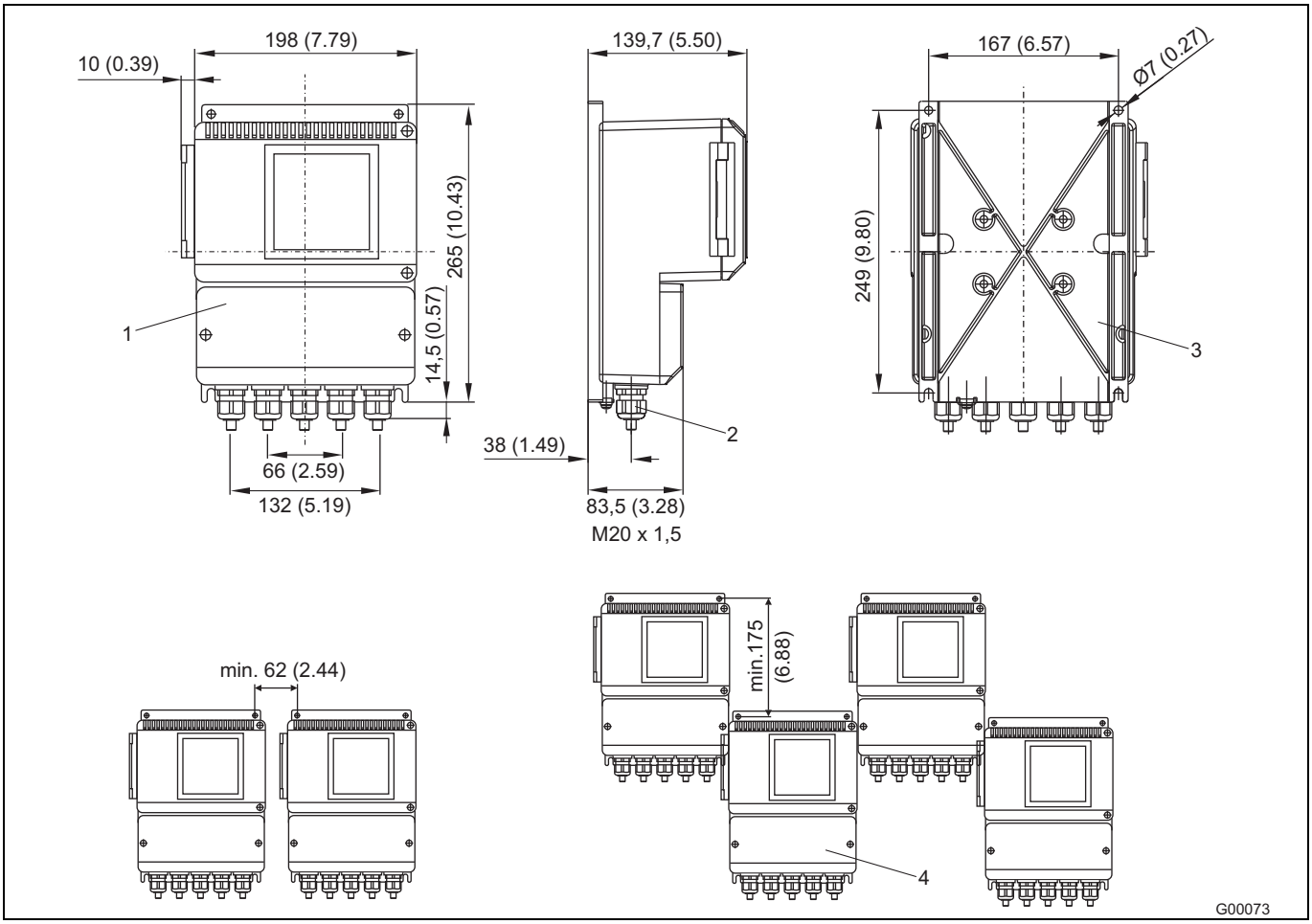


Fig. 44: Dimensions in mm (inch)

1 Field-mount housing with window
2 Cable gland M20 x 1.5
3 Installation holes for pipe mounting set, for 2" pipe installation; mounting set available on request (order no. 3KXF081100L0001)
4 Protection class IP 67

