Data Sheet
DS/FAM540-EN

Metal Cone Variable Area Flowmeter
VA Master FAM540

- **For metering liquids, gases and steam**
- **Graphic, 2-line display**
- **Magnet stick operation**
  - Configuration also possible with closed housing
- **Easily adjustable for new operating conditions**
- **Approvals for explosion protection**
  - ATEX
  - IECEx
  - FM, CSA

HART COMMUNICATION PROTOCOL

Contents

1 Device designs

	FAM541	FAM544	FAM545	FAM546
	 G00448	 G00449	 G00450	 G00451
Design	Standard	Hygienic	PTFE liner	Heating jacket
Measured value error	1.6 % qg = 50 % VDE / VDI 3513	1.6 % qg = 50 % VDE / VDI 3513	2.5 % qg = 50 % VDE / VDI 3513	1.6 % qg = 50 % VDE / VDI 3513
Reproducibility	0.25 % of measured value			
Process connection	Flange acc. to DIN, ASME, JIS, female thread	Thread DIN 11851, SMS 1145	Flange acc. to DIN, ASME, JIS	Flange acc. to DIN, ASME, JIS
Connection meter sizes	DN 15 (1/2“) ... DN 100 (4")	DN 25 (1“) ... DN 100 (4")	DN 25 (1") ... DN 80 (3")	DN 25 (1") ... DN 100 (4")
Max. temperature of measured medium	400 °C (752 °F)	140 °C (284 °F)	120 °C (248 °F)	400 °C (752 °F)
Max. pressure rating	PN 400 / class 2500	PN 40	PN 40 / class 300	PN 100 / class 600
Indicator / transmitter				
Degree of protection acc. to EN 60529	IP 65 / 67; NEMA 4X			
Indicator, mechanical	Analog indicator without limit signal transmitter; analog indicator with limit signal transmitter			
Indicator, electronic	Analog indicator with transmitter (4 ... 20 mA), with / without LCD display			
Communication	HART protocol (with transmitter only)			
Supply power	Without, for analog indicator without limit signal transmitter 8 V DC via isolated switch amplifier, for analog indicator with limit signal transmitter 10 … 46 V DC (Ex: 10 …30 V DC), for analog indicator with transmitter			
Paint	Epoxy finish 80 ... 100 µm; color, bottom: RAL 7012, color, cover: RAL 9002 (No paint applied to stainless steel indicator housings.)			
Approvals / certificates				
Explosion protection acc. to ATEX / IECEx	Zone 0 / 1 / 2 / 21, see section Ex relevant specifications			
Explosion protection to FM / $_{C}CSA_{US}$	XP, IS, DIP, NI, FM Zone 1 + 2, see "Ex relevant specifications"			
EMC protection	The devices comply with both EU Directive 2004/08/EC (EMC Directive) and NAMUR recommendation NE21.			
Sealing concept	Dual sealing acc. to ANSI/ISA-12.27.01			
SIL approvals	Analog display with limit signal transmitter SIL 2 Analog indicator with transmitter: FMEDA rating		None	see model FAM541 / FAM544
Materials				
Materials in contact with fluid	Stainless steel 1.4404 (316L) 1.4571 (316Ti)	Stainless steel 1.4404 (316L) 1.4571 (316Ti)	PTFE	Stainless steel 1.4404 (316L) 1.4571 (316Ti)
Meter housing	Stainless steel 1.4404 (316L) 1.4571 (316Ti)	Stainless steel 1.4404 (316L)	Stainless steel 1.4571 (316Ti)	Stainless steel 1.4404 (316L) 1.4571 (316Ti)
Gaskets	Viton A (DN 15 only)	Viton A (DN 25 only)	PTFE	Viton A (DN 25 only)
Indicator housing	Al Si 12 ; material number 3.2582 (copper content 0.1%) CrNi steel 1.4408			
Ordering information	Page 13	Page 19	Page 25	Page 32

2 Introduction and basics

2.1 Float shapes

VA Master FAM540 variable area flowmeters are installed vertically in a pipeline. The flow must travel in an upward direction.

Keep the meter as far as possible from pipeline vibrations and powerful magnetic fields. The pipeline should be the same size as the connection size of the flowmeter. Inlet and outlet straight pipe length are not required.

Installation recommendations

Refer to VDI/VDE Directive 3513 sheet 3, Selection and Installation Recommendations for variable area flowmeters.

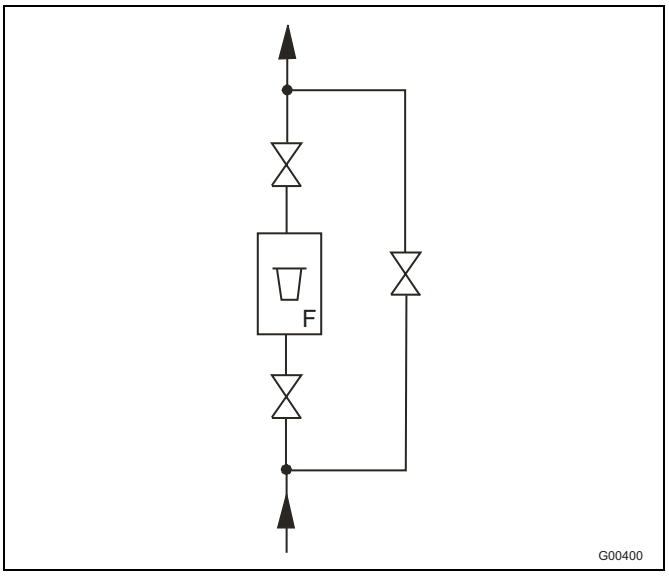

Fig. 1: Flowmeter installation

Float shape "S":

Basic shape of float.
Lower flowrates, minimal pressure drops, essentially independent of viscosity; when metering gases, lower upstream pressure required.

Float shape "N":

Basic shape of float with "N" float head.
Higher flow ranges, medium pressure drops, suitable for liquids with minimum viscosity; when metering gases, higher minimum upstream pressure requirements.

Float shape "X":

Basic shape of float with "X" float head.
Highest flowrates, highest pressure drops, suitable for liquids with minimum viscosity; when metering gases, higher minimum upstream pressure requirements.

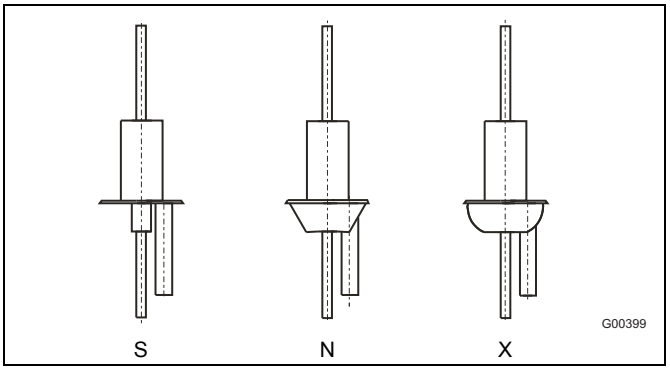

Fig. 2: Float shape overview

For range limits, based on meter size and float type, refer to the flow range tables.

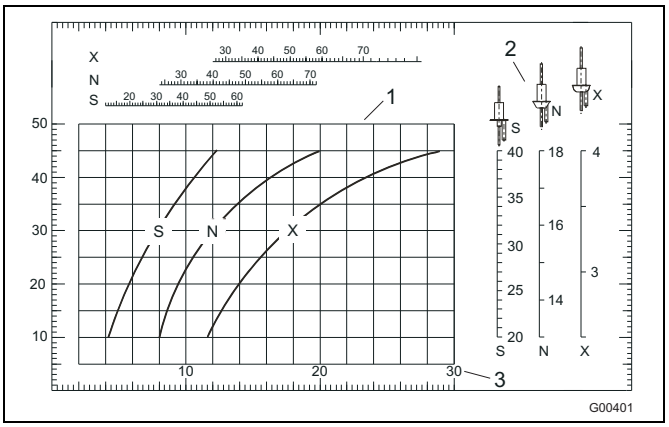

Fig. 3: Flowrate as a function of float shape and weight (example)

1 Pressure drop (dP in mbar)
2 Diameter of the float weight (mm)
3 x 1000 l/h water

2.2 Operating conditions

A variable area flowmeter is specified for a defined set of operating conditions. For liquids and gases, these are pressure and temperature-related properties (density and viscosity) under operating conditions. For gases, in particular, this means operating at a specific pressure and temperature. The specified accuracy of the instrument is always based on these operating conditions.

Pressure drop

The available operating pressure at the flowmeter must be higher than the pressure drop listed for the flowmeter in these specifications. It is important to also consider the pressure drop downstream from the flowmeter due to losses in the pipeline and other fittings.

Damping and compression oscillations when metering gases

If a specific critical volume is exceeded between the closest throttling locations up and downstream of the flowmeter, compression oscillations (float bounce) may occur when the operating pressure is low. If the minimum required upstream pressure listed in this specification is not maintained, then the flowmeter must include a gas damping option (see Fig. 4).

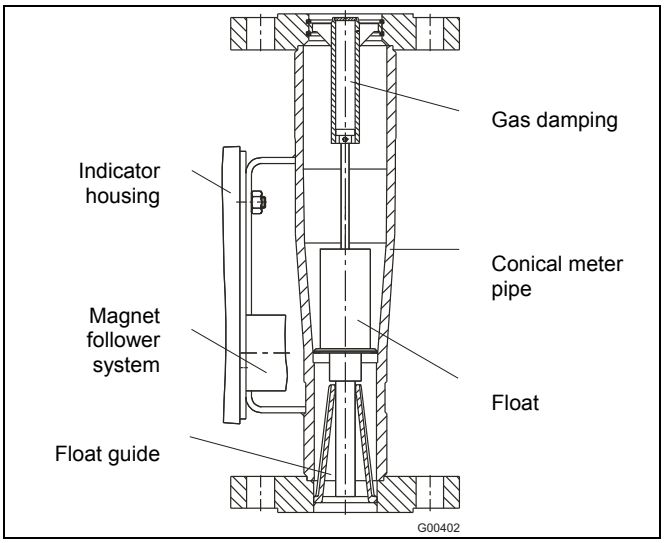

Fig. 4: Flowmeter with gas damping

To prevent self-generated compression oscillations, the following information should taken into consideration:

- Select a flowmeter with the lowest possible pressure drop.
- Minimize the pipeline length between the flowmeter and the closest up or downstream throttling location.
- Increase the operating pressure, and consider its effect on the flowrate values due to the change in the gas density at the new operating conditions.

Pressure shocks

Especially when metering gases, it is possible that pressure shock waves can occur when fast opening solenoid valves are employed and the pipeline volume is not throttled, or if there are gas bubbles in a liquid. As a result of the sudden expansion of the gas in the pipeline, the float is forcibly driven against the upper float stop. Under certain conditions, this can lead to destruction of the instrument. The installation of gas dampers will not compensate for such pressure shocks.

Solids in the fluid

Variable area flowmeters can only be used under certain conditions for metering fluids containing solids. As a function of the concentration, particle size and type of solid, increased mechanical abrasion may occur especially at the critical metering edge of the float. In addition, solidified deposits on the float can change its weight and shape. These effects can, as a function of the float type, lead to erroneous measurement results. In general, the use of appropriate filters is recommended in such applications.

When metering fluids containing magnetic particles, we recommend the installation of a magnetic separator upstream of the flowmeter.

Temperature diagram

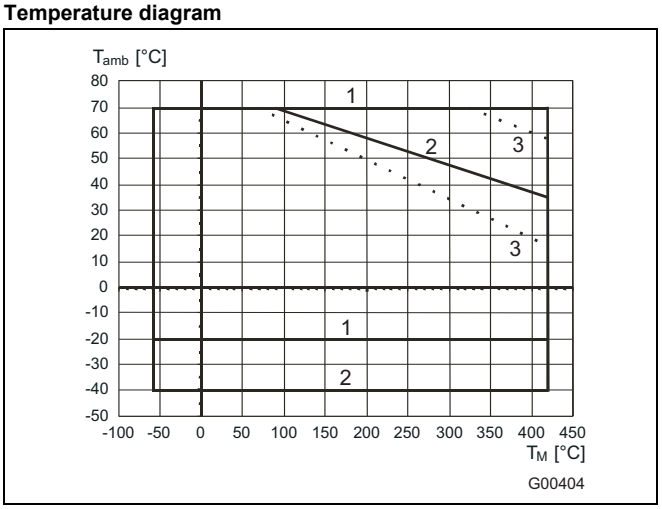

Fig. 5: Max. medium temperature (T_M) and ambient temperature (T_{amb})

1 Alarm output -20 ... 70 °C (-4 ... 158 °F)
2 Current output -40 ... 70 °C (-40 ... 158 °F)
3 With insulation

For Ex design, see chapter “Ex relevant specifications“.

Insulation

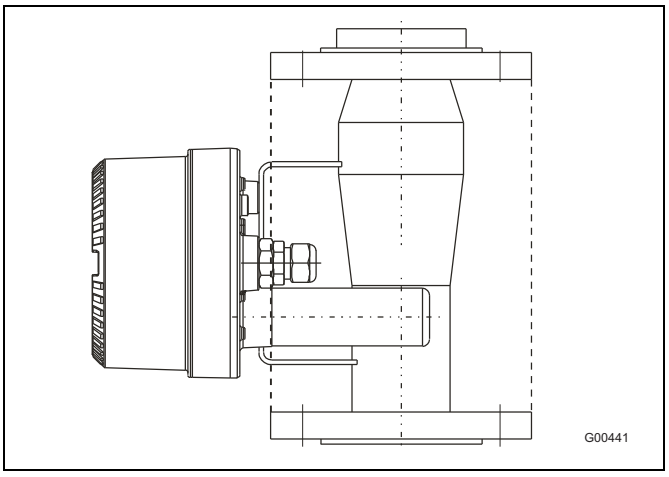

Fig. 6: Maximum insulation = Flange diameter

3 Specifications for indicator / transmitter

A magnet in the float translates the height of the float as a measurement for the flow to the decouple-proof magnet follower system of the flowmeter, which is directly connected to the indicator pointer.

For analog indicators, the flowrate is shown on the scale. For displays with intelligent dual wire transmitter, the indicator position is measured directly at the axis. A standard eddy-current brake is used to dampen indicator vibrations and ensure outstanding readability.

The indicator / transmitter unit is attached to the flowmeter with two screws in a reproducible manner. To facilitate installation, the indicator can be removed. A model plate on the flowmeter bracket allows you to assign the meter unique identifier.

3.1 Analog display with / without limit signal transmitter

The mechanical analog indicators are available with or without limit signal transmitter. The limit signal transmitters are housed on an alarm module that can be subsequently added. It is available as single (min. or max. alarm) or dual alarm.

Fig. 7

Product highlights

- Limit signal transmitter can be added via compact slide-in module.
- The position of the limit signal settings is visible externally.
- Limit signals can be set on the scale.
- Decouple-proof and hysteresis-free magnet follower system.
- Meter conforms to NAMUR Recommendations NE43, NE53, NE107
- Install and deinstall the secondary portion on the primary flowmeter without opening the indicator housing.
- Reproducibility ± 0.25 % of scale end value.

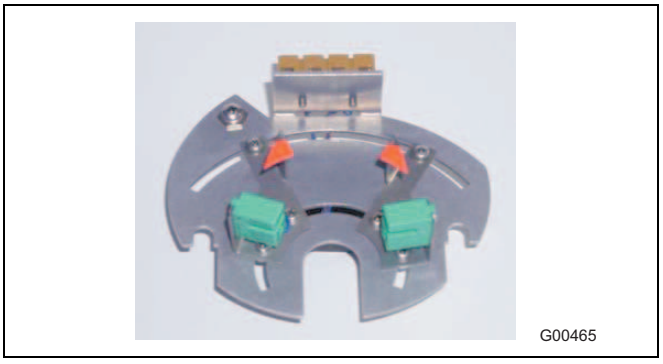

Fig. 8: Alarm module

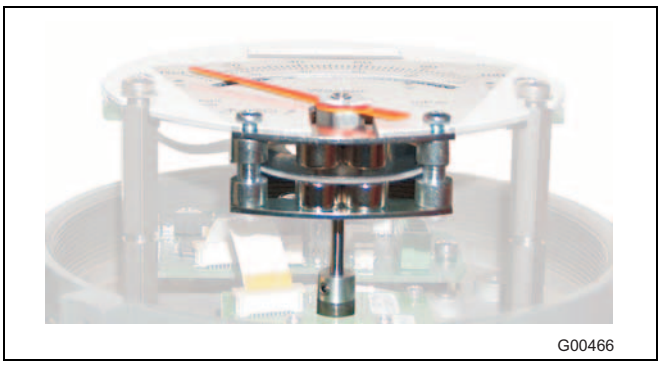

Fig. 9: Standard eddy-current brake

Version with limit signal transmitter

The alarm signal is triggered when the contact disc enters the slot initiator (contact opens). The alarms can be shifted without repositioning or removing the scale and are visible from the front.