9.7 Transmitter housing for model FET525 for Ex zone 1 / Div. 1

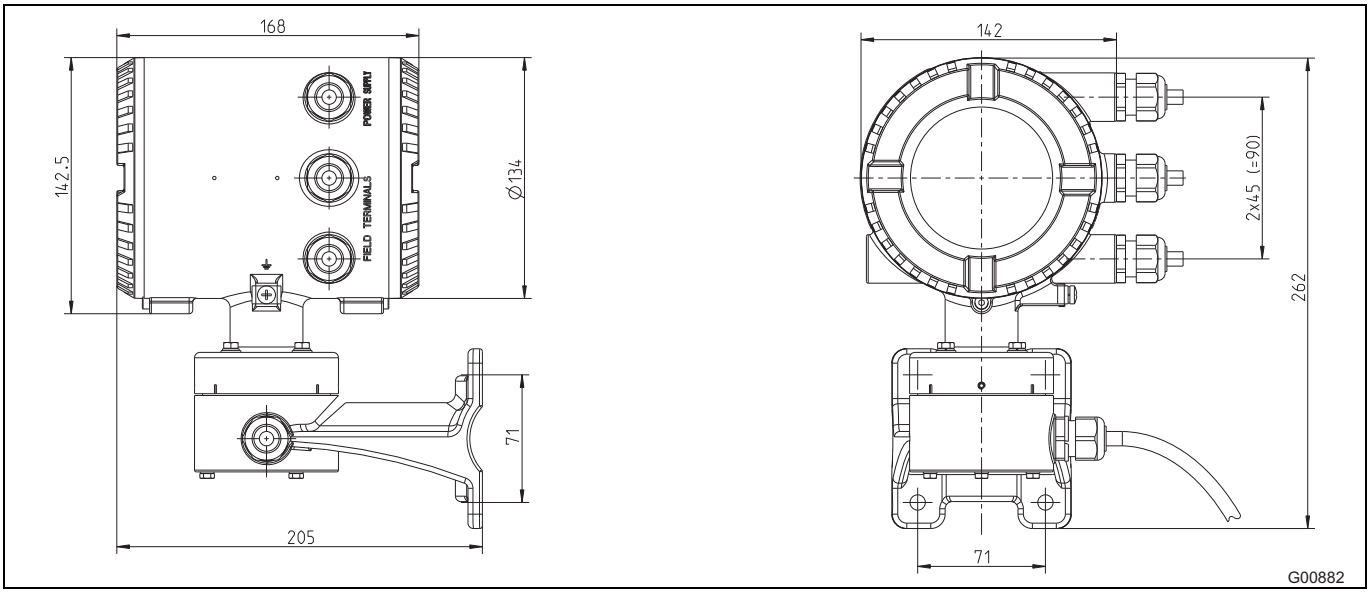


Fig. 45: Dimensions in mm (inch)

9.8 Transmitter housing (single-compartment housing) model FET521

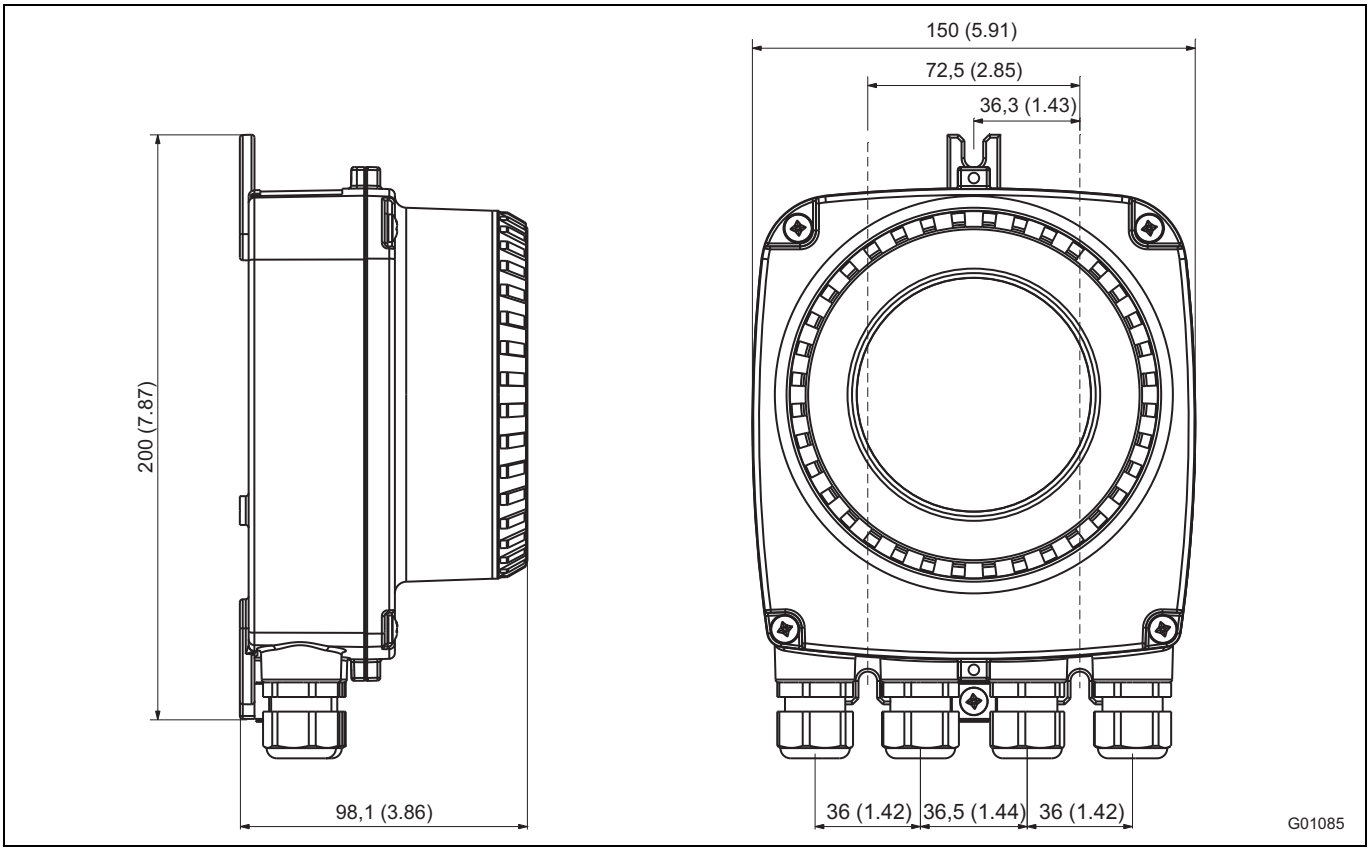


Fig. 46: Dimensions in mm (inch)

10 Ordering information

10.1 ProcessMaster FEP511, FEP515 electromagnetic flowmeter, compact design

		Main order number																					Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP511**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX
With explosion protection	**FEP515**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX
Nominal diameter																							
DN 3 (1/10 in.)		0	0	3																			
DN 4 (5/32 in.)		0	0	4																			
DN 6 (1/4 in.)		0	0	6																			
DN 8 (5/16 in.)		0	0	8																			
DN 10 (3/8 in.)		0	1	0																			
DN 15 (1/2 in.)		0	1	5																			
DN 20 (3/4 in.)		0	2	0																			
DN 25 (1 in.)		0	2	5																			
DN 32 (1-1/4 in.)		0	3	2																			
DN 40 (1-1/2 in.)		0	4	0																			
DN 50 (2 in.)		0	5	0																			
DN 65 (2-1/2 in.)		0	6	5																			
DN 80 (3 in.)		0	8	0																			
DN 100 (4 in.)		1	0	0																			
DN 125 (5 in.)		1	2	5																			
DN 150 (6 in.)		1	5	0																			
DN 200 (8 in.)		2	0	0																			
DN 250 (10 in.)		2	5	0																			
DN 300 (12 in.)		3	0	0																			
DN 350 (14 in.)		3	5	0																			
DN 400 (16 in.)		4	0	0																			
DN 450 (18 in.)		4	5	0																			
DN 500 (20 in.)		5	0	0																			
DN 600 (24 in.)		6	0	0																			
DN 700 (28 in.)		7	0	0																			
DN 760 (30 in.)		7	6	0																			
DN 800 (32 in.)		8	0	0																			
DN 900 (36 in.)		9	0	0																			
DN 1000 (40 in.)		0	0	1																			
DN 1050 (42 in.)		0	5	1																			
DN 1100 (44 in.)		1	0	1																			
DN 1200 (48 in.)		2	0	1																			
DN 1400 (54 in.)		4	0	1																			
DN 1500 (60 in.)		5	0	1																			
DN 1600 (66 in.)		6	0	1																			
DN 1800 (72 in.)		8	0	1																			
DN 2000 (80 in.)		0	0	2																			
Lining material																							
PTFE					A																		
Ceramic carbide				1)	D																		
ETFE					E																		
Thick PTFE					F																		
Hard rubber					H																		
Elastomer (only for US production site)				2)	M																		
PFA					P																		
Soft rubber					S																		
Electrode design																							
Standard						1																	
Standard + full filling electrode (TFE)					3)	2																	
Pointed head						5																	
Spray head + full filling electrode (TFE)					3)	6																	

Continued on next page

1) Only with Tungsten carbide electrodes / protection plates attached to both sides of the flange
2) Only for US production site, model FEP515, FEP525 (approval certificates: without PED approval, process connection: Flange ASME Cl 150 / 300, length: US installation length)
3) TFE electrode for detecting partially filled tubes, available from DN 50 (2 in.). Not available for Zone 1 / Div 1

Continued

	Main order number																					Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP511**	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	XX
With explosion protection	**FEP515**	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	XX
Signal electrode material																							
Stainless steel 1.4539 (904)							A																
Hastelloy C-4 (2.4610)							D																
Titanium							F																
Tantalum							G																
Hastelloy B-3 (2.4600)							H																
Platinum-iridium							J																
Stainless steel 1.4571 (316Ti)							S																
Double layer						4)	W																
Tungsten carbide coated							T																
Grounding accessories																							
Standard								1															
Grounding electrodes (for material, refer to "Signal electrode material")								2															
Grounding plate made of stainless steel, attached to one side of the flange							5)	3															
Protection plate made of stainless steel, attached to both sides of the flange							5)	4															
Process connection																							
Flange DIN PN 6								6)	D	0													
Flange DIN PN 10									D	1													
Flange DIN PN 16									**D**	**2**													
Flange DIN PN 25									D	3													
Flange DIN PN 40									D	4													
Flange DIN PN 64								7)	D	5													
Flange DIN PN 100								7)	D	6													
Flange, ASME CL 150									A	1													
Flange, ASME CL 300									A	3													
Flange, ASME CL 600								7)	A	6													
Flange, JIS 10K									J	1													
Process connection material																							
Steel											**B**												
Stainless steel flange										8)	D												
Certificates																							
Meter tube with PED approval												**0**											
Meter tube without PED approval (only China and US production sites. Specify installation length J1, J3 or JN)												1											
Acceptance test certificate (3.1) to EN 10204												2											
Pressure test to AD-2000												3											
Material certificate 3.1 to EN 10204 and pressure test to AD-2000												4											
Calibration																							
Standard accuracy											9)		**A**										
Increased accuracy											10)		B										
Standard accuracy + ScanMaster function											9)		K										
Increased accuracy + ScanMaster function											10)		L										
Standard accuracy for certified calibration													M										
5-point DKD calibration											11)		T										

Continued on next page

4) Base material Hastelloy C4
5) Can only be used for sensors ≤ DN 600 (24 in) and PTFE / thick PTFE / ETFE / PFA linings. Material: See data sheet
6) Available from DN 1000 (40 in.)
7) DN 15 ... DN 200 (1/2 ... 8 in.) Hard rubber.
8) Material: See data sheet.
9) Standard accuracy (0.3% of rate) assumes 2 calibration points. If more than 2 calibration points are required, you must specify 3 or 5 points under "Number of test points".
10) Increased accuracy (0.2% of rate) assumes 3 calibration points. If more than 3 calibration points are required, you must specify 5 points under "Number of test points". Available for DN10 (3/8 in.) ... 800 (32 in.)
11) Available for nominal diameters DN 50 (2 in.) ... 600 (24 in.), DN 800 (32 in.).