Operating mode	bistable
Reproducibility	± 0.5 % of scale end value
Nominal voltage	8 V DC (Ri approx. 1 kΩ)
Operating voltage	5 ... 25 V DC
Switching frequency, max	3 kHz

An isolated switch amplifier is required for limit signal transmitters:

Type	Auxiliary power	Channel
KFD2-SR2-Ex1.W No. D163A011U03	24 V, DC	1
KFA5-SR2-Ex1.W No. D163A011U01	115 V, AC	1
KFA6-SR2-Ex1.W No. D163A011U02	230 V, AC	1
KFD5-SR2-Ex2.W No. D163A011U06	24 V, DC	2
KFA5-SR2-Ex2.W No. D163A011U04	115 V, AC	2
KFA6-SR2-Ex2.W No. D163A011U05	230 V, AC	2

The isolated switch amplifiers from Pepperl & Fuchs are provided as examples; other amplifiers can also be used.

Terminal connection diagram

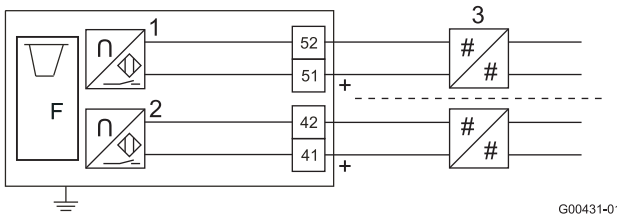

Fig. 10

1 Max. limit signal transmitter
2 Min. limit signal transmitter
3 Isolated switch amplifier
F Flowmeter

3.2 Analog indicator with transmitter with or without LCD display

The electronic indicator with intelligent microprocessor transmitter is designed for 2-wire operation. An optional LCD display enables users to make local adjustments based on new measurement parameters. For models with LCD display, ABB recommends that you use a bar graph scale to avoid differences between a product scale and the flowrate shown on the display.

Fig. 11

Product highlights

- Display can be added later.
- Electronic min/max device alarms or pulse output.
- Configuration using HART communication via handheld terminal or DSV401 (SMART VISION).
- Measurement parameters can be made at any time (pressure and temperature influence, density, units, etc.).

Design with LCD display:

- flowrate and flow totalizer value display.
- Menu-guided configuration.
- Configuration using a magnet stick without opening the housing.

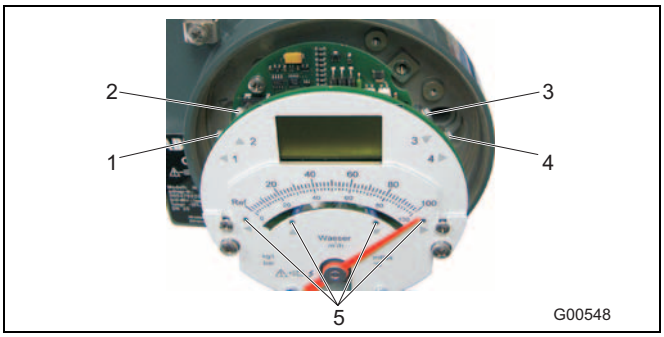

Fig. 12: Display with control buttons and magnet stick markings

1 Control button ◄
2 Control button ▲
3 Control button ▼
4 Control button ►
5 Position for magnet stick operation

Note:

When the housing cover is open, the EMC protection is suspended.

Replacing the electronic unit

The electronic unit can be replaced in the event of a malfunction. Settings are updated immediately when the device is turned on.

LCD display

High contrast LCD display provides real-time flowrate and totalized flow.

Use 4 control buttons on device or externally via magnet stick with closed housing.

Enter information in the plain text dialog screen of the LCD display or by digital communication using HART protocol.

Current output terminals 31 / 32

The auxiliary power is connected to these terminals (10 ... 46 V DC). The 4 ... 20 mA output signal is also routed over these terminals.

In addition, terminals 31 / 32 support digital communication. An AC signal is superimposed on the analog output signal.

Programmable output terminals 41 / 42

The programmable output can be assigned a variety of functions.

The following options can be selected via the "Prog Output" software:

1. Pulse output

The scaled pulse output (passive) can be designed either as a NAMUR contact (DIN 19234) or standard optocoupler (U_H = 16 ... 30 V DC). The internal resistance for an open contact > 10 kΩ NAMUR. The pulse width can be configured between 5 ... 256 ms, but with max. 50% of the period. Max. frequency f_{max} = 50 Hz.

2. General Alarm

The error status for the meter and min/max alarms are collected and output. Configurable as normally closed or normally open contacts.

3. Max-Min alarm

Configurable as normally closed or normally open contacts.

4. No function (factory default)

This output has no function.

The following limits apply:

Max. allowable switching current 15 mA

Min. output voltage U_S 2 V DC

U_S = Voltage for auxiliary power source

Damping

Configurable from 1 ... 100 s, corresponds to 5 τ.

Low flow cutoff

0 ... 5 % for current and pulse output.

Function tests

Function tests can be used to test individual internal components. For commissioning and inspection, the current output can be simulated to match selected flowrates (manual process control). The binary output can also be controlled for functional checks.

Current output for alarm

Set the current output in case of alarm using the menu item "I out at Alarm" to 21 ... 23 mA (NAMUR NE43).

Error message on the LCD display

Automatic system monitoring with error diagnostics in plain text on the LCD display.

Data security

Automatic saving of the totalizer values and application conditions using EEPROM at shutdown or when supply voltage fails (over 10 years).

3.2.1 Electrical connection

Terminal connection diagram

a) Auxiliary power from central power supply

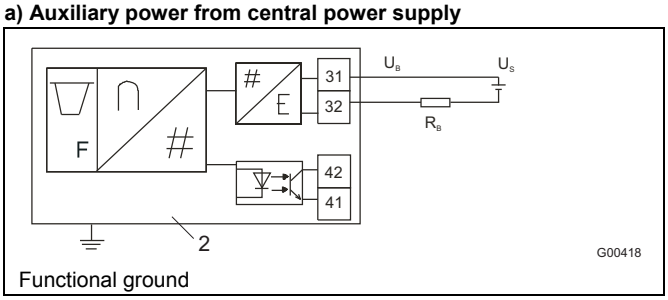

Fig. 13

b) Auxiliary power from power supply

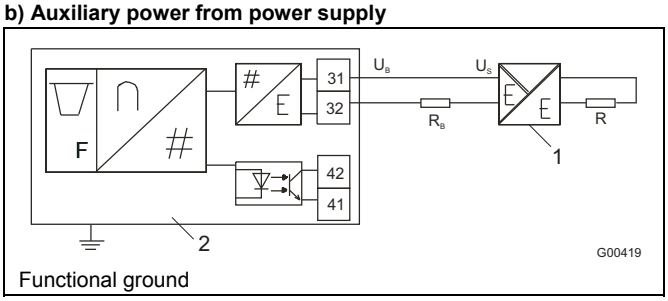

Fig. 14

1 Power supply unit
2 FAM540
U_B = Operating voltage
U_S = Supply voltage
R_B = Max. allowable load for power supply (e.g., indicator)
R = Max. allowable load for output circuit is determined by the power supply

Auxiliary power (supply voltage)

Standard: 10 ... 46 V DC

Ex design: 10 ... 30 V DC (see chapter "Ex relevant specifications").

Residual ripple: max. 5% or ±1.5 V_{ss}

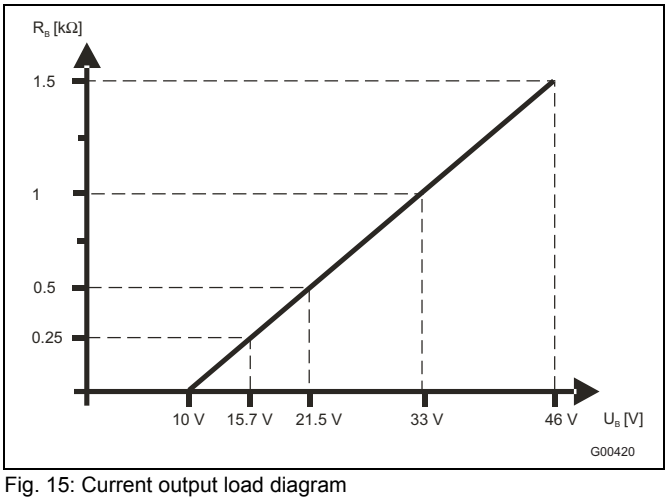

Fig. 15: Current output load diagram

Current output load

Min. > 250 Ω, max. 1500 Ω (with I on alarm = 23.0 mA)

Cable

Max. cable length 1500 m, AWG 24 twisted and shielded.
To ensure full EMC protection, the cable shield must be connected to the internal ground terminal as shown in Fig. 16:

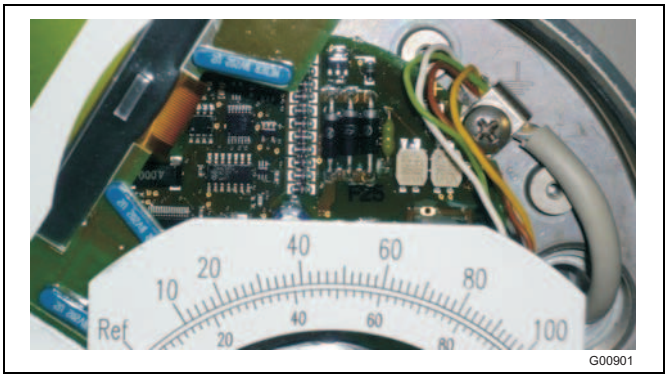

Fig. 16

Power consumption

< 1 W

Temperature influence on current output

≤ 8 µ A/K

For the hazardous area design, see chapter "Ex relevant specifications".

3.2.2 Digital communication

Communication HART protocol

The HART protocol is used for digital communication between a process control system or PC, a handheld terminal and the FAM540. All meter and measuring point parameters can be transmitted. In reverse direction, the integrated transmitter can also be configured in this manner.

The digital communication utilizes an AC signal superimposed on the analog current output (4 … 20 mA) that does not affect any meters connected to the output.

HART communication is performed via FSK modem with point-to-point or multidrop operation.

Transmission method

FSK modulation at current output of 4 ... 20 mA based on the Bell 202 standard. Max. signal amplitude 1.2 mA_{SS}.

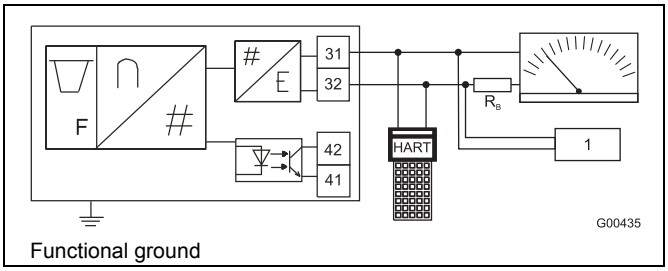

Fig. 17

1 Bell 202 modem
R_B Min. = 250 Ω, max. = 1500 Ω

4 Standard version, model FAM541

4.1 Specifications

Design	Standard version in CrNi steel					
Measurement range See 4.3 "Flow range tables"	Water at 20 °C (68 °F): 28 l/h ... 120 m³/h / 0.125 ... 540 gpm Air at 0 °C and 1,013 mbar: 0.83 ... 1,550 m³/h Qn / Air at 70 °F and 14.7 psia: 0.62 ... 960 scfm					
Flow range ratio	10:1					
Scales	Percentage scale Product scale					
Accuracy	1.6 % qg = 50 % acc. to VDE / VDI 3513, sheet 2, optional 1 % of end value					
Connections	Flange acc. to EN 1092-1 (PN 16, PN 40), acc. to DIN 2501 (PN 63, PN 100) Flange with groove acc. to DIN 2501 Flange in acc. with ASME B16.5 Female thread G 1“ (1/2“ meter tube), female thread G 1 1/2“ (1“ meter tube)					
Pressure rating See 4.2 "Material loads"	Standard pressure rating: PN 40 (PN 16 for DN 100 [4"]) Flange acc. to DIN / EN: PN 16, PN 40, PN 63, PN 100 Flange acc. to ASME: CL 150, CL 300, CL 600 Other designs and pressure ratings are available upon request					
Max. perm. operating pressure	64 bar, 100 bar, 160 bar, 250 bar (CL 600 / 900 / 1500 / 2500)					
Installation length	Flange design:	See section 4.4, "Dimensions"				
	Female thread:	1“: 296 mm (11.65 inch), 1 1/2“: 304 mm (11.97 inch)				
Materials	Meter tube:	Stainless steel 1.4404 (316 L)				
	Conical meter pipe:	Stainless steel 1.4571 (316 Ti), DN 15 (1/2“) only				
	Flange:	Stainless steel 1.4404 (316 L)				
	Float:	Stainless steel 1.4571 (316 Ti), standard				
		Stainless steel 1.4571 (316 Ti)				
	Gas damping:	Stainless steel 1.4571 (316 Ti)				
	Indicator housing:	Powder-coated aluminum, stainless steel 1.4408				
	Housing gasket (O-ring):	Buna N				
	Viewing window:	Shatterproof glass				
Temperature ranges	Permissible temperature of measured medium: -55 ... 400 °C (-67 ... 752 °F) Permissible ambient temperature: -40 ... 70 °C (-40 ... 158 °F) Refer to the temperature diagram on page 5. For Ex designs, see chapter Ex relevant specifications.					
Gas damping	Prevents compression oscillations in case of gas measurements with low operating pressure					
Weight (kg) / in () = (lb)	Indicator housing material	Meter size (meter tube size)				
		DN 15 (1/2")	DN 25 (1")	DN 50 (2")	DN 80 (3")	DN 100 (4")
	AlSi 12	4,5 / (9,9)	5,8 / (12,8)	9,5 / (20,9)	15,7 / (34,6)	34,0 / (75)
	Stainless steel	7,0 / (15,4)	8,3 / (18,3)	12,0 / (26,4)	18,2 / (40,1)	36,5 / (80,4)
SIL classifications	SIL2 declaration of conformity for meters with alarm function Manufacturer's declaration (SIL1) acc. to IEC 61508 / IEC61511 for meters with 4 ... 20 mA current output					