Continued

Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Add. order no.
	Main order number																						
Without explosion protection	**FEP511**	X	X	X	X	X	X	X	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
With explosion protection	**FEP515**	X	X	X	X	X	X	X	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Sensor temperature range / Ambient temperature range																							
Standard sensor design / -20 ... 60 °C (-4 ... 140 °F)												12)		1									
Standard sensor design / -40 ... 60 °C (-40 ... 140 °F)												12)		2									
High-temperature sensor design / -20 ... 60 °C (-4 ... 140 °F)												13)		3									
High-temperature sensor design / -40 ... 60 °C (-40 ... 140 °F)												13)		4									
Name plate																							
Sticker															A								
Stainless steel															B								
Stainless steel, and TAG label stainless steel															C								
Signal cable length																							
No cable																0							
Explosion protection															14)								
None															15)		A						
ATEX / IEC Zone 1																	L						
ATEX / IEC Zone 2 / 21																	M						
usFMc Div 2 Zone 2																	P						
usFMc Div 1															16)		R						
Protection type for transmitter / sensor																							
Standard / IP67 (NEMA 4X)																17)		1					
Other																		9					
Cable gland																							
M20 x 1.5																			A				
1/2 in. NPT																			B				
PF 1/2 in.																			C				
Power supply																							
100 ... 230 V AC, 50 Hz																				1			
24 V AC / DC, 50 Hz																				2			
100 ... 230 V AC, 60 Hz																				3			
24 V AC / DC, 60 Hz																				4			
Signal inputs and outputs																							
HART + 20 mA passive + pulses + contact input / output																			18)		B		
HART + 20 mA active + pulses + contact input / output																			19)		C		
HART + 20 mA active + pulses + contact output																			20)		D		
PROFIBUS PA + contact output																					E		
FOUNDATION Fieldbus + contact output																					F		
Default settings / Diagnostics																							
Parameters are at factory settings / Extended diagnostics functions activated.																						2	
Parameters are set according to customer specifications / Extended diagnostics functions activated.																						4	

Continued on next page

12) Maximum fluid temperature for standard sensor design: 130 °C with PTFE, PFA, ETFE, thick PTFE / 90 °C with hard rubber / 60 °C with soft rubber. -40 °C only in conjunction with stainless steel flange.
13) Maximum fluid temperature for high-temperature sensor design: 180 °C with PFA, thick PTFE. 130 °C with ETFE, PTFE. Thick PTFE available for DN 25 ... DN 300, PFA available for DN 10 ... DN 200. -40 °C only in conjunction with stainless steel flange.
14) Explosion protection only possible in conjunction with dual-compartment transmitter housing
15) Model FEP511 only.
16) Div 1 available up to DN 300 (12 in.).
17) Transmitter degree of protection = IP67 (NEMA 4X) with single-compartment and dual-compartment housing
18) Choice with design Zone 2 / Div 2 or Zone 1 / Div1.
19) Choice with design Zone 2 / Div 2.
20) Choice with design Zone 1 / Div 1.

Continued

	Main order number																						Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP511**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**XX**
With explosion protection	**FEP515**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**XX**
Accessories																							
None																							AY
Plug connector																							
M12 x 1 fieldbus																						20)	U2
Transmitter housing design																							
Single-compartment housing																						21)	H1
Dual-compartment housing																							H2
Insertion depth																							
Flanges, ASME Class 150 (North American installation length) (Production site: USA. Certificate: Without PED approval)																							J1
Flanges, ASME Class 300 (North American installation length) (Production site: USA. Certificate: Without PED approval)																							J3
Flanges, ASME CL 150, ISO-compliant installation length																							JA
Flanges, ASME CL 300, ISO-compliant installation length																							JC
Flanges (Chinese installation length) (production site: China. Certificate: Without PED approval)																							JN
Number of test points																							
3 points																							T3
5 points																							T5
Language of documentation																							
German																							M1
English																							M5
Chinese																							M6
Russian																							MB
Western Europe / Scandinavia language package (languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)																							MW
Eastern Europe language package (languages: DE, EL, CS, ET, LV, LT, HU, PL, SK, SL, RO, BG)																							ME

20) Only for PROFIBUS PA Not for model FEP515.

21) For model FEP511 only.

10.2 ProcessMaster FEP521, FEP525 electromagnetic flowmeter, remote mount design

	Main order number																					Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP521**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX
With explosion protection	**FEP525**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX
Nominal diameter																							
DN 3 (1/10 in.)		0	0	3																			
DN 4 (5/32 in.)		0	0	4																			
DN 6 (1/4 in.)		0	0	6																			
DN 8 (5/16 in.)		0	0	8																			
DN 10 (3/8 in.)		0	1	0																			
DN 15 (1/2 in.)		0	1	5																			
DN 20 (3/4 in.)		0	2	0																			
DN 25 (1 in.)		0	2	5																			
DN 32 (1-1/4 in.)		0	3	2																			
DN 40 (1-1/2 in.)		0	4	0																			
DN 50 (2 in.)		0	5	0																			
DN 65 (2-1/2 in.)		0	6	5																			
DN 80 (3 in.)		0	8	0																			
DN 100 (4 in.)		1	0	0																			
DN 125 (5 in.)		1	2	5																			
DN 150 (6 in.)		1	5	0																			
DN 200 (8 in.)		2	0	0																			
DN 250 (10 in.)		2	5	0																			
DN 300 (12 in.)		3	0	0																			
DN 350 (14 in.)		3	5	0																			
DN 400 (16 in.)		4	0	0																			
DN 450 (18 in.)		4	5	0																			
DN 500 (20 in.)		5	0	0																			
DN 600 (24 in.)		6	0	0																			
DN 700 (28 in.)		7	0	0																			
DN 760 (30 in.)		7	6	0																			
DN 800 (32 in.)		8	0	0																			
DN 900 (36 in.)		9	0	0																			
DN 1000 (40 in.)		0	0	1																			
DN 1050 (42 in.)		0	5	1																			
DN 1100 (44 in.)		1	0	1																			
DN 1200 (48 in.)		2	0	1																			
DN 1400 (54 in.)		4	0	1																			
DN 1500 (60 in.)		5	0	1																			
DN 1600 (66 in.)		6	0	1																			
DN 1800 (72 in.)		8	0	1																			
DN 2000 (80 in.)		0	0	2																			
Lining material																							
PTFE					A																		
Ceramic carbide				1)	D																		
ETFE					E																		
Thick PTFE					F																		
Hard rubber					H																		
Elastomer (only for US production site)				2)	M																		
PFA					P																		
Soft rubber					S																		
Electrode design																							
Standard						1																	
Standard + full filling electrode (TFE)					3)	2																	
Pointed head						5																	
Spray head + full filling electrode (TFE)					3)	6																	

Continued on next page

1) Only with Tungsten carbide electrodes / protection plates attached to both sides of the flange
2) Only for US production site, model FEP515, FEP525 (approval certificates: without PED approval, process connection: Flange ASME Cl 150 / 300, length: US installation length).
3) TFE electrode for detecting partially filled tubes, available from DN 50 (2 in.). Not available for Zone 1 / Div 1.

Continued

Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Add. order no.
	Main order number																						
Without explosion protection	**FEP521**	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	XX
With explosion protection	**FEP525**	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	X	X	X	X	X	X	X	X	X	XX
Signal electrode material																							
Stainless steel 1.4539 (904)							A																
Hastelloy C-4 (2.4610)							D																
Titanium							F																
Tantalum							G																
Hastelloy B-3 (2.4600)							H																
Platinum-iridium							J																
Stainless steel 1.4571 (316Ti)							S																
Double layer					4)		W																
Tungsten carbide coated							T																
Grounding accessories																							
Standard								1															
Grounding electrodes (for material, refer to "Signal electrode material")								2															
Grounding plate made of stainless steel, attached to one side of the flange							5)	3															
Protection plate made of stainless steel, attached to both sides of the flange							5)	4															
Process connection																							
Flange DIN PN 6								6)	D	0													
Flange DIN PN 10									D	1													
Flange DIN PN 16									D	2													
Flange DIN PN 25									D	3													
Flange DIN PN 40									D	4													
Flange DIN PN 64								7)	D	5													
Flange DIN PN 100								7)	D	6													
Flange, ASME CL 150									A	1													
Flange, ASME CL 300									A	3													
Flange, ASME CL 600								7)	A	6													
Flange, JIS 10K									J	1													
Process connection material																							
Steel											B												
Stainless steel flange									8)		D												
Certificates																							
Meter tube with PED approval												0											
Meter tube without PED approval (only China and US production sites. Specify installation length J1, J3 or JN)												1											
Acceptance test certificate (3.1) to EN 10204												2											
Pressure test to AD-2000												3											
Material certificate 3.1 to EN 10204 and pressure test to AD-2000												4											
Calibration																							
Standard accuracy											9)		A										
Increased accuracy											10)		B										
Standard accuracy + ScanMaster function											9)		K										
Increased accuracy + ScanMaster function											10)		L										
Standard accuracy for certified calibration													M										
5-point DKD calibration											11)		T										

Continued on next page

4) Base material Hastelloy C4.
5) Can only be used for sensors ≤ DN 600 (24 in) and PTFE / thick PTFE / ETFE / PFA linings. Material: See data sheet
6) Available from DN 1000 (40 in.)
7) DN 15 ... DN 200 (1/2 ... 8 in.) Hard rubber.
8) Material: See data sheet.
9) Standard accuracy (0.3% of rate) assumes 2 calibration points. If more than 2 calibration points are required, you must specify 3 or 5 points under "Number of test points".
10) Increased accuracy (0.2% of rate) assumes 3 calibration points. If more than 3 calibration points are required, you must specify 5 points under "Number of test points". Available for DN10 (3/8 in.) ... 800 (32 in.)
11) Available for nominal diameters DN 50 (2 in.) ... 600 (24 in.), DN 800 (32 in.).