4.2 Material loads for process connections

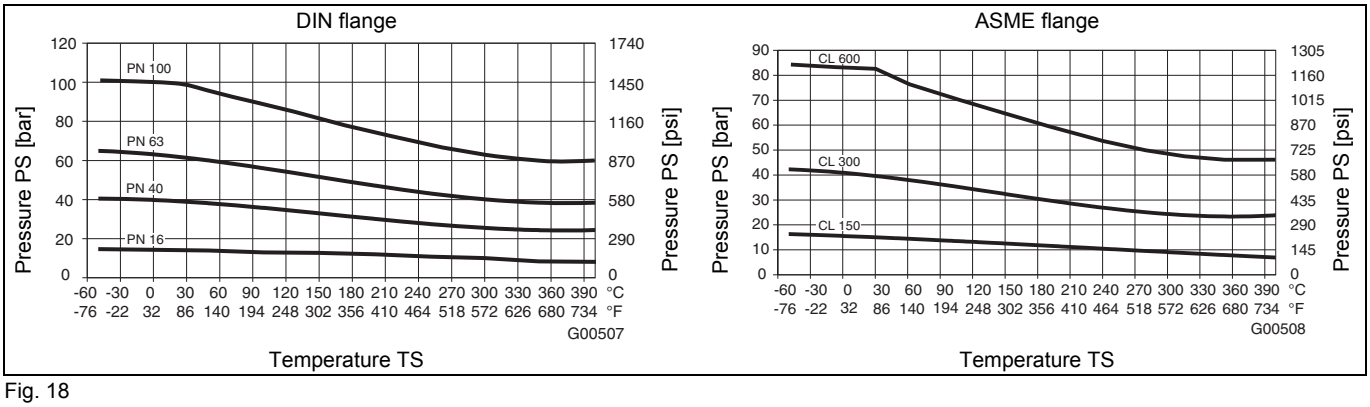

Fig. 18

4.3 Flow range tables

Metric unit values

DN [1]	Measuring range end value [2] l/h water 1 kg/dm³, 1 mPa s	Qn m³/h air at 0 °C; 1013 mbar	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (mbar)	Min. req. upstream pressure for gas measurement (bar abs) [5] without	with [6]	Order code
Installation length 250 mm								
	28 ... 32	0,83 ... 0,95	1/2 in-30	6	80	4,0	1,0	A7 [7]
	37 ... 43	1,10 ... 1,28	1/2 in-40	6	80	4,0	1,0	B7 [7]
	44 ... 55	1,30 ... 1,63	1/2 in-50	6	80	4,0	1,0	C7 [7]
	56 ... 64	1,66 ... 1,90	1/2 in-60	6	80	4,0	1,0	D7 [7]
	77 ... 83	2,29 ... 2,47	1/2 in-80	16	40	3,0	1,0	E7
DN15	96 ... 104	2,85 ... 3,09	1/2 in-100	16	45	3,2	1,0	F7
	115 ... 125	3,42 ... 3,72	1/2 in-120	16	50	3,5	1,0	G7
DN25	144 ... 156	4,28 ... 4,64	1/2 in-150	16	60	3,8	1,0	H7
	188 ... 212	5,59 ... 6,30	1/2 in-200	16	60	4,0	1,0	J7
G1”	235 ... 265	6,98 ... 7,88	1/2 in-250	16	65	4,2	1,0	K7
	282 ... 318	8,38 ... 9,45	1/2 in-300	16	70	4,4	1,0	L7
	376 ... 424	11,17 ... 12,60	1/2 in-400	16	75	4,6	1,0	M7
	470 ... 530	13,97 ... 15,75	1/2 in-500	16	75	4,8	1,0	N7
	565 ... 635	16,79 ... 18,87	1/2 in-600	16	80	5,0	1,0	P7
	750 ... 850	22,29 ... 25,26	1/2 in-800	16	85	5,4	1,0	R7
	280 ... 656	8,32 ... 19,50	1 in-400 (1.050-S)	13 ... 21	20 ... 76	2,9 ... 3,1	1,1 ... 1,4	A1
DN25	393 ... 870	11,70 ... 25,85	1 in-600 (1.050-N)	7 ... 10	27 ... 76	3,0 ... 3,4	1,2 ... 1,4	B1
	660 ... 1600	19,38 ... 50,80	1 in-1000 (1.113-S)	16 ... 22	20 ... 76	3,3 ... 4,3	1,1 ... 1,4	C1
G1 1/2“	975 ... 2370	28,98 ... 70,44	1 in-1600 (1.113-N)	8 ... 10	27 ... 82	3,3 ... 5.3	1,2 ... 1,5	D1
	1650 ... 4020	49,04 ... 119,50	1 in-2500 (1.263-S)	17 ... 6	20 ... 76	4,2 ... 6,4	1,1 ... 1,4	E1
	2585 ... 6170	76,83 ... 183,50	1 in-4000 (1.263-N)	8 ... 10	27 ... 82	5,2 ... 8,0	1,2 ... 1,5	F1
DN40	4220 ... 12130	125,40 ... 360,50	2 in-8000 (1.330-S)	21 ... 38	11 ... 62	3,1 ... 4,5	1,1 ... 1,4	A2
	7940 ... 18460	236,00 ... 548,60	2 in-12000 (1.330-N)	13 ... 17	24 ... 74	3,8 ... 6,2	1,1 ... 1,4	B2
DN50	11760 ... 24200	349,50 ... 720,00	2 in-18000 (1.330-X)	3 ... 4	28 ... 72	4,4 ... 7,5	1,1 ... 1,4	C2
	7000 ... 21010	208,00 ... 624,40	3 in-12000 (1.315-S)	22 ... 54	6 ... 48	3,4 ... 5,4	1,1 ... 1,3	A3
DN80	18090 ... 35010	537,70 ... 1040,00	3 in-25000 (1.315-N)	18 ... 25	24 ... 65	4,8 ... 7,4	1,1 ... 1,4	B3
	26750 ... 53810	795,00 ... 1600,00	3 in-40000 (1.315-X)	4 ... 5	26 ... 68	6,0 ... 9,2	1,1 ... 1,4	C3
DN100	25000 ... 50000		4 in-40000 (1.310-S)	60 ... 81	28 ... 74			A4
	50000 ... 120000		4 in-80000 (1.310-N)	24	42 ... 95			B4

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m³/h water, flow span of meter 1.2 to 12 m³/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm³)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   Some installations may have higher values (high free volume upstream / downstream of the meter).
6) Cylinder / piston damping. For meter sizes DN 15 ... DN 80 (1/2 ... 3").
7) These meter tube/float combinations always require gas piston damping for gas measurements.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

ANSI unit values

DN [1]	Measuring range end value [2] USgal/h water 62.43 lb/ft³, 1 cP	scfh air at 70 °F; 14.7 psia	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (psi)	Min. req. upstream pressure for gas measurement (psia) [5] without	with [6]	Order code
Installation length 9.84“								
	7,4 ... 8,8	37 ... 45	1/2 in-30	6	1,16	58	14,5	A7 [7]
	10 ... 11,6	52 ... 59	1/2 in-40	6	1,16	58	14,5	B7 [7]
	11,6 ... 14,5	54 ... 66	1/2 in-50	6	1,16	58	14,5	C7 [7]
	14,5 ... 17	68 ... 80	1/2 in-60	6	1,16	58	14,5	D7 [7]
	20,5 ... 21,5	84 ... 90	1/2 in-80	16	0,56	43	14,5	E7
1/2“	25,5 ... 27	104 ... 112	1/2 in-100	16	0,65	46	14,5	F7
	30 ... 33	125 ... 135	1/2 in-120	16	0,73	51	14,5	G7
1“	38 ... 41	155 ... 165	1/2 in-150	16	0,87	55	14,5	H7
	50 ... 56	205 ... 230	1/2 in-200	16	0,87	58	14,5	J7
G1“	62 ... 70	255 ... 285	1/2 in-250	16	0,94	61	14,5	K7
	74 ... 84	310 ... 340	1/2 in-300	16	1,0	64	14,5	L7
	100 ... 112	410 ... 460	1/2 in-400	16	1,1	67	14,5	M7
	125 ... 140	510 ... 570	1/2 in-500	16	1,1	70	14,5	N7
	150 ... 165	620 ... 680	1/2 in-600	16	1,2	73	14,5	P7
	200 ... 220	820 ... 920	1/2 in-800	16	1,2	78	14,5	R7
	74 ... 170	310 ... 700	1 in-400 (1.050-S)	13 ... 21	0,3 ... 1,1	42,1 ... 45,0	16,0 ... 20,3	A1
1“	104 ... 220	430 ... 940	1 in-600 (1.050-N)	7 ... 10	0,4 ... 1,1	43,5 ... 49,3	17,4 ... 20,3	B1
	170 ... 450	720 ... 1850	1 in-1000 (1.113-S)	16 ... 22	0,3 ... 1,1	48,0 ... 62,4	16,0 ... 20,3	C1
G1 1/2“	260 ... 620	1060 ... 2550	1 in-1600 (1.113-N)	8 ... 10	0,4 ... 1,2	48,0 ... 77,0	17,4 ... 21,8	D1
	440 ... 1060	1800 ... 4300	1 in-2500 (1.263-S)	17 ... 6	0,3 ... 1,1	61,0 ... 92,8	16,0 ... 20,3	E1
	680 ... 1600	2800 ... 6600	1 in-4000 (1.263-N)	8 ... 10	0,4 ... 1,2	75,4 ... 116	17,4 ... 21,8	F1
1 1/2“	1120 ... 3200	4600 ... 13000	2 in-8000 (1.330-S)	21 ... 38	0,2 ... 0,9	45,0 ... 65,3	16,0 ... 20,3	A2
	2100 ... 4800	8600 ... 20000	2 in-12000 (1.330-N)	13 ... 17	0,3 ... 1,1	55,1 ... 90,0	16,0 ... 20,3	B2
2“	3100 ... 6400	13000 ... 27000	2 in-18000 (1.330-X)	3 ... 4	0,4 ... 1,0	63,8 ... 109	16,0 ... 20,3	C2
	1850 ... 5500	7600 ... 22000	3 in-12000 (1.315-S)	22 ... 54	0,1 ... 0,7	49,3 ... 78,3	16,0 ... 18,9	A3
3“	4800 ... 9200	19500 ... 38000	3 in-25000 (1.315-N)	18 ... 25	0,3 ... 0,9	69,6 ... 107	16,0 ... 20,3	B3
	7000 ... 14000	29000 ... 58000	3 in-40000 (1.315-X)	4 ... 5	0,4 ... 1,0	87,0 ... 133	16,0 ... 20,3	C3
4“	5400 ... 13500		4 in-40000 (1.310-S)	60 ... 81	0,4 ... 1,1			A4
	12500 ... 32000		4 in-80000 (1.310-N)	24	0,6 ... 1,4			B4

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m^3/h water, flow span of meter 1.2 to 12 m^3/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm^3)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   Some installations may have higher values (high free volume upstream / downstream of the meter).
6) Cylinder / piston damping. For meter sizes DN 15 ... DN 80 (1/2 ... 3").
7) These meter tube/float combinations always require gas piston damping for gas measurements.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

4.4 Dimensions

FAM541 with current and/or alarm output

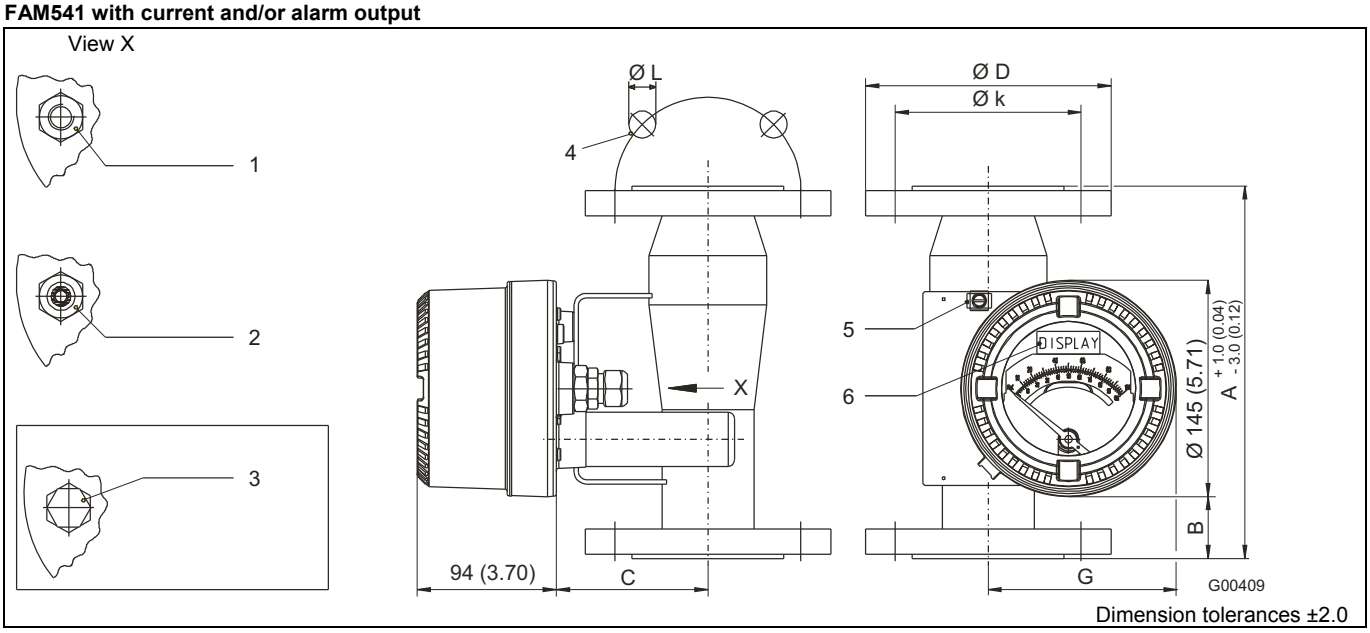

Fig. 19: All dimensions in mm (inch)

1 Threaded socket 1/2" NPT
2 Cable entry M20 x 1.5
3 Threaded plug M25 x 1.5 (FAM541-A only)
4 N number of holes
5 Protective conductor
6 FAM541-F only

Meter size	Pressure rating	Standard design							
	PN	DN	Ø D	Ø k	Ø L	N	A	C	G
1/2"	40	**15**	95,0 (3,74)	65,0 (2,56)	14,0 (0,55)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	63 / 100	**15**	105,0 (4,13)	75,0 (2,95)	14,0 (0,55)	4	258,0 (10,16)	87,0 (3,43)	118,0 (4,65)
	CL 150	**1/2"**	89,0 (3,50)	60,3 (2,37)	15,9 (0,63)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	CL 300	**1/2"**	95,2 (3,75)	66,7 (2,63)	15,9 (0,63)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	CL 600	**1/2"**	95,2 (3,75)	66,5 (2,62)	15,7 (0,62)	4	260,0 (10,24)	87,0 (3,43)	118,0 (4,65)
1"	40	**25**	115,0 (4,53)	85,0 (3,35)	14,0 (0,55)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	63 / 100	**25**	140,0 (5,51)	100,0 (3,94)	18,0 (0,71)	4	262,0 (10,31)	87,0 (3,43)	118,0 (4,65)
	CL 150	**1"**	107,9 (4,25)	79,4 (3,13)	15,9 (0,63)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	CL 300	**1"**	123,8 (4,87)	88,9 (3,50)	19,0 (0,75)	4	250,0 (9,84)	87,0 (3,43)	118,0 (4,65)
	CL 600	**1"**	124,0 (4,88)	88,9 (3,50)	19,0 (0,75)	4	262,0 (10,31)	87,0 (3,43)	118,0 (4,65)
2"	40	**40**	150 (5,91)	110 (4,33)	18,0 (0,71)	4	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
	CL 150	**1 1/2"**	127 (5,0)	98,4 (3,87)	15,7 (0,62)	4	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
	CL 300	**1 1/2"**	155,3 (6,11)	114,3 (4,5)	22,2 (0,87)	4	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
2"	40	**50**	165,0 (6,50)	125,0 (4,92)	18,0 (0,71)	4	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
	63	**50**	180,0 (7,09)	135,0 (5,31)	22,0 (0,87)	4	262,0 (10,31)	102,0 (4,02)	130,0 (5,12)
	100	**50**	195,0 (7,68)	145,0 (5,71)	26,0 (1,02)	4	266,0 (10,47)	102,0 (4,02)	130,0 (5,12)
	CL 150	**2"**	152,4 (6,00)	120,6 (4,75)	19,0 (0,75)	4	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
	CL 300	**2"**	165,1 (6,50)	127,0 (5,00)	19,0 (0,75)	8	250,0 (9,84)	102,0 (4,02)	130,0 (5,12)
	CL 600	**2"**	165,1 (6,50)	127,0 (5,00)	19,0 (0,75)	8	274,0 (10,79)	102,0 (4,02)	130,0 (5,12)
3"	40	**80**	200,0 (7,87)	160,0 (6,30)	18,0 (0,71)	8	250,0 (9,84)	132,0 (5,20)	144,0 (5,67)
	63	**80**	215,0 (8,46)	170,0 (6,69)	22,0 (0,87)	8	258,0 (10,16)	132,0 (5,20)	144,0 (5,67)
	100	**80**	230,0 (9,06)	180,0 (7,09)	26,0 (1,02)	8	272,0 (10,71)	132,0 (5,20)	144,0 (5,67)
	CL 150	**3"**	190,5 (7,50)	152,4 (6,00)	19,0 (0,75)	4	250,0 (9,84)	132,0 (5,20)	144,0 (5,67)
	CL 300	**3"**	209,5 (8,25)	168,3 (6,63)	22,2 (0,87)	8	250,0 (9,84)	132,0 (5,20)	144,0 (5,67)
	CL 600	**3"**	209,5 (8,25)	168,1 (6,62)	22,2 (0,87)	8	278,0 (10,94)	132,0 (5,20)	144,0 (5,67)
4"	16	**100**	220,0 (8,66)	180,0 (7,09)	18,0 (0,71)	8	250,0 (9,84)	147,0 (5,79)	158,0 (6,22)
	40	**100**	235,0 (9,25)	190,0 (7,48)	22,0 (0,87)	8	250,0 (9,84)	147,0 (5,79)	158,0 (6,22)
	63	**100**	250,0 (9,84)	200,0 (7,87)	26,0 (1,02)	8	262,0 (10,31)	147,0 (5,79)	158,0 (6,22)
	CL 150	**4"**	228,6 (9,00)	190,5 (7,50)	19,0 (0,75)	8	250,0 (9,84)	147,0 (5,79)	158,0 (6,22)
	CL 300	**4"**	254,0 (10,00)	200,0 (7,87)	22,2 (0,87)	8	266,0 (10,47)	147,0 (5,79)	158,0 (6,22)

All dimensions in mm (inch)

4.5 Ordering information (FAM541)

		Main order number													Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
VA Master metal tube float flowmeter	**FAM541**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Indicator / Output signal															
Analog indicator / No indicator		**A**													
Analog indicator / Min alarm		B													
Analog indicator / Max alarm		C													
Analog indicator / Min and max alarm		D													
Analog indicator / 4 ... 20 mA with HART protocol		E													
Analog indicator with LCD display / 4 ... 20 mA with HART protocol		F													
Housing material / Cable connection															
Aluminum / M20 x 1.5 cable gland			**1**												
Aluminum / 1/2 in. NPT thread			2												
Stainless steel / M20 x 1.5 cable gland		1)	3												
Stainless steel / 1/2 inch NPT thread		1)	4												
Explosion protection and approvals															
None				**Y**	**0**										
ATEX / IEC category 3 (Zone 2 / 21), Ex n			2)	B	1										
ATEX / IEC category 2 (Zone 1 / 21), Ex i, Ex c			2)	A	4										
ATEX / IEC category 2 (Zone 1 / 21), Ex d + Ex i			3)	A	9										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI			4)	F	3										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI			4)	F	4										
Process connection															
Flange						**F**	**1**								
Flange with groove (DIN 2512)						F	2								
Female thread, metric (DN25 = PN100, DN40 = PN40)					5)	T	1								
Nominal diameter															
DN 15								A							
DN 25								**B**							
DN 40								N							
DN 50								C							
DN 80								D							
DN 100							6)	E							
Float design															
Standard									**1**						
With gas damping								7)	3						
Pressure rating															
PN 16										D	2				
PN 40										**D**	**4**				
PN 64									8)	D	5				
PN 100									9)	D	6				
ASME CL 150										A	1				
ASME CL 300										A	3				
ASME CL 600									9)	A	6				
JIS 10K									9)	J	1				
Design level															
(Specified by ABB)												X			
Meter tube / float combination															
(Specified by ABB.) See flow range tables.													X	X	

Continued on next page

1) Not available with Ex d or XP types of Ex protection.
2) Analog indicator without output signal design: ATEX approval only; IEC Ex not available.
3) With Ex d cable gland. Not available for analog indicator without output signal design:
4) Only with 1/2 inch NPT cable entry.
5) Not available with FM / CSA approval.
6) Meter only suitable for measuring fluids.
7) For DN 15 ... DN 80 (1/2 … 3 inch) only.
8) Not available with DN 40 (1-1/2 inch).
9) Not available with DN 40 (1-1/2 inch) or DN 100 (4 inch).