Continued

	Main order number																					Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP521**	X	X	X	X	X	X	X	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**XX**
With explosion protection	**FEP525**	X	X	X	X	X	X	X	X	X	X	X	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**XX**
Sensor temperature range / Ambient temperature range																							
Standard sensor design / -20 ... 60 °C (-4 ... 140 °F)												12)		1									
Standard sensor design / -40 ... 60 °C (-40 ... 140 °F)												12)		2									
High-temperature sensor design / -20 ... 60 °C (-4 ... 140 °F)												13)		3									
High-temperature sensor design / -40 ... 60 °C (-40 ... 140 °F)												13)		4									
Name plate																							
Sticker															A								
Stainless steel													14)		B								
Stainless steel, and TAG label stainless steel													14)		C								
Signal cable length														15)									
No cable																0							
5 m (approx. 15 ft.) standard cable																1							
10 m (approx. 30 ft.) standard cable																2							
20 m (approx. 60 ft.) standard cable																3							
30 m (approx. 100 ft.) standard cable																4							
50 m (approx. 165 ft.) standard cable																5							
80 m (approx. 260 ft.) standard cable														14)		6							
100 m (approx. 325 ft.) standard cable														14)		7							
150 m (approx. 490 ft.) standard cable														14)		8							
Explosion protection																							
None															16)		A						
ATEX / IEC Zone 1																	L						
ATEX / IEC Zone 2 / 21																	M						
usFMc Div 2 Zone 2																	P						
usFMc Div 1															17)		R						
Protection type for transmitter / sensor																							
Standard / IP 67 (NEMA 4X)																		1					
Standard / IP 68 (NEMA 6P)															18)	19)		2					
Standard / IP 68 (NEMA 6P), signal cable connected and sealed in															18)	20)		3					
Cable gland																							
M20 x 1.5																			A				
1/2 in. NPT																			B				
PF 1/2 in.																			C				
Power supply																							
None																				0			
Signal inputs and outputs																							
None																					Y		
Default settings / Diagnostics																							
Parameters are at factory settings / Extended diagnostics functions activated																						2	
Parameters are set according to customer specifications / Extended diagnostics functions activated																						4	

Continued on next page

12) Maximum fluid temperature for standard sensor design: 130 °C with PTFE, PFA, ETFE, thick PTFE / 90 °C with hard rubber / 60 °C with soft rubber. -40 °C only in conjunction with stainless steel flange.
13) Maximum fluid temperature for high-temperature sensor design: 180 °C with PFA, thick PTFE. 130 °C with ETFE, PTFE. Thick PTFE available for DN 25 ... DN 300, PFA available for DN 10 ... DN 200. -40 °C only in conjunction with stainless steel flange.
14) Not with plastic terminal box.
15) For flowmeter sensor model FEP525 designed for Zone 1 / Div 1, signal cable length can be max. 50 m (164 ft) in combination with transmitter model FET521 or transmitter model FET525 designed for Zone 2 / Div 2. For sensor model FEP525 designed for Zone 1 / Div 1, signal cable length can be max. 10 m (32.8 ft) in combination with transmitter model FET525 designed for Zone 1 / Div 1.
16) Only with model FEP521.
17) Div 1 available up to DN 300 (12 in.).
18) Transmitter degree of protection = IP67 (NEMA 4X) with single-compartment and dual-compartment housing.
19) Only with external transmitter, sealing compound (optional) D141B038U01.
20) Not available with FET525 transmitter in Zone1 / Div1 design.

Continued

	Main order number																						Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Without explosion protection	**FEP521**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**XX**
With explosion protection	**FEP525**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**XX**
Accessories																							
None																							AY
With preamplifier, integrated into sensor housing																						21)	AP
Insertion depth																							
Flanges, ASME Class 150 (North American installation length) (Production site: USA. Certificate: Without PED approval)																							J1
Flanges, ASME Class 300 (North American installation length) (Production site: USA. Certificate: Without PED approval)																							J3
Flanges, ASME CL 150, ISO-compliant installation length																							JA
Flanges, ASME CL 300, ISO-compliant installation length																							JC
Flanges (Chinese installation length) (production site: China. Certificate: Without PED approval)																							JN
Terminal box material																							
Aluminum																							UTA
Plastic																						22)	UTP
Line frequency																							
50 Hz (When ordering the sensor without a transmitter, specify the mains frequency.)																							F5
60 Hz (When ordering the sensor without a transmitter, specify the mains frequency.)																							F6
Number of test points																							
3 points																							T3
5 points																							T5
Language of documentation																							
German																							M1
English																							M5
Chinese																							M6
Russian																							MB
Western Europe / Scandinavia language package (languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)																							MW
Eastern Europe language package (languages: DE, EL, CS, ET, LV, LT, HU, PL, SK, SL, RO, BG)																							ME

21) Preamplifier required if signal cable length is > 50 m (160 ft). Preamplifier not available for Zone1 / Div1.

22) Only with model FEP521 (DN10 and above) and up to a maximum signal cable length of 50 m (160 ft).