Continued

Main order number														Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	FAM541	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX

Flowmeter sensor		
None, only secondary meter	10)	Y0
Standard	11)	**Y1**
Measured value error		
1.6 % qg = 50 % acc. to VDE / VDI 3513	11)	**A1**
1 % of end value		AA
4 % of end value (high viscosity, without calculation)		AK
4 % of end value (high viscosity, with calculation)		AL
Material: 3.1, 3.2; test certificate / NACE		
Material confirmation with inspection certificate 3.1 to EN 10204		C2
Material confirmation with inspection certificate 3.2 to EN 10204		C3
Material confirmation NACE MR 01-75 with acceptance test certificate 3.1 to EN 10204		CN
Material: 2.1; order conformity		
Certificate of compliance 2.1 to EN 10204 for order conformity		C4
Certificates: 3.1; visual, dimensional, functional		
Acceptance test certificate 3.1 to EN 10204 for visual, dimensional, and functional checks		C6
Certificates: 3.1; PMI test		
Acceptance test certificate 3.1 to EN 10204 for Positive Material Identification (PMI)		CA
Certificates: 3.1; compression test		
Compression test to AD2000		CB
Test package (compression test, non-destructive material test, welder test, welding procedure test)		CP
Certificates: Calibration, test report		
Certificate of compliance 2.1 to EN 10204 with confirmation of accuracy		CM
Calibration certificate with confirmation of accuracy and calibration data		CE
Other user certificates		
Russia: Metrological and GOST R certificate		CG1
Kazakhstan: Metrological and GOST K certificate (in preparation)		CG2
Ukraine: Metrological certificate		CG3
Belarus: Metrological certificate		CG6
Additional Ex certificates and approvals		
Russia: GOST-Ex and RTN certificate		EG7
Kazakhstan: Ex permission certificate (in preparation)		EG3
Ukraine: GOST Ex and Ex permission certificate (in preparation)		EG5
Belarus: GGTN certificate		EG9
Language of documentation		
German		M1
English	11)	**M5**
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
Applications		
Oil- and grease-free for oxygen applications		P1
Meter name plate		
Stainless steel plate with TAG no.		T0
Adhesive label with TAG no.	11)	**TC**
Float material		
Stainless steel 1.4571 (AISI 316Ti SST)	11)	**F1**
Scale design		
Directly readable scale	11)	**SD**
Percentage scale		SP
Bar graph	12)	SB
Ambient temperature range		
Extended -40 ... 85 °C (without Ex protection) / -40 ... 60 °C (with Ex protection)	13)	**R5**
Standard -20 ... 85 °C (without Ex protection) / -20 ... 60 °C (with Ex protection)	11)	**R6**

10) For Ex version on request.
11) Standard, specified automatically by ABB if no customer specifications have been provided.
12) Recommended for indicator with transmitter (4 ... 20 mA) with display.
13) Not available for analog indicator with alarm.

5 Hygienic version, model FAM544

5.1 Specifications

Design	Hygienic design					
Measurement range See 5.3 "Flow range tables"	Water at 20 °C (68 °F): 28 l/h ... 53 m^3/h / 0.125 ... 235 gpm Air at 0 °C and 1,013 mbar: 0.83 ... 1,550 m^3/h Qn / Air at 70 °F and 14.7 psia: 0.62 ... 960 scfm					
Flow range ratio	10:1					
Scales	Percentage scale Product scale					
Accuracy	1.6 % qg = 50 % acc. to VDE / VDI 3513, sheet 2, optional 1 % of end value					
Connections	Threaded connector DIN 11851 (SC 25 ... SC 80), SMS-1145 (DN38 … DN102)					
Pressure rating See 5.2 "Material loads"	DIN 11851: PN 25 at DN 50 ... DN 80 (2 ... 3"); PN 40 at DN 25 ... DN 40 (1 ... 1 1/2") SMS-1145 (DN38 … DN102) = PN6					
Max. perm. operating pressure	See section 5.3					
Installation length	See section 5.4, "Dimensions"					
Materials	Meter tube:	Stainless steel 1.4404 (316 L)				
	Conical meter pipe:	Stainless steel 1.4571 (316 Ti), DN 15 (1/2“) only				
	Float:	Stainless steel 1.4571 (316 Ti), standard				
	Gas damping:	Stainless steel 1.4571 (316 Ti)				
	Indicator housing:	Powder-coated aluminum, stainless steel 1.4408				
	Housing gasket (O-ring):	Buna N				
	Viewing window:	Shatterproof glass				
Temperature ranges	Permissible temperature of measured medium: -40 ... 140 °C (-40 ... 284 °F) Permissible ambient temperature: -40 ... 70 °C (-40 ... 158 °F) Refer to the temperature diagram on page 5. For Ex designs, see chapter Ex relevant specifications.					
Gas damping	Prevents compression oscillations in case of gas measurements with low operating pressure					
Weight (kg) / in () = (lb)	Indicator housing material	Meter size (meter tube size)				
		DN 15 (1/2")	DN 25 (1")	DN 50 (2")	DN 80 (3")	DN 100 / (4")
	AlSi 12	4,5 / (9,9)	5,8 / (12,8)	9,0 / (19,8)	15,7 / (34,6)	34 / (75)
	Stainless steel	7,0 / (15,4)	8,3 / (18,3)	11,5 / (25,3)	18,2 / (40,1)	36,5 / (80,4)
SIL classifications	SIL2 declaration of conformity for meters with alarm function Manufacturer's declaration (SIL1) acc. to IEC 61508 / IEC61511 for meters with 4 ... 20 mA current output					

5.2 Material load for process connections

Process connection	**Nominal size DN**	**PS_{max}**	**TS_{max}**	**TS_{min}**
Threaded pipe connection conforming to DIN 11851	15 ... 40 (1/2 ... 1 1/2“)	40 bar (580 psi)	140 °C (284 °F)	-40 °C (-40 °F)
	50 ... 100 (2 ... 4“)	25 bar (362 psi)	140 °C (284 °F)	-40 °C (-40 °F)
SMS 1145	38 … 102 (1 1/2 … 4“)	6 bar (87 psi)	140 °C (284 °F)	-40 °C (-40 °F)

5.3 Material load for process connections

Process connection	**Nominal size DN**	**PS_{max}**	**TS_{max}**	**TS_{min}**
Threaded pipe connection acc. to DIN 11851	15 ... 40 (1/2 ... 1 1/2“)	40 bar (580 psi)	140 °C (284 °F)	-40 °C (-40 °F)
	50 ... 100 (2 ... 4“)	25 bar (362 psi)	140 °C (284 °F)	-40 °C (-40 °F)

5.4 Flow range tables

This version has been specially constructed with threaded connections acc. to DIN 11851 to meet the demands of the food and beverage industry, and provides cleaning options to help meet biological requirements.

All parts that come into contact with the measured medium are welded and polished. There are no gaps or other dead areas. The meter is suitable for cleaning or sterilization with steam, acids and alkali. The meter is also suitable for CIP cleaning.

Metric unit values

DN [1]	Measuring range end value [2] l/h water 1 kg/dm³, 1 mPa s	Qn m³/h air at 0 °C; 1013 mbar	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (mbar)	Min. req. upstream pressure for gas measurement (bar abs)[5]	Order code
25	28 ... 32	-	1/2 in-30	6	80	-	A7
	37 ... 43	-	1/2 in-40	6	80	-	B7
	44 ... 55	-	1/2 in-50	6	80	-	C7
	56 ... 64	-	1/2 in-60	6	80	-	D7
	77 ... 83	2,3 ... 2,4	1/2 in-80	16	40	3,0	E7
	96 ... 104	2,85 ... 3,0	1/2 in-100	16	45	3,2	F7
	115 ... 125	3,4 ... 3,7	1/2 in-120	16	50	3,5	G7
	144 ... 156	4,3 ... 4,6	1/2 in-150	16	60	3,8	H7
	188 ... 212	5,6 ... 6,2	1/2 in-200	16	60	4,0	J7
	235 ... 265	7,0 ... 7,8	1/2 in-250	16	65	4,2	K7
	282 ... 318	8,4 ... 9,4	1/2 in-300	16	70	4,4	L7
	376 ... 424	11,2 ... 12,5	1/2 in-400	16	75	4,6	M7
	470 ... 530	14 ... 15,5	1/2 in-500	16	75	4,8	N7
	565 ... 635	16,8 ... 18,5	1/2 in-600	16	80	5,0	P7
	750 ... 850	22,3 ... 25,0	1/2 in-800	16	85	5,4	R7
40	280 ... 656	8,3 ... 19,5	1 in-400 (1.050-S)	13 ... 21	20 ... 76	2,9 ... 3,1	A1
	393 ... 870	11,7 ... 25,5	1 in-600 (1.050-N)	7 ... 10	27 ... 76	3,0 ... 3,4	B1
	660 ... 1600	19,4 ... 50,0	1 in-1000 (1.113-S)	16 ... 22	20 ... 76	3,3 ... 4,3	C1
	975 ... 2370	29,0 ... 70,0	1 in-1600 (1.113-N)	8 ... 10	27 ... 82	3,3 ... 5,3	D1
	1650 ... 4020	49,0 ... 118,0	1 in-2500 (1.263-S)	17 ... 6	20 ... 76	4,2 ... 6,4	E1
	2585 ... 6170	77,0 ... 180,0	1 in-4000 (1.263-N)	8 ... 10	27 ... 82	5,2 ... 8,0	F1
50	4220 ... 12130	125,0 ... 360,0	2 in-8000 (1.330-S)	21 ... 38	11 ... 62	3,1 ... 4,5	A2
	7940 ... 18460	236,0 ... 540,0	2 in-12000 (1.330-N)	13 ... 17	24 ... 74	3,8 ... 6,2	B2
	11760 ... 24200	349,5 ... 720,0	2 in-18000 (1.330-X)	3 ... 4	28 ... 72	4,4 ... 7,5	C2
50	3580 … 7932	106,0 ... 236,0	2 in-6000 Hygiene	18…28	18 … 63	3,1 … 4,5	H2
	7670 … 16700	228,3 … 496,0	2 in-12000 Hygiene	8 …9	33 … 77	3,8 … 6,2	J2
80	7000 ... 21010	208,0 ... 620,0	3 in-12000 (1.315-S)	22 ... 54	6 ... 48	3,4 ... 5,4	A3
	18090 ... 35010	537,7 ... 1040,0	3 in-25000 (1.315-N)	18 ... 25	24 ... 65	4,8 ... 7,4	B3
	26750 ... 53810	795,0 ... 1550,0	3 in-40000 (1.315-X)	4 ... 5	26 ... 68	6,0 ... 9,2	C3
80	9864 ... 21420	293,0 … 637,0	3 in-16000 Hygiene	25 … 43	13 … 49	3,4 … 5,4	H3
	22800 … 41640	677,0 … 1237,0	3 in-30000 Hygiene	15 ... 18	30 … 66	4,8 … 7,4	J3
100	25000 … 50000	-	4 in-40000 (1.310-S)	60 … 81	28 … 74	-	A4
	50000 … 120000	-	4 in-80000 (1.310-N)	24	42 … 95	-	B4

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m³/h water, flow span of meter 1.2 to 12 m³/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm³)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   Some installations may have higher values (high free volume upstream / downstream of the meter).
6) DIN 11851 only
7) SMS 1145 only

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

ANSI unit values

DN [1]	Measuring range end value [2] USgal/h water 62.43 lb/ft³, 1 cP	scfh air at 70°F; 14.7 psia	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (psi)	Min. req. upstream pressure for gas measurement (psia) [5]	Order code
1" [6]	7,4 ... 8,8	37 ... 45	1/2 in-30	6	1,16	58	A7
	10 ... 11,6	52 ... 59	1/2 in-40	6	1,16	58	B7
	11,6 ... 14,5	54 ... 66	1/2 in-50	6	1,16	58	C7
	14,5 ... 17	68 ... 80	1/2 in-60	6	1,16	58	D7
	20,5 ... 21,5	84 ... 90	1/2 in-80	16	0,56	43	E7
	25,5 ... 27	104 ... 112	1/2 in-100	16	0,65	46	F7
	30 ... 33	125 ... 135	1/2 in-120	16	0,73	51	G7
	38 ... 41	155 ... 165	1/2 in-150	16	0,87	55	H7
	50 ... 56	205 ... 230	1/2 in-200	16	0,87	58	J7
	62 ... 70	255 ... 285	1/2 in-250	16	0,94	61	K7
	74 ... 84	310 ... 340	1/2 in-300	16	1,0	64	L7
	100 ... 112	410 ... 460	1/2 in-400	16	1,1	67	M7
	125 ... 140	510 ... 570	1/2 in-500	16	1,1	70	N7
	150 ... 165	620 ... 680	1/2 in-600	16	1,2	73	P7
	200 ... 220	820 ... 920	1/2 in-800	16	1,2	78	R7
1 1/2"	74 ... 170	310 ... 700	1 in-400 (1.050-S)	13 ... 21	0,3 ... 1,1	42,1 ... 45,0	A1
	104 ... 220	430 ... 940	1 in-600 (1.050-N)	7 ... 10	0,4 ... 1,1	43,5 ... 49,3	B1
	170 ... 450	720 ... 1850	1 in-1000 (1.113-S)	16 ... 22	0,3 ... 1,1	48,0 ... 62,4	C1
	260 ... 620	1060 ... 2550	1 in-1600 (1.113-N)	8 ... 10	0,4 ... 1,2	48,0 ... 77,0	D1
	440 ... 1060	1800 ... 4300	1 in-2500 (1.263-S)	17 ... 6	0,3 ... 1,1	61,0 ... 92,8	E1
	680 ... 1600	2800 ... 6600	1 in-4000 (1.263-N)	8 ... 10	0,4 ... 1,2	75,4 ... 116	F1
2"	1120 ... 3200	4600 ... 13000	2 in-8000 (1.330-S)	21 ... 38	0,2 ... 0,9	45,0 ... 65,3	A2
	2100 ... 4800	8600 ... 20000	2 in-12000 (1.330-N)	13 ... 17	0,3 ... 1,1	55,1 ... 90,0	B2
	3100 ... 6400	13000 ... 27000	2 in-18000 (1.330-X)	3 ... 4	0,4 ... 1,0	63,8 ... 109	C2
2" [6]	944 … 2080	3830 ... 8520	2 in-6000 Hygiene	18 … 28	0,3 … 0,9	45,0 … 65,3	H2
	2025 … 4400	8250 … 17900	2 in-12000 Hygiene	8 … 9	0,5 … 1,1	55,1 … 90,0	J2
3"	1850 ... 5500	1100 ... 22000	3 in-12000 (1.315-S)	22 ... 54	0,1 ... 0,7	49,3 ... 78,3	A3
	4800 ... 9200	19500 ... 38000	3 in-25000 (1.315-N)	18 ... 25	0,3 ... 0,9	69,6 ... 107	B3
	7000 ... 14000	29000 ... 58000	3 in-40000 (1.315-X)	4 ... 5	0,4 ... 1,0	87,0 ... 133	C3
3" [6]	2550 ... 5650	10600 … 23000	3 in-16000 Hygiene	25 … 43	0,2 … 0,7	49,3 … 78,3	H3
	6015 … 10950	24500 … 44600	3 in-30000 Hygiene	15 … 18	0,4 … 1,0	69,6 … 107	J3
4" [7]	5400 … 13500	-	4 in-40000 (1.310-S)	60 … 81	0,4 … 1,1	-	A4
	12500 … 32000	-	4 in-80000 (1.310-N)	24	06 … 1,4	-	B4

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m^3/h water, flow span of meter 1.2 to 12 m^3/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_S = density of the float acc. to table (r = 8.02 g/cm^3)
   ρ_{S1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   Some installations may have higher values (high free volume upstream / downstream of the meter).
6) DIN 11851 only
7) SMS 1145 only

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

5.5 Dimensions

FAM544 with current and/or alarm output

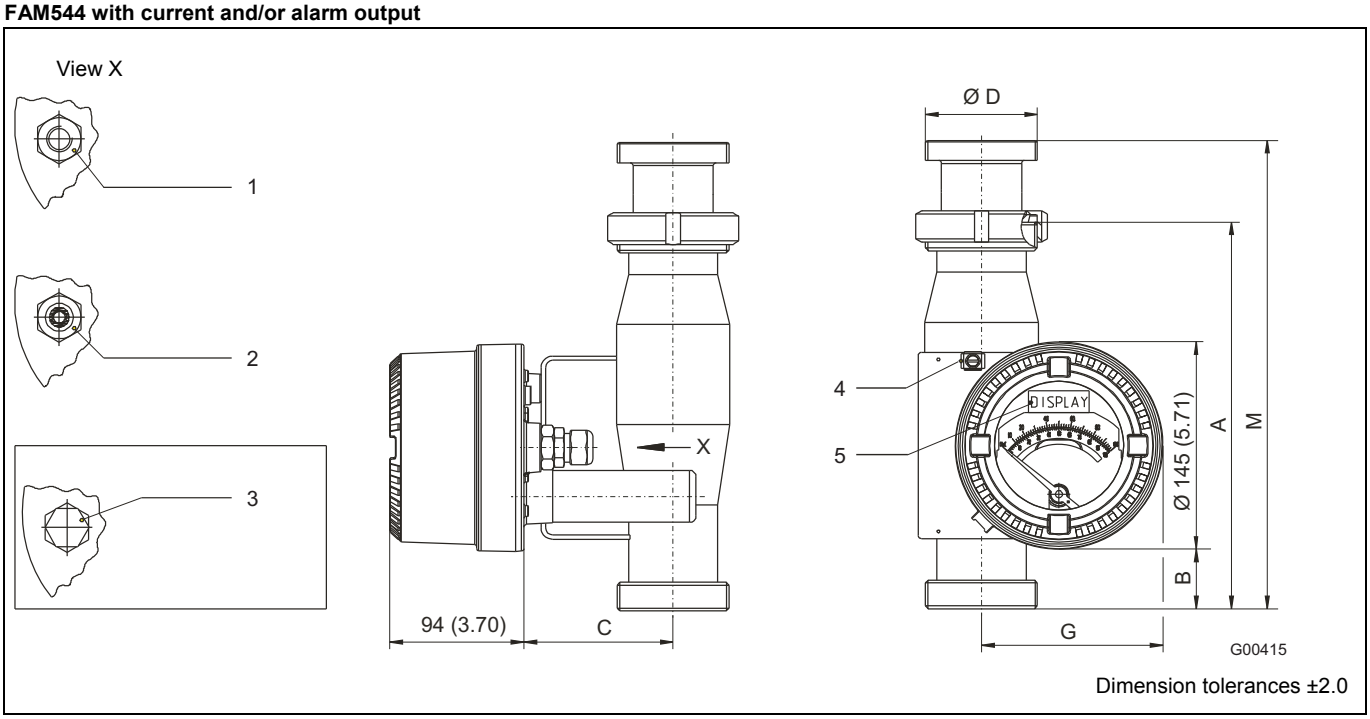

Fig. 20: All dimensions in mm (inch)

1 Threaded socket 1/2" NPT
2 Cable entry M20 x 1.5
3 Threaded plug M25 x 1.5 (FAM544-A only)
4 Protective conductor
5 FAM544-F only

Dimensions acc. to DIN 11851

Meter size	DN	PN	Ø D	A	B	C	G	M[1)]
1/2"	SC 25 (1")	**40**	Rd 52 x 1/6"	270,0 (10,63)	51,5 (2,03)	87,0 (3,43)	118,0 (4,65)	–
1"	SC 40 (1 1/2")	**40**	Rd 65 x 1/6"	270,0 (10,63)	51,5 (2,03)	87,0 (3,43)	118,0 (4,65)	–
2"	SC 50 (2")	**25**	Rd 78 x 1/6"	270,0 (10,63)	51,5 (2,03)	102,0 (4,02)	130,0 (5,12)	315,0 (12,40)
3"	SC 80 (3")	**25**	Rd 110 x 1/6"	272,0 (10,71)	52,5 (2,07)	132,0 (5,20)	144,0 (5,67)	326,0 (12,83)

All dimensions in mm (inch)

1) Dimension A: Version with threaded connector DIN 11851
Dimension M: Hygienic version with threaded connectors acc. DIN 11851 (available upon request)

Dimensions acc. to SMS 1145

Meter size	DN	PN	Ø D	A	B	C	G
1"	38	**6**	Rd 60 x 1/6"	300,0 (11,81)	66,5 (2,62)	87,0 (3,43)	118,0 (4,65)
2"	51		Rd 70 x 1/6"			102,0 (4,02)	130,0 (5,12)
3"	76		Rd 98 x 1/6"			132,0 (5,20)	144,0 (5,67)
4"	102		Rd 132 x 1/6"			147,0 (5,79)	158,0 (6,22)

All dimensions in mm (inch)

5.6 Ordering information (FAM544)

		Main order number													Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
VA Master metal tube float flowmeter	**FAM544**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Indicator / Output signal															
Analog indicator / No indicator		**A**													
Analog indicator / Min alarm		B													
Analog indicator / Max alarm		C													
Analog indicator / Min and max alarm		D													
Analog indicator / 4 ... 20 mA with HART protocol		E													
Analog indicator with LCD display / 4 ... 20 mA with HART protocol		F													
Housing material / Cable connection															
Aluminum / M20 x 1.5 cable gland			**1**												
Aluminum / 1/2 inch NPT thread			2												
Stainless steel / M20 x 1.5 cable gland		1)	3												
Stainless steel / 1/2 inch NPT thread		1)	4												
Explosion protection and approvals															
None				**Y**	**0**										
ATEX / IEC category 3 (Zone 2 / 21), Ex n	2)			B	1										
ATEX / IEC category 2 (Zone 1 / 21), Ex i, Ex c	2)			A	4										
ATEX / IEC category 2 (Zone 1 / 21), Ex d + Ex i	3)			A	9										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI	4)			F	3										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI	4)			F	4										
Process connection															
Threads DIN 11851						**S**	**1**								
SMS 1145						S	2								
Nominal diameter															
DN 25							5)	B							
DN 40 (SMS 1145: DN 38)								N							
DN 50 (SMS 1145: DN 51)								**C**							
DN 80 (SMS 1145: DN 76)								D							
DN 100 (4 inch) (SMS 1145: DN 102)								E							
Float design															
Standard									**1**						
Pressure rating															
PN 6	6)									D	0				
PN 25	7)									**D**	**3**				
PN 40	8)									D	4				
Design level															
(Specified by ABB)												X			
Meter tube / float combination															
(Specified by ABB.) See flow range tables													X	X	

Continued on next page

1) Not available with Ex d or XP types of Ex protection
2) Analog indicator without output signal design: ATEX approval only; IEC Ex not available
3) With Ex d cable gland. Not available for analog indicator without output signal design:
4) Only with 1/2 inch NPT cable entry.
5) Only available with DIN 11851 connections.
6) Only for SMS 1145 connections.
7) For DN 50 and DN 80 (2 inch and 3 inch)
8) For DN 25 and DN 40 (2 inch and 3 inch)

Continued

Main order number														Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	FAM544	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX

Flowmeter sensor		
None, only secondary meter	9)	Y0
Standard	10)	**Y1**
Measured value error		
1.6 % qg = 50 % acc. to VDE / VDI 3513	10)	**A1**
1 % of end value		AA
4 % of end value (high viscosity, without calculation)		AK
4 % of end value (high viscosity, with calculation)		AL
Material: 3.1, 3.2; test certificate / NACE		
Material confirmation with inspection certificate 3.1 to EN 10204		C2
Material confirmation with inspection certificate 3.2 to EN 10204		C3
Material confirmation NACE MR 01-75 with acceptance test certificate 3.1 to EN 10204		CN
Material: 2.1; order conformity		
Certificate of compliance 2.1 to EN 10204 for order conformity		C4
Certificates: 3.1; visual, dimensional, functional		
Acceptance test certificate 3.1 to EN 10204 for visual, dimensional, and functional checks		C6
Certificates: 3.1; PMI test		
Acceptance test certificate 3.1 to EN 10204 for Positive Material Identification (PMI)		CA
Certificates: 3.1; compression test		
Compression test to AD2000		CB
Test package (compression test, non-destructive material test, welder test, welding procedure test)		CP
Certificates: Calibration, test report		
Certificate of compliance 2.1 to EN 10204 with confirmation of accuracy		CM
Calibration certificate with confirmation of accuracy and calibration data		CE
Other user certificates		
Russia: Metrological and GOST R certificate		CG1
Kazakhstan: Metrological and GOST K certificate (in preparation)		CG2
Ukraine: Metrological certificate		CG3
Belarus: Metrological certificate		CG6
Additional Ex certificates and approvals		
Russia: GOST-Ex and RTN certificate		EG7
Kazakhstan: Ex permission certificate (in preparation)		EG3
Ukraine: GOST Ex and Ex permission certificate (in preparation)		EG5
Belarus: GGTN certificate		EG9
Language of documentation		
German		M1
English	10)	**M5**
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
Applications		
Oil- and grease-free for oxygen applications		P1
Meter name plate		
Stainless steel plate with TAG no.		T0
Adhesive label with TAG no.	10)	**TC**
Float material		
Stainless steel 1.4571 (AISI 316Ti SST)	10)	**F1**
Scale design		
Directly readable scale	10)	**SD**
Percentage scale		SP
Bar graph	11)	SB
Ambient temperature range		
Extended -40 ... 85 °C (without Ex protection) / -40 ... 60 °C (with Ex protection)	12)	R5
Standard -20 ... 85 °C (without Ex protection) / -20 ... 60 °C (with Ex protection)	10)	**R6**

9) For Ex version on request.
10) Standard, specified automatically by ABB if no customer specifications have been provided
11) Recommended for indicator with transmitter (4 ... 20 mA) with display
12) Not available for analog indicator with alarm

6 Version with PTFE liner, model FAM545

6.1 Specifications

Design	Version with PTFE liner					
Measurement range See 6.3 "Flow range tables"	Water at 20 °C (68 °F): 270 l/h ... 27 m^3/h / 0.118 ... 118 gpm Air at 0 °C and 1,013 mbar: 9.4 ... 880 m^3/h Qn / Air at 70 °F and 14.7 psia: 5.7 ... 540 scfm					
Flow range ratio	10:1					
Scales	Percentage scale Product scale					
Accuracy	2.5 % qg = 50 % acc. to VDE / VDI 3513, sheet 2					
Connections	Flange acc. to DIN 2501 (DN 25 ... DN 80) Flange in acc. with ASME B16.5					
Pressure rating See 6.2 "Material loads"	Standard pressure rating: PN 40 Flange acc. to DIN 2501: PN 40, PN 63 Flange acc. to ASME CL 150, CL 300					
Max. perm. operating pressure	50 bar (CL 300), (higher pressures available upon request)					
Installation length	260 mm (10.24") DN 25 (1") 375 mm (14.76") DN 50 (2") and DN 80 (3")					
Materials	Meter tube:	Stainless steel 1.4571 (316 Ti)				
	Conical meter pipe:	PTFE				
	Flange:	Stainless steel 1.4571 (316 Ti)				
	Float:	PTFE				
	Indicator housing:	Powder-coated aluminum, stainless steel 1.4408				
	Housing gasket (O-ring):	Buna N				
	Viewing window:	Shatterproof glass				
Temperature ranges	Permissible temperature of measured medium: -20 ... 125 °C (-4 ... 257 °F) Permissible ambient temperature: -40 ... 70 °C (-40 ... 158 °F) Refer to the temperature diagram on page 5. For Ex designs, see chapter Ex relevant specifications.					
Gas damping	Not supported					
Weight (kg) / in () = (lb)	Indicator housing material	Meter size (meter tube size)				
			DN 25 (1")	DN 50 (2")	DN 80 (3")	
	AlSi 12		5,8 / (12,8)	10,7 / (23,6)	16,7 / (36,8)	
	Stainless steel		8,3 / (18,3)	13,2 / (29,1)	19,2 / (42,3)	

Important
For Ex devices in PTFE design, the minimum conductivity of the medium must be > 10^{-8} S/m.
(See chapter Ex relevant specifications.)

6.2 Material loads for process connections

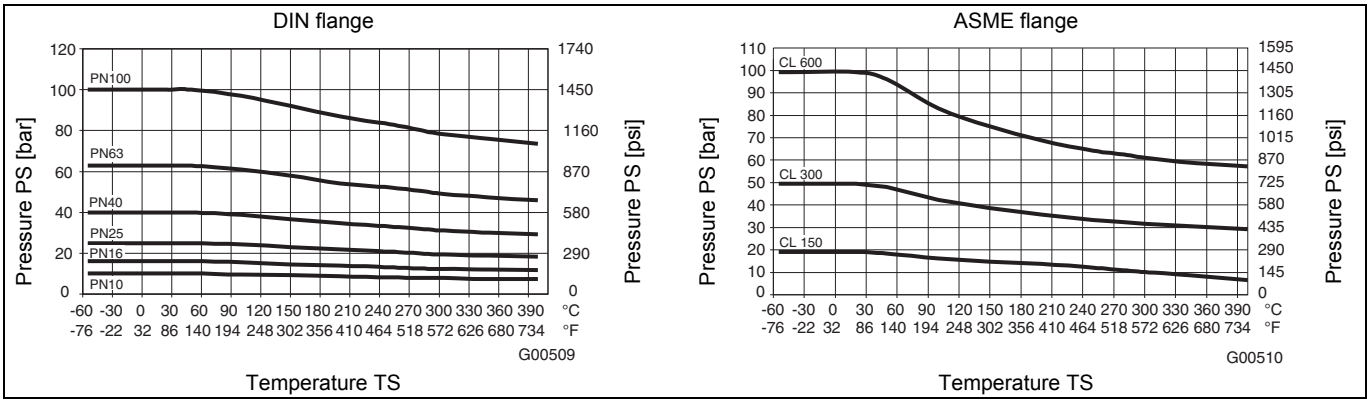

Fig. 21

6.3 Flow range tables

Metric unit values

DN [1]	Measuring range end value [2] l/h water 1 kg/dm³, 1 mPa s	Qn m³/h air at 0 °C; 1013 mbar	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (mbar)	Order code
25	270 ... 370	8,02 ... 11,00	1 in-300	18	30 ... 55	K1
	370 ... 530	11,00 ... 15,75	1 in-500	18	35 ... 60	L1
	530 ... 750	15,75 ... 22,29	1 in-600	18	40 ... 65	M1
	750 ... 1050	22,29 ... 31,21	1 in-900	18	45 ... 70	N1
	1050 ... 1500	31,21 ... 44,58	1 in-1300	18	55 ... 80	P1
	1500 ... 2100	11,58 ... 62,41	1 in-1800	18	65 ... 90	R1
	2100 ... 3000	62,41 ... 89,16	1 in-2500	18	75 ... 100	S1
50	2850 ... 3550	84,70 ... 105,50	2 in-3200	26	40 ... 80	K2
	3550 ... 4450	105,50 ... 132,20	2 in-4000	26	45 ... 85	L2
	4450 ... 5450	132,20 ... 162,00	2 in-5000	26	50 ... 90	M2
	5450 ... 6750	162,00 ... 200,60	2 in-6000	26	60 ... 100	N2
	6750 ... 8250	200,60 ... 245,20	2 in-7500	26	70 ... 110	P2
	8250 ... 10000	245,20 ... 297,20	2 in-9100	26	90 ... 130	R2
80	10000 ... 14000	294,20 ... 416,10	3 in-12000	36	40 ... 70	K3
	14000 ... 19000	416,10 ... 564,70	3 in-16500	36	60 ... 90	L3
	19000 ... 27000	564,70 ... 802,40	3 in-23000	20	80 ... 110	M3

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m^3/h water, flow span of meter 1.2 to 12 m^3/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$\text{VIN} = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm^3)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