10.3 FET521, FET525 external transmitter for ProcessMaster

	Main order number									Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	XX
Without explosion protection	**FET521**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
With explosion protection	**FET525**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Sensor temperature range / Ambient temperature range											
Standard sensor design / -20 ... 60 °C (-4 ... 140 °F)		1									
Standard sensor design / -40 ... 60 °C (-4 ... 140 °F)		2									
High-temperature sensor design / -20 ... 60 °C (-4 ... 140 °F)		3									
High-temperature sensor design / -40 ... 60 °C (-4 ... 140 °F)		4									
Name plate											
Sticker			A								
Stainless steel			B								
Stainless steel, and TAG label stainless steel			C								
Signal cable length											
No cable		1)		0							
Explosion protection											
None					A						
ATEX / IEC Zone 1			2)		L						
ATEX / IEC Zone 2 / 21			2)		M						
usFMc Div 2 Zone 2			2)		P						
usFMc Div 1			2)		R						
Protection type for transmitter / sensor											
Standard / IP 67 (NEMA 4X)						1					
Cable gland											
M20 x 1.5							A				
1/2 in. NPT							B				
PF 1/2 in.							C				
None							Y				
Power supply											
100 ... 230 V AC, 50 Hz								1			
24 V AC / DC, 50 Hz								2			
100 ... 230 V AC, 60 Hz								3			
24 V AC / DC, 60 Hz								4			
Signal inputs / outputs											
HART + 20 mA passive + pulses + contact input / output							3)		B		
HART + 20 mA active + pulses + contact input / output							4)		C		
HART + 20 mA active + pulses + contact output							5)		D		
PROFIBUS PA + contact output									E		
FOUNDATION Fieldbus + contact output									F		
Default settings / Diagnostics											
Without / standard diagnostic functions								6)		0	
Parameters are at factory settings / Extended diagnostics functions activated										2	
Parameters are set according to customer specifications / Extended diagnostics functions activated										4	

Continued on next page

1) For model FET525 designed for Ex Zone 1 / Div 1, 10 m (32.81 ft) of cable is connected to the transmitter.
2) Model FET525 only.
3) Choice with design Zone 2 / Div 2 or Zone 1 / Div1 or Zone 1 / Div1 or without explosion protection.
4) Choice with design Zone 2 / Div 2 or without explosion protection.
5) Choice with design Zone 1 / Div 1.
6) Must be selected if transmitter is being ordered as a spare part or without a sensor.

Continued

	Main order number										Add. order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	XX
Without explosion protection	**FET521**	X	X	X	X	X	X	X	X	X	**XX**
With explosion protection	**FET525**	X	X	X	X	X	X	X	X	X	**XX**
Plug connector											
M12 x 1 fieldbus										7)	U2
Transmitter housing design											
Single-compartment housing										8)	H1
Dual-compartment housing											H2
Additional options											
With Gore-Tex diaphragm										8)	KG
Language of documentation											
German											M1
English											M5
Chinese											M6
Russian											MB
Western Europe / Scandinavia language package (languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)											MW
Eastern Europe language package (languages: DE, EL, CS, ET, LV, LT, HU, PL, SK, SL, RO, BG)											ME

7) Only for Profibus PA, not for model FET525.
8) Model FET521 only.

10.4 FET501 transmitter plug-in module for ProcessMaster/HygienicMaster

	Main order number									Additional order no.
Version number	1 – 6	7	8	9	10	11	12	13	14	15	X
	FET501	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Temperature Range of Installation / Ambient Temperature Range											
Standard design / -20 ... 60 °C (-4 ... 140 °F)		1									
Name Plate											
Adhesive label			A								
Signal Cable Length and Type											
Without signal cable				0							
Explosion Protection Certification											
Without					A						
Protection Class Transmitter / Protection Class Sensor											
Others						9					
Cable Conduits											
Others							Z				
Power Supply											
100 ... 230 V AC, 50 Hz								1			
24 V AC / DC, 50 Hz								2			
100 ... 230 V AC, 60 Hz								3			
24 V AC / DC, 60 Hz								4			
Input and Output Signal Type											
HART + 20 mA passive + Pulse + Contact I/O									B		
HART + 20 mA active + Pulse + Contact I/O									C		
PROFIBUS PA + contact output									E		
FOUNDA FOUNDATION Fieldbus + contact output									F		
Configuration Type / Diagnostics Type											
Without / Standard diagnostic functions										0	
Language of Documentation											
German											M1
English											M5
Chinese											M6
Russian											MB
Language package Western Europe / Scandinavia (Languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)											MW
Language package Eastern Europe (Languages: DE, EL, CS, ET, LV, LT, HU, PL, SK, SL, RO, BG)											ME

10.5 FXC4000 flowmeter sensor simulator

	Main order number					
Version number	1 – 5	6	7	8	9	10
	55XC4	**X**	**X**	**X**	**X**	**X**
Flow Signal Setting						
Without (adapter only)		0				
3-position digitswitch with 1000 steps		1				
Power Supply						
Without (adapter only)			0			
110 ... 240 V AC 50 / 60 Hz // With Schuko plug			1			
24 ... 48 V AC / DC // With 4 mm plug			2			
110 ... 240 V AC 50 / 60 Hz // With US plug			3			
Accessories						
Without				0		
Adapter for converter type FXE4000-E4, FXM2000-XM2, FXF2000-DF23				1		
Adapter board for converter type FSM4000-S4				5		
Adapter board for converter type FET321, FET325, FET521, FET525				6		
Design level (specified by ABB)					*	
Name Plate						
German						1
English						2
French						3

10.6 Diagnostic and verification software - ScanMaster FZC500

ScanMaster allows you to easily check the installed device for proper functioning. The determined test and verification results are stored in a database and can be printed if required.

ScanMaster is based on DTM technology and can be run on Asset Vision Basic or other frame applications (as of FDT 1.2).

There are two ways to communicate with the device.