ANSI unit values

DN [1]	Measuring range end value [2] USgal/h water 62.43 lb/ft^3, 1 cP	scfh air at 70 °F; 14.7 psia	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (psi)	Order code
1“	72 ... 96	340 ... 470	1 in-300	18	0,4 ... 0,8	K1
	98 ... 140	440 ... 620	1 in-500	18	0,5 ... 0,9	L1
	140 ... 195	680 ... 940	1 in-600	18	0,6 ... 0,9	M1
	200 ... 275	920 ... 1250	1 in-900	18	0,7 ... 1,0	N1
	275 ... 390	1300 ... 1800	1 in-1300	18	0,8 ... 1,2	P1
	400 ... 550	1850 ... 2600	1 in-1800	18	0,9 ... 1,3	R1
	550 ... 780	2600 ... 3600	1 in-2500	18	1,1 ... 1,5	S1
2“	760 ... 920	3300 ... 4000	2 in-3200	26	0,6 ... 1,2	K2
	940 ... 1160	4100 ... 5000	2 in-4000	26	0,7 ... 1,2	L2
	1180 ... 1400	5100 ... 6200	2 in-5000	26	0,7 ... 1,3	M2
	1450 ... 1750	6200 ... 7600	2 in-6000	26	0,9 ... 1,5	N2
	1800 ... 2150	7800 ... 9400	2 in-7500	26	1,0 ... 1,6	P2
	2200 ... 2600	9400 ... 11400	2 in-9100	26	1,3 ... 1,9	R2
3“	2650 ... 3600	12000 ... 16500	3 in-12000	36	0,6 ... 1,0	K3
	3700 ... 5000	17000 ... 23000	3 in-16500	36	0,9 ... 1,3	L3
	5000 ... 7000	23000 ... 32000	3 in-23000	20	1,2 ... 1,6	M3

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m^3/h water, flow span of meter 1.2 to 12 m^3/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm^3)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

6.4 Dimensions

FAM545 with current and/or alarm output

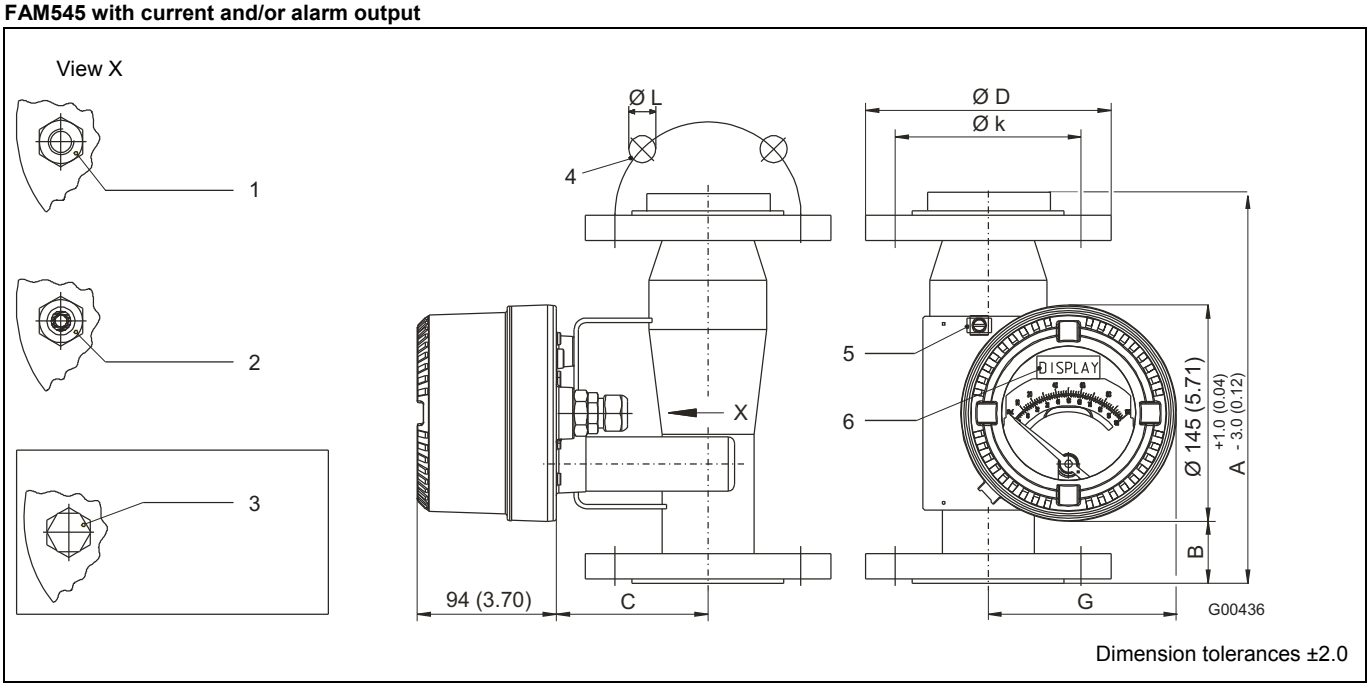

Fig. 22: All dimensions in mm (inch)

1 Threaded socket 1/2" NPT
2 Cable entry M20 x 1.5
3 Threaded plug M25 x 1.5 (FAM545-A only)
4 N number of holes
5 Protective conductor
6 FAM545-F only

Meter size	Pressure rating	Standard design							
	PN	DN	Ø D	Ø k	Ø L	N	A	C	G
1"	40	25	115,0 (4,53)	85,0 (3,35)	14,0 (0,55)	4	260,0 (10,24)	87,0 (3,43)	118,0 (4,65)
	CL 150	1"	107,9 (4,25)	79,4 (3,13)	15,9 (0,63)	4	260,0 (10,24)	87,0 (3,43)	118,0 (4,65)
	CL 300	1"	123,8 (4,87)	88,9 (3,50)	19,0 (0,75)	4	260,0 (10,24)	87,0 (3,43)	118,0 (4,65)
2"	40	50	165,0 (6,50)	125,0 (4,92)	18,0 (0,71)	4	375,0 (14,76)	102,0 (4,02)	130,0 (5,12)
	CL 150	2"	152,4 (6,00)	120,6 (4,75)	19,0 (0,75)	4	375,0 (14,76)	102,0 (4,02)	130,0 (5,12)
	CL 300	2"	165,1 (6,50)	127,0 (5,00)	19,0 (0,75)	8	375,0 (14,76)	102,0 (4,02)	130,0 (5,12)
3"	40	80	200,0 (7,87)	160,0 (6,30)	18,0 (0,71)	8	375,0 (14,76)	132,0 (5,20)	144,0 (5,67)
	CL 150	3"	190,5 (7,50)	152,4 (6,00)	19,0 (0,75)	4	375,0 (14,76)	132,0 (5,20)	144,0 (5,67)
	CL 300	3"	209,5 (8,25)	168,3 (6,63)	22,2 (0,87)	8	375,0 (14,76)	132,0 (5,20)	144,0 (5,67)

All dimensions in mm (inch)

6.5 Ordering information (FAM545)

		Main order number													Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
VA Master metal tube float flowmeter	**FAM545**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Indicator / Output signal															
Analog indicator / No indicator		**A**													
Analog indicator / Min alarm		B													
Analog indicator / Max alarm		C													
Analog indicator / Min and max alarm		D													
Analog indicator / 4 ... 20 mA with HART protocol		E													
Analog indicator with LCD display / 4 ... 20 mA with HART protocol		F													
Housing material / Cable connection															
Aluminum / M20 x 1.5 cable gland			**1**												
Aluminum / 1/2 inch NPT thread			2												
Stainless steel / M20 x 1.5 cable gland		1)	3												
Stainless steel / 1/2 inch NPT thread		1)	4												
Explosion protection and approvals															
None				**Y**	**0**										
ATEX / IEC category 3 (Zone 2 / 21), Ex n	2)			B	1										
ATEX / IEC category 2 (Zone 1 / 21), Ex i, Ex c	2)			A	4										
ATEX / IEC category 2 (Zone 1 / 21), Ex d + Ex i	3)			A	9										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI	4)			F	3										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI	4)			F	4										
Process connection															
Flange						**F**	**1**								
Nominal diameter															
DN 25								**B**							
DN 50								C							
DN 80								D							
Float design															
Standard									**1**						
Pressure rating															
PN 40										**D**	**4**				
ASME CL 150										A	1				
ASME CL 300										A	3				
Design level															
(Specified by ABB)												X			
Meter tube / float combination															
(Specified by ABB.) See flow range tables													X	X	

Continued on next page

1) Not available with Ex d or XP types of Ex protection.
2) Analog indicator without output signal design: ATEX approval only; IEC Ex not available.
3) Not available for analog indicator with alarm.
4) Only with 1/2 inch NPT cable entry.

Continued

Main order number														Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	FAM545	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX

Flowmeter sensor		
None, only secondary meter	5)	Y0
Standard	6)	**Y1**
Measured value error		
2.5 % qg = 50 % acc. to VDE / VDI 3513	6)	**A2**
4 % of end value (high viscosity, without calculation)		AK
Material: 3.1, 3.2; test certificate / NACE		
Material confirmation with inspection certificate 3.1 to EN 10204		C2
Material confirmation with inspection certificate 3.2 to EN 10204		C3
Material confirmation NACE MR 01-75 with acceptance test certificate 3.1 to EN 10204		CN
Material: 2.1; order conformity		
Certificate of compliance 2.1 to EN 10204 for order conformity		C4
Certificates: 3.1; visual, dimensional, functional		
Acceptance test certificate 3.1 to EN 10204 for visual, dimensional, and functional checks		C6
Certificates: 3.1; PMI test		
Acceptance test certificate 3.1 to EN 10204 for Positive Material Identification (PMI)		CA
Certificates: 3.1; compression test		
Compression test to AD2000		CB
Test package (compression test, non-destructive material test, welder test, welding procedure test)		CP
Certificates: Calibration, test report		
Certificate of compliance 2.1 to EN 10204 with confirmation of accuracy		CM
Calibration certificate with confirmation of accuracy and calibration data		CE
Other user certificates		
Russia: Metrological and GOST R certificate		CG1
Kazakhstan: Metrological and GOST K certificate (in preparation)		CG2
Ukraine: Metrological certificate		CG3
Belarus: Metrological certificate		CG6
Additional Ex certificates and approvals		
Russia: GOST-Ex and RTN certificate		EG7
Kazakhstan: Ex permission certificate (in preparation)		EG3
Ukraine: GOST Ex and Ex permission certificate (in preparation)		EG5
Belarus: GGTN certificate		EG9
Language of documentation		
German		M1
English	6)	**M5**
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
Applications		
Oil- and grease-free for oxygen applications		P1
Meter name plate		
Stainless steel plate with TAG no.		T0
Adhesive label with TAG no.	6)	**TC**
Float material		
PTFE	6)	**F2**
Scale design		
Directly readable scale	6)	**SD**
Percentage scale		SP
Bar graph	7)	SB
Ambient temperature range		
Extended -40 ... 85 °C (without Ex protection) / -40 ... 60 °C (with Ex protection)	8)	R5
Standard -20 ... 85 °C (without Ex protection) / -20 ... 60 °C (with Ex protection)	6)	**R6**

5) For Ex version on request.
6) Standard, specified automatically by ABB if no customer specifications have been provided.
7) Recommended for indicator with transmitter (4 ... 20 mA) with display.
8) Not available for analog indicator with alarm.

7 Version with heating jacket, model FAM546

7.1 Specifications

Design	Heating jacket design					
Measurement range See 7.3 "Flow range tables"	Water at 20 °C (68 °F): 28 l/h ... 53 m^3/h / 0.125 ... 235 gpm Air at 0 °C and 1,013 mbar: 0.83 ... 1,550 m^3/h Qn / Air at 70 °F and 14.7 psia: 0.62 ... 960 scfm					
Flow range ratio	10:1					
Scales	Percentage scale Product scale					
Accuracy	1.6 % qg = 50 % acc. to VDE / VDI 3513, sheet 2, optional 1 % of end value					
Connections	Flange acc. to DIN 2501 (DN 50 [2"] ... DN 100 [4"]); acc. to EN 1092-1 (DN 25 [1"]) Flange in acc. with ASME B16.5					
Heating jacket connection	Female thread G 1/4, at the back of the flowmeter					
Pressure rating See 7.2 "Material loads"	Standard pressure rating: PN 40 (PN 16 for DN 100 [4"]) Flange acc. to DIN / EN: PN 16, PN 40, PN 63, PN 100 Flange acc. to ASME CL 150, CL 300, CL 600					
Max. perm. operating pressure	100 bar (CL 600), (higher pressures available upon request)					
Installation length	See section 7.4, "Dimensions"					
Materials	Meter tube: Stainless steel 1.4571 (316 Ti) Conical meter pipe: Stainless steel 1.4571 (316 Ti), DN 15 (1/2“) only Flange: Stainless steel 1.4571 (316 Ti) Float: Stainless steel 1.4571 (316 Ti), standard Stainless steel 1.4571 (316 Ti) / Float head: Hastelloy C 2.4610, optional Gas damping: Stainless steel 1.4571 (316 Ti) Indicator housing: Powder-coated aluminum, stainless steel 1.4408 Housing gasket (O-ring): Buna N Viewing window: Shatterproof glass					
Temperature ranges	Permissible temperature of measured medium: -55 ... 400 °C (-67 ... 752 °F) Permissible ambient temperature: -40 ... 70 °C (-40 ... 158 °F) Refer to the temperature diagram on page 5. For Ex designs, see chapter Ex relevant specifications.					
Gas damping	Prevents compression oscillations in case of gas measurements with low operating pressure					
Weight (kg) / in () = (lb)	Indicator housing material	Meter size (meter tube size)				
			DN 15 (1/2")	DN 25 (1")	DN 50 (2")	DN 80 (3")
	AlSi 12		6,8 / (15)	10,7 / (23,6)	15,7 / (34,6)	34 / (75)
	Stainless steel		9,3 / (20,5)	13,2 / (29,1)	18,2 / (40,1)	36,5 / (80,4)
SIL classifications	SIL2 declaration of conformity for meters with alarm function Manufacturer's declaration (SIL1) acc. to IEC 61508 / IEC61511 for meters with 4 ... 20 mA current output					