- Via a HART modem
- Via FZA100 infrared service port adapter

10.6.1 Communication via HART protocol on the 20 mA line

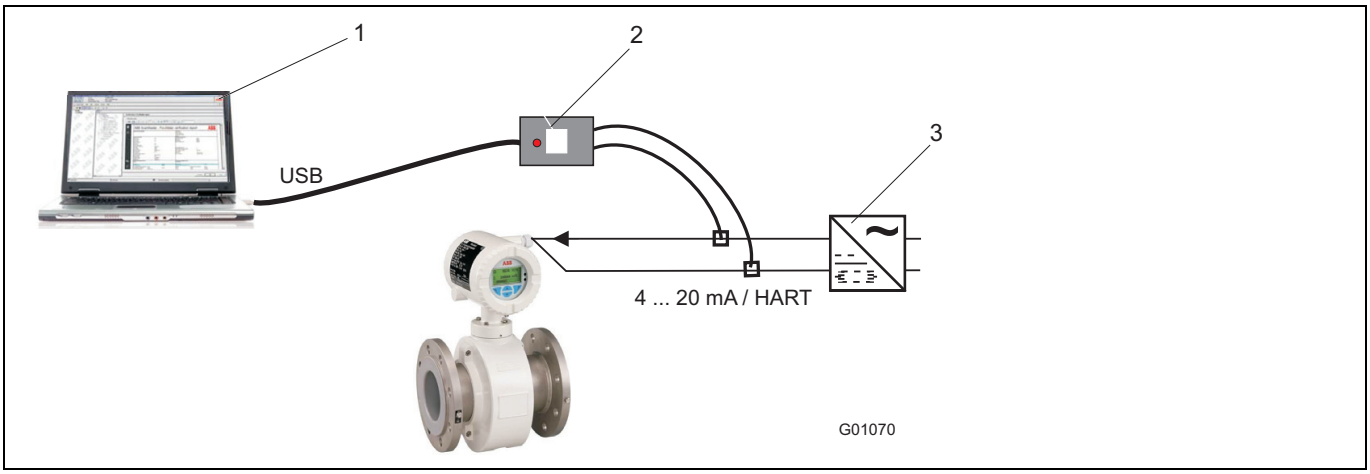


Fig. 47

1 Frame application,
e.g., DAT200 Asset Vision Basic
- Communication DTM: "is HRT USB"
- ScanMaster DTM

2 USB HART FSK / PC modem, electrical isolation,
e.g., NHA121Nx (Ex)
or NHA121No (Std.)

3 Power supply unit

10.6.2 Communication via FZA100 infrared adapter

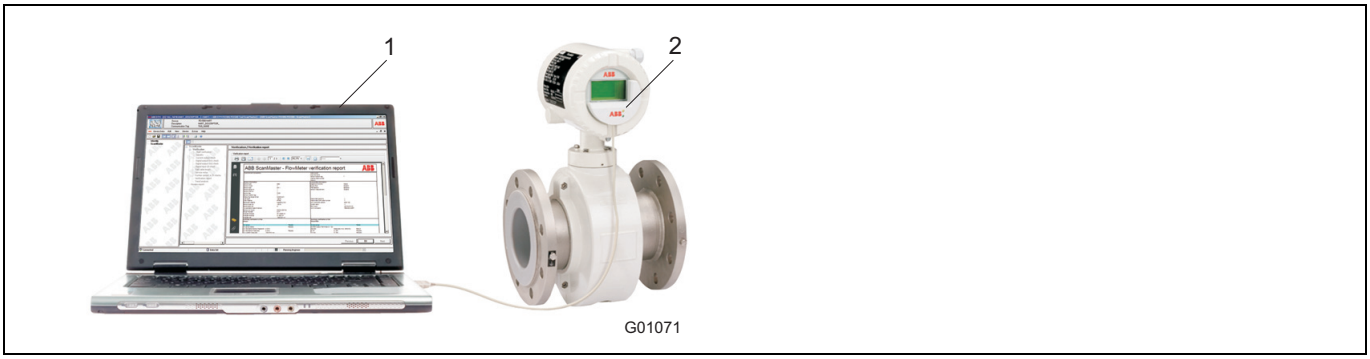


Fig. 48

1 Frame application,
e.g., DAT200 Asset Vision Basic
- Communication DTM:
DTM HART Communication ServicePort
- ScanMaster DTM
- Service Port Splitter software

2 FZA100 infrared adapter

10.7 Infrared service port adapter type FZA100

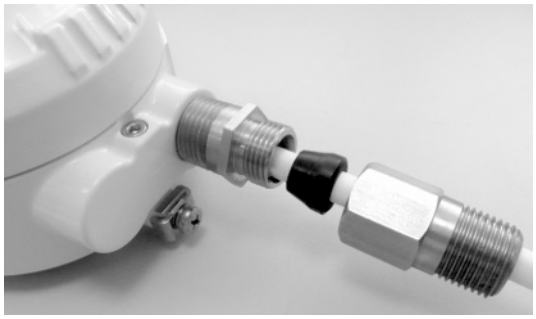
G00788

10.8 Installation set for 2" pipe installation in dual-compartment field-mount housing

G00789

Part number: 3KXF081100L0001

10.9 Installation set for NPT 1/2" cable gland



G01312

Installation set for sealing the cable conduit during outdoor installation.

Part number: 3KXF081300L0001

Notes

Notes

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