7.2 Material loads for process connections

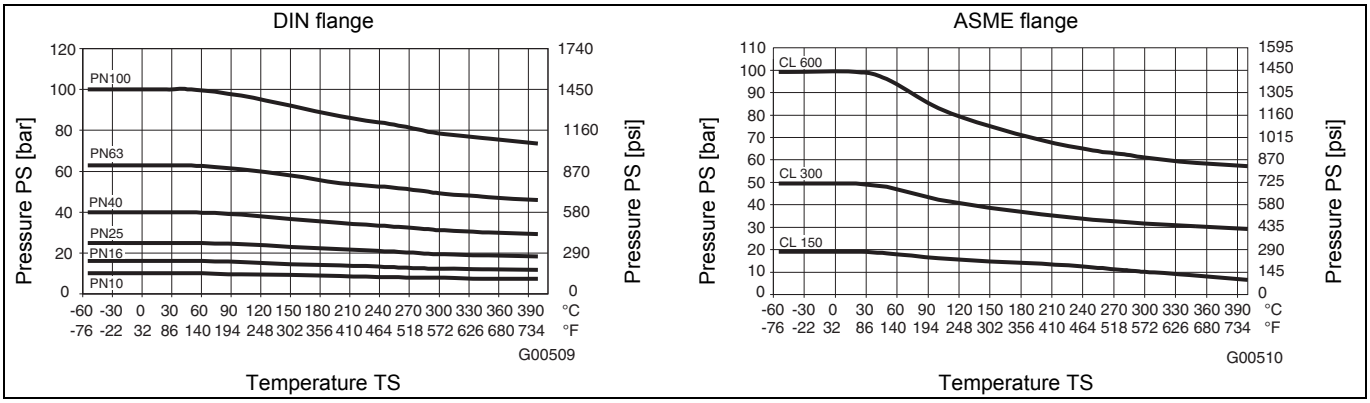

Fig. 23

7.3 Flow range tables

Metric unit values

DN [1]	Measuring range end value [2] l/h water 1 kg/dm³, 1 mPa s	Qn m³/h air at 0 °C; 1013 mbar	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (mbar)	Min. req. upstream pressure for gas measurement (bar abs) [5] without	with [6]	Order code
Installation length 250 mm								
25	28 ... 32	0,83 ... 0,95	1/2 in-30	6	80	4,0	1,0	A7 [7]
	37 ... 43	1,10 ... 1,28	1/2 in-40	6	80	4,0	1,0	B7 [7]
	44 ... 55	1,30 ... 1,63	1/2 in-50	6	80	4,0	1,0	C7 [7]
	56 ... 64	1,66 ... 1,90	1/2 in-60	6	80	4,0	1,0	D7 [7]
	77 ... 83	2,29 ... 2,47	1/2 in-80	16	40	3,0	1,0	E7
	96 ... 104	2,85 ... 3,09	1/2 in-100	16	45	3,2	1,0	F7
	115 ... 125	3,42 ... 3,72	1/2 in-120	16	50	3,5	1,0	G7
	144 ... 156	4,28 ... 4,64	1/2 in-150	16	60	3,8	1,0	H7
	188 ... 212	5,59 ... 6,30	1/2 in-200	16	60	4,0	1,0	J7
	235 ... 265	6,98 ... 7,88	1/2 in-250	16	65	4,2	1,0	K7
	282 ... 318	8,38 ... 9,45	1/2 in-300	16	70	4,4	1,0	L7
	376 ... 424	11,17 ... 12,60	1/2 in-400	16	75	4,6	1,0	M7
	470 ... 530	13,97 ... 15,75	1/2 in-500	16	75	4,8	1,0	N7
	565 ... 635	16,79 ... 18,87	1/2 in-600	16	80	5,0	1,0	P7
	750 ... 850	22,29 ... 25,26	1/2 in-800	16	85	5,4	1,0	R7
50	280 ... 656	8,32 ... 19,50	1 in-400 (1.050-S)	13 ... 21	20 ... 76	2,9 ... 3,1	1,1 ... 1,4	A1
	393 ... 870	11,70 ... 25,85	1 in-600 (1.050-N)	7 ... 10	27 ... 76	3,0 ... 3,4	1,2 ... 1,4	B1
	660 ... 1600	19,38 ... 50,80	1 in-1000 (1.113-S)	16 ... 22	20 ... 76	3,3 ... 4,3	1,1 ... 1,4	C1
	975 ... 2370	28,98 ... 70,44	1 in-1600 (1.113-N)	8 ... 10	27 ... 82	3,3 ... 5,3	1,2 ... 1,5	D1
	1650 ... 4020	49,04 ... 119,50	1 in-2500 (1.263-S)	17 ... 6	20 ... 76	4,2 ... 6,4	1,1 ... 1,4	E1
	2585 ... 6170	76,83 ... 183,50	1 in-4000 (1.263-N)	8 ... 10	27 ... 82	5,2 ... 8,0	1,2 ... 1,5	F1
80	4220 ... 12130	125,40 ... 360,50	2 in-8000 (1.330-S)	21 ... 38	11 ... 62	3,1 ... 4,5	1,1 ... 1,4	A2
	7940 ... 18460	236,00 ... 548,60	2 in-12000 (1.330-N)	13 ... 17	24 ... 74	3,8 ... 6,2	1,1 ... 1,4	B2
	11760 ... 24200	349,50 ... 720,00	2 in-18000 (1.330-X)	3 ... 4	28 ... 72	4,4 ... 7,5	1,1 ... 1,4	C2
100	7000 ... 21010	208,00 ... 624,40	3 in-12000 (1.315-S)	22 ... 54	6 ... 48	3,4 ... 5,4	1,1 ... 1,3	A3
	18090 ... 35010	537,70 ... 1040,00	3 in-25000 (1.315-N)	18 ... 25	24 ... 65	4,8 ... 7,4	1,1 ... 1,4	B3
	26750 ... 53810	795,00 ... 1600,00	3 in-40000 (1.315-X)	4 ... 5	26 ... 68	6,0 ... 9,2	1,1 ... 1,4	C3

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m³/h water, flow span of meter 1.2 to 12 m³/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm³)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   The values may be lower depending on the quality of the installation. The pressure drop in such cases must be considered as the minimum value. Some installations may have higher values.
6) Cylinder / piston damping. For meter sizes DN 15 ... DN 80 (1/2 ... 3").
7) These meter tube/float combinations always require gas piston damping for gas measurements.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

ANSI unit values

DN [1]	Measuring range end value [2] USgal/h water 62.43 lb/ft³, 1 mPa s	Qn scfh air at 32 °F; 14.7 psia	Meter tube / float Abbreviation	VIN [3]	Pressure drop [4] (psi)	Min. req. upstream pressure for gas measurement (psia) [5] without	with [6]	Order code
Installation length 9.84“								
1“	7,4 ... 8,8	37 ... 45	1/2 in-30	6	1,16	58	14,5	A7 [7]
	10 ... 11,6	52 ... 59	1/2 in-40	6	1,16	58	14,5	B7 [7]
	11,6 ... 14,5	54 ... 66	1/2 in-50	6	1,16	58	14,5	C7 [7]
	14,5 ... 17	68 ... 80	1/2 in-60	6	1,16	58	14,5	D7 [7]
	20,5 ... 21,5	84 ... 90	1/2 in-80	16	0,56	43	14,5	E7
	25,5 ... 27	104 ... 112	1/2 in-100	16	0,65	46	14,5	F7
	30 ... 33	125 ... 135	1/2 in-120	16	0,73	51	14,5	G7
	38 ... 41	155 ... 165	1/2 in-150	16	0,87	55	14,5	H7
	50 ... 56	205 ... 230	1/2 in-200	16	0,87	58	14,5	J7
	62 ... 70	255 ... 285	1/2 in-250	16	0,94	61	14,5	K7
	74 ... 84	310 ... 340	1/2 in-300	16	1,0	64	14,5	L7
	100 ... 112	410 ... 460	1/2 in-400	16	1,1	67	14,5	M7
	125 ... 140	510 ... 570	1/2 in-500	16	1,1	70	14,5	N7
	150 ... 165	620 ... 680	1/2 in-600	16	1,2	73	14,5	P7
	200 ... 220	820 ... 920	1/2 in-800	16	1,2	78	14,5	R7
2“	74 ... 170	310 ... 700	1 in-400 (1.050-S)	13 ... 21	0,3 ... 1,1	42,1 ... 45,0	16,0 ... 20,3	A1
	104 ... 220	430 ... 940	1 in-600 (1.050-N)	7 ... 10	0,4 ... 1,1	43,5 ... 49,3	17,4 ... 20,3	B1
	170 ... 450	720 ... 1850	1 in-1000 (1.113-S)	16 ... 22	0,3 ... 1,1	48,0 ... 62,4	16,0 ... 20,3	C1
	260 ... 620	1060 ... 2550	1 in-1600 (1.113-N)	8 ... 10	0,4 ... 1,2	48,0 ... 77,0	17,4 ... 21,8	D1
	440 ... 1060	1800 ... 4300	1 in-2500 (1.263-S)	17 ... 6	0,3 ... 1,1	61,0 ... 92,8	16,0 ... 20,3	E1
	680 ... 1600	2800 ... 6600	1 in-4000 (1.263-N)	8 ... 10	0,4 ... 1,2	75,4 ... 116	17,4 ... 21,8	F1
3“	1120 ... 3200	4600 ... 13000	2 in-8000 (1.330-S)	21 ... 38	0,2 ... 0,9	45,0 ... 65,3	16,0 ... 20,3	A2
	2100 ... 4800	8600 ... 20000	2 in-12000 (1.330-N)	13 ... 17	0,3 ... 1,1	55,1 ... 90,0	16,0 ... 20,3	B2
	3100 ... 6400	13000 ... 27000	2 in-18000 (1.330-X)	3 ... 4	0,4 ... 1,0	63,8 ... 109	16,0 ... 20,3	C2
4“	1850 ... 5500	7600 ... 22000	3 in-12000 (1.315-S)	22 ... 54	0,1 ... 0,7	49,3 ... 78,3	16,0 ... 18,9	A3
	4800 ... 9200	19500 ... 38000	3 in-25000 (1.315-N)	18 ... 25	0,3 ... 0,9	69,6 ... 107	16,0 ... 20,3	B3
	7000 ... 14000	29000 ... 58000	3 in-40000 (1.315-X)	4 ... 5	0,4 ... 1,0	87,0 ... 133	16,0 ... 20,3	C3

1) Connection meter size
2) The flowrate end value can be selected anywhere within these limits. The flow span is 10:1.
   Example: Flowrate end value 12 m^3/h water, flow span of meter 1.2 to 12 m^3/h (USgal/h) water.
3) Viscosity influence number (VIN). If the calculated VIN is less than or equal to the VIN value listed in the flow range table, then the viscosity does not affect the measurements.

$$VIN = \eta \cdot \sqrt{\frac{(\rho_{s-1}) \cdot 1}{(\rho_{s1} - \rho_1) \cdot \rho_1}}$$

   η = Dyn. viscosity of the measured medium [mPa s]
   ρ_s = density of the float acc. to table (r = 8.02 g/cm^3)
   ρ_{s1} = density of the float that is being used.
   ρ_1 = Density of the measured medium.
   If the calculated value is higher than the listed VIN value, then the flowmeters are provided with a scale at our factory to take into account the viscosity of the fluid.
4) The pressure drop values listed are based on the relevant flowrate end value.
5) The minimum pressure (abs) required to prevent compression oscillations (float bounce) in the meter tube. The specifications with and without damping are based on average installation conditions.
   The values may be lower depending on the quality of the installation. The pressure drop in such cases must be considered as the minimum value. Some installations may have higher values.
6) Cylinder / piston damping. For meter sizes DN 15 ... DN 80 (1/2 ... 3").
7) These meter tube/float combinations always require gas piston damping for gas measurements.

Important
The "FlowCalc" program, which is available as a free download from www.abb.com/flow, can be used to calculate flowrates, pressure drops, and upstream pressure requirements.

7.4 Dimensions

FAM546 with current and/or alarm output

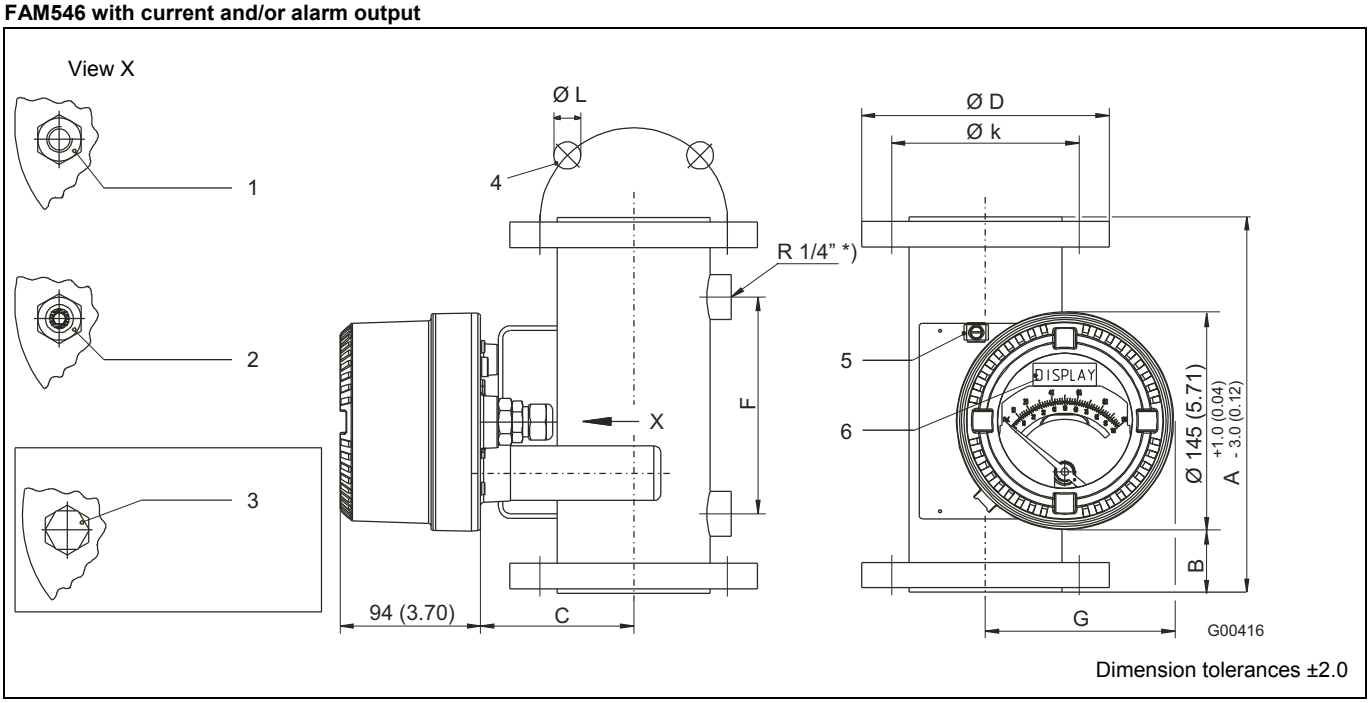

Fig. 24: All dimensions in mm (inch)

1 Threaded socket 1/2" NPT
2 Cable entry M20 x 1.5
3 Threaded plug M25 x 1.5 (FAM546-A only)
4 N number of holes
5 Protective conductor
6 FAM546-F only
*) 1/2" NPT on request

Meter size	Pressure rating	Heating jacket design: Sheathing PN 16								
	PN	Ø D	Ø k	Ø L	N	A	B	C	F	G
25	40	115,0	85,0	14,0	4	258,0	45,5	87,0	170,0	118,0
		(4,53)	(3,35)	(0,55)		(10,16)	(1,79)	(3,43)	(6,69)	(4,65)
25	63 / 100	140,0	100,0	18,0	4	270,0	51,5	87,0	170,0	118,0
		(5,51)	(3,94)	(0,71)		(10,63)	(2,03)	(3,43)	(6,69)	(4,65)
1“	CL 150	107,9	79,4	15,9	4	258,0	45,5	87,0	170,0	118,0
		(4,25)	(3,13)	(0,63)		(10,16)	(1,79)	(3,43)	(6,69)	(4,65)
1“	CL 300	123,8	88,9	19,0	4	258,0	45,5	87,0	170,0	118,0
		(4,87)	(3,50)	(0,75)		(10,16)	(1,79)	(3,43)	(6,69)	(4,65)
1“	CL 600	124,0	88,9	19,0	4	270,0	51,5	87,0	170,0	118,0
		(4,88)	(3,50)	(0,75)		(10,63)	(2,03)	3,43()	(6,69)	(4,65)
50	40	165,0	125,0	18,0	4	258,0	45,5	102,0	170,0	118,0
		(6,50)	(4,92)	(0,71)		(10,16)	(1,79)	(4,02)	(6,69)	(4,65)
50	63	180,8	135,0	22,0	4	270,0	51,5	102,0	170,0	118,0
		(7,12)	(5,31)	(0,87)		(10,63)	(2,03)	(4,02)	(6,69)	(4,65)
50	100	195,0	145,0	26,0	4	274,0	53,5	102,0	170,0	118,0
		(7,68)	(5,71)	(1,02)		(10,79)	(2,11)	(4,02)	(6,69)	(4,65)
2“	CL 150	152,4	120,7	19,0	4	258,0	45,5	102,0	170,0	118,0
		(6,00)	(4,75)	(0,75)		(10,16)	(1,79)	(4,02)	(6,69)	(4,65)
2“	CL 300	165,1	127,0	19,0	8	263,0	48,0	102,0	170,0	118,0
		(6,50)	(5,00)	(0,75)		(10,35)	(1,89)	(4,02)	(6,69)	(4,65)
2“	CL 600	165,1	127,0	19,0	8	284,0	58,5	102,0	170,0	118,0
		(6,50)	(5,00)	(0,75)		(11,18)	(2,30)	(4,02)	(6,69)	(4,65)
80	40	200,0	160,0	18,0	8	262,0	47,5	117,0	166,0	130,0
		(7,87)	(6,30)	(0,71)		(10,31)	(1,87)	(4,61)	(6,54)	(5,12)
80	63	215,0	170,0	22,0	8	270,0	51,5	117,0	166,0	130,0
		(8,46)	(6,69)	(0,87)		(10,63)	(2,03)	(4,61)	(6,54)	(5,12)
80	100	230,0	180,0	26,0	8	282,0	57,5	117,0	166,0	130,0
		(9,06)	(7,09)	(1,02)		(11,10)	(2,26)	(4,61)	(6,54)	(5,12)
3“	CL 150	190,5	152,4	19,0	4	262,0	47,5	117,0	166,0	130,0
		(7,50)	(6,00)	(0,75)		(10,31)	(1,87)	(4,61)	(6,54)	(5,12)
3“	CL 300	209,5	168,1	22,3	8	271,0	52,0	117,0	166,0	130,0
		(8,25)	(6,62)	(0,88)		(10,67)	(2,05)	(4,61)	(6,54)	(5,12)
3“	CL 600	209,5	168,1	22,2	8	292,0	58,5	117,0	166,0	130,0
		(8,25)	(6,62)	(0,87)		(11,50)	(2,30)	(4,61)	(6,54)	(5,12)
100	40	235,0	190,0	22,0	8	254,0	43,5	132,0	168,0	144,0
		(9,25)	(7,48)	(0,87)		(10,00)	(1,71)	(5,20)	(6,61)	(5,67)
100	63	250,0	200,0	26,0	8	266,0	49,5	132,0	168,0	144,0
		(9,84)	(7,87)	(1,02)		(10,47)	(1,95)	(5,20)	(6,61)	(5,67)
100	100	265,0	210,0	30,0	8	278,0	55,5	132,0	168,0	144,0
		(10,43)	(8,27)	(1,18)		(10,94)	(2,19)	(5,20)	(6,61)	(5,67)
4“	CL 150	228,6	190,5	19,0	8	254,0	43,5	132,0	168,0	144,0
		(9,00)	(7,50)	(0,75)		(10,00)	(1,71)	(5,20)	(6,61)	(5,67)
4“	CL 300	254,0	200,1	22,2	8	270,0	51,5	132,0	168,0	144,0
		(10,00)	(7,88)	(0,87)		(10,63)	(2,03)	(5,20)	(6,61)	(5,67)
4“	CL 600	273,0	215,9	25,4	8	290,0	61,5	132,0	168,0	144,0
		(10,75)	(8,50)	(1,00)		(11,42)	(2,42)	(5,20)	(6,61)	(5,67)

All dimensions in mm (inch)

7.5 Ordering information (FAM546)

		Main order number													Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
VA Master metal tube float flowmeter	**FAM546**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX
Indicator / Output signal															
Analog indicator / No indicator		**A**													
Analog indicator / Min alarm		B													
Analog indicator / Max alarm		C													
Analog indicator / Min and max alarm		D													
Analog indicator / 4 ... 20 mA with HART protocol		E													
Analog indicator with LCD display / 4 ... 20 mA with HART protocol		F													
Housing material / Cable connection															
Aluminum / M20 x 1.5 cable gland			**1**												
Aluminum / 1/2 inch NPT thread			2												
Stainless steel / M20 x 1.5 cable gland		1)	3												
Stainless steel / 1/2 inch NPT thread		1)	4												
Explosion protection and approvals															
None				**Y**	**0**										
ATEX / IEC category 3 (Zone 2 / 21), Ex n	2)			B	1										
ATEX / IEC category 2 (Zone 1 / 21), Ex i, Ex c	2)			A	4										
ATEX / IEC category 2 (Zone 1 / 21), Ex d + Ex i	3)			A	9										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI	4)			F	3										
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI	4)			F	4										
Process connection															
Flange						**F**	**1**								
Nominal diameter															
DN 25								B							
DN 50								**C**							
DN 80								D							
DN 100								E							
Float design															
Standard									**1**						
With gas damping									3						
Pressure rating															
PN 16										D	2				
PN 40										**D**	**4**				
PN 63										D	5				
PN 100										D	6				
ASME CL 150										A	1				
ASME CL 300										A	3				
ASME CL 600										A	6				
Design level															
(Specified by ABB)												X			
Meter tube / float combination															
(Specified by ABB.) See flow range tables													X	X	

Continued on next page

1) Not available with Ex d or XP types of Ex protection
2) Analog indicator without output signal design: ATEX approval only; IEC Ex not available
3) With Ex d cable gland. Not available for analog indicator without output signal design:
4) Only with 1/2 inch NPT cable entry

Continued

Main order number														Additional order no.
Variant digit no.	1 - 6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	FAM546	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	XX

Flowmeter sensor		
None, only secondary meter	5)	Y0
Standard	6)	**Y1**
Measured value error		
1.6 % qg = 50 % acc. to VDE / VDI 3513	6)	**A1**
1 % of end value		AA
4 % of end value (high viscosity, without calculation)		AK
4 % of end value (high viscosity, with calculation)		AL
Material: 3.1, 3.2; test certificate / NACE		
Material confirmation with inspection certificate 3.1 to EN 10204		C2
Material confirmation with inspection certificate 3.2 to EN 10204		C3
Material confirmation NACE MR 01-75 with acceptance test certificate 3.1 to EN 10204		CN
Material: 2.1; order conformity		
Certificate of compliance 2.1 to EN 10204 for order conformity		C4
Certificates: 3.1; visual, dimensional, functional		
Acceptance test certificate 3.1 to EN 10204 for visual, dimensional, and functional checks		C6
Certificates: 3.1; PMI test		
Acceptance test certificate 3.1 to EN 10204 for Positive Material Identification (PMI)		CA
Certificates: 3.1; compression test		
Compression test to AD2000		CB
Test package (compression test, non-destructive material test, welder test, welding procedure test)		CP
Certificates: Calibration, test report		
Certificate of compliance 2.1 to EN 10204 with confirmation of accuracy		CM
Calibration certificate with confirmation of accuracy and calibration data		CE
Other user certificates		
Russia: Metrological and GOST R certificate		CG1
Kazakhstan: Metrological and GOST K certificate (in preparation)		CG2
Ukraine: Metrological certificate		CG3
Belarus: Metrological certificate		CG6
Additional Ex certificates and approvals		
Russia: GOST-Ex and RTN certificate		EG7
Kazakhstan: Ex permission certificate (in preparation)		EG3
Ukraine: GOST Ex and Ex permission certificate (in preparation)		EG5
Belarus: GGTN certificate		EG9
Language of documentation		
German		M1
English	6)	**M5**
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
Applications		
Oil- and grease-free for oxygen applications		P1
Meter name plate		
Stainless steel plate with TAG no.		T0
Adhesive label with TAG no.	6)	**TC**
Float material		
Stainless steel 1.4571 (AISI 316Ti SST)	6)	**F1**
Scale design		
Directly readable scale	6)	**SD**
Percentage scale		SP
Bar graph	7)	SB
Ambient temperature range		
Extended -40 ... 85 °C (without Ex protection) / -40 ... 60 °C (with Ex protection)	8)	R5
Standard -20 ... 85 °C (without Ex protection) / -20 ... 60 °C (with Ex protection)	6)	**R6**

5) For Ex version on request
6) Standard, specified automatically by ABB if no customer specifications have been provided
7) Recommended for indicator with transmitter (4 ... 20 mA) with display
8) Not available for analog indicator with alarm

8 Ex relevant specifications

8.1 Safety-relevant information ATEX / IECEx

The meters are designed for maximum versatility. Each meter provides a combination of explosion protection types. All meters are suitable for use in areas with combustible dust.

8.1.1 Approved installation sites

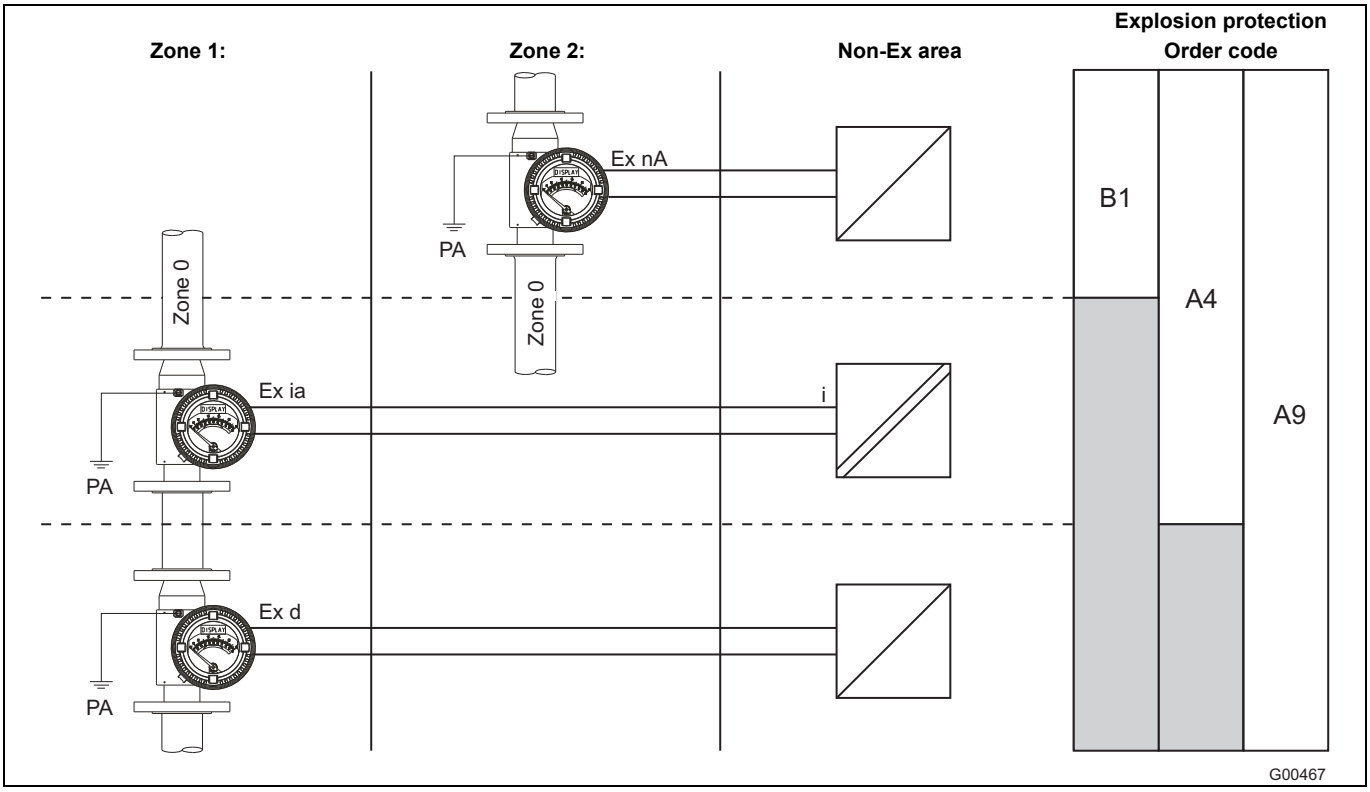

Fig. 25

PA Potential equalization

For detailed information and terminal assignments, see chapters Analog display with / without limit signal transmitter, page 6 and Electrical connection, page 8.

8.1.2 Identification and protection classes

Analog indicator without limit signal transmitter **FAM54_A_**

	Designation	Explosion protection type	Certificate	Ignition protection Order code	Limit value table no.
ATEX	II 1/2G Ex c II T6 ... T1	Mechanical safety	KEMA 07ATEX0104X	A4 A9 B1	4
	II 2 D Ex c T85 °C ... T_{Medium}	Mechanical safety			
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			

T_{amb} = -40 °C ... 60 °C (combustible dusts)

T_{amb} = -40 °C ... 70 °C

Analog indicator with limit signal transmitter **FAM54_B/C/D_**

	Designation	Explosion protection type	Certificate	Ignition protection Order code	Limit value table no.
ATEX	II 1/2G Ex c ia IIC T6 ... T1	Intrinsic safety	KEMA 07ATEX0104X	A4	2
	II 1/3G Ex c nA II T6 ... T1	nA (non-incendive component)			4
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			2, 4
IECEx	Ex ia IIC T6 ... T1	Intrinsic safety	IECEx KEM07.0037X		2
	Ex nA II T6 ... T1	nA (non-incendive component)			4
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			2, 4
ATEX	II 1/2G Ex c d IIC T6 ... T1	Flameproof protection	KEMA 07ATEX0104X	A9	3
	II 1/2G Ex c ia IIC T6 ... T1	Intrinsic safety			2
	II 1/3G Ex c nA II T6 ... T1	nA (non-incendive component)			4
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			2, 3, 4
IECEx	Ex d IIC T6 ... T1	Flameproof protection	IECEx KEM07.0037X		3
	Ex ia IIC T6 ... T1	Intrinsic safety			2
	Ex nA II T6 ... T1	nA (non-incendive component)			4
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			2, 3, 4
ATEX	II 1/3G Ex c nA II T6 ... T1	nA (non-incendive component)	KEMA 07ATEX0104X	B1	4
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			4
IECEx	Ex nA II T6 ... T1	nA (non-incendive component)	IECEx KEM07.0037X		4
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			4

T_{amb} = - 20 °C (-40 °C) ... 60 °C (combustible dusts)

T_{amb} = - 20 °C (-40 °C) ... 70 °C

Analog indicator with transmitter with or without LCD display **FAM54_E/F_**

	Designation	Explosion protection type	Certificate	Ignition protection Order code	Limit value Table no.
ATEX	II 1/2G Ex c ia IIC T4 ... T1	Intrinsic safety	KEMA 07ATEX0104X	A4	1
	II 1/3G Ex c nA [nL] IIC T6 ... T1	nA (non-incendive component)			
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			
IECEx	Ex ia IIC T4 ... T1	Intrinsic safety	IECEx KEM07.0037X		
	Ex nA [nL] IIC T6 ... T1	nA (non-incendive component)			
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			
ATEX	II 1/2G Ex c d IIC T6 ... T1	Flameproof protection	KEMA 07ATEX0104X	A9	1
	II 1/2G Ex c ia IIC T4 ... T1	Intrinsic safety			
	II 1/3G Ex c nA [nL] IIC T6 ... T1	nA (non-incendive component)			
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			
IECEx	Ex d IIC T6 ... T1	Flameproof protection	IECEx KEM07.0037X		
	Ex ia IIC T4 ... T1	Intrinsic safety			
	Ex nA [nL] IIC T6 ... T1	nA (non-incendive component)			
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			
ATEX	II 1/3G Ex c nA [nL] IIC T6 ... T1	nA (non-incendive component)	KEMA 07ATEX0104X	B1	1
	II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			
IECEx	Ex nA [nL] IIC T6 ... T1	nA (non-incendive component)	IECEx KEM07.0037X		
	Ex tD A21 IP6X T85 °C ... T_{Medium}	Encapsulated device (dust-ignition proof)			

T_{amb} = -40 °C ... 60 °C (combustible dusts)

T_{amb} = -40 °C ... 70 °C

8.1.3 Limit value tables

Table 1: Analog indicator with transmitter with or without LCD display

Explosion protection type: Hermetically sealed, intrinsically safe "nA" (non-incendive component), encapsulated device (dust-ignition proof)

Order code	Designation	Connection terminals	Input values	T_{amb} -20 °C (-40 °C) ...	Temp. class	Max. Medium temp.	Therm. isola-tion	Heating jacket
A4 A9	ATEX: II 1/2G Ex c ia IIC T4 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex ia IIC T4 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	31 / 32 for connection with an intrinsically safe circuit	U_i = 30 V I_i = 110 mA P_i = 770 mW C_i = 5.3 nF L_i = 266 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
		41 / 42 for connection with an intrinsically safe circuit	U_i = 30 V I_i = 30 mA P_i = 115 mW C_i = 4,8 nF L_i = 133 µH	60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	125 °C	yes	yes
A9	ATEX: II 1/2G Ex c d IIC T6 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex d IIC T6 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	31 / 32 for connection with a non-intrinsically safe circuit[1)]	V_{max} = 46 V	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
		41 / 42 for connection with a non-intrinsically safe circuit[1)]	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				60 °C	T4	130 °C	yes	yes
				60 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
A4 A9 B1	ATEX: II 1/3G Ex c nA [nL] IIC T6 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex nA [nL] IIC T6 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	31 / 32 for connection with a non-intrinsically safe circuit[1)]	V_{max} = 46 V	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
		41 / 42 for connection with a non-intrinsically safe circuit[1)]	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				30 °C	T6	25 °C	yes	yes

Special conditions for explosion protection type "Encapsulated device" (dust-ignition proof) for the models with Ex protection (A4 and B1):

$T_{Medium} \leq 250°C$ at T_{amb} = -40 ... 60 °C

$T_{Medium} \leq 340°C$ at T_{amb} = -40 ... 40 °C

$T_{Medium} \leq 430°C$ at T_{amb} = -40 ... 20 °C

1) If the meter will be operated subsequently with explosion protection type "intrinsically safe", then U_{max} = 60 V may not be exceeded.

Table 2: Analog indicator with limit signal transmitter

Explosion protection type: Intrinsic safety, encapsulated device (dust-ignition proof)

Order code	Designation	Connection terminals	Input values	T_{amb} -20 °C (-40 °C) ...	Temp. class	Max. Medium temp.	Therm. isola-tion	Heating jacket
A4 A9	ATEX: II 1/2G Ex c ia IIC T6 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex ia IIC T6 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	41 / 42 and 51 / 52 for connection with an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 25 mA P_i = 64 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
		41 / 42 and 51 / 52 for connection with an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 52 mA P_i = 169 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
				40 °C	T6	60 °C	yes	yes
		41 / 42 and 51 / 52 for connection with an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 76 mA P_i = 242 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230°C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes
				30 °C	T6	30 °C	yes	yes

Special conditions for explosion protection type "Encapsulated device" (dust-ignition proof) for the models with Ex protection (A4 and A9):

$T_{Medium} \leq 250°C$ at T_{amb} = -20 ... 60 °C

$T_{Medium} \leq 340°C$ at T_{amb} = -20 ... 40 °C

$T_{Medium} \leq 430°C$ at T_{amb} = -20 ... 20 °C

Table 3: Analog indicator with limit signal transmitter

Explosion protection type: Hermetically sealed, encapsulated device (dust-ignition proof)

Order code	Designation	Connection terminals	Input values	T_{amb} -20 °C (-40 °C) ...	Temp. class	Max. Medium temp.	Therm. isola-tion	Heating jacket
A9	ATEX: II 1/2G Ex c d IIC T6 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex d IIC T6 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1)]	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
		41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1)]	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
				40 °C	T6	60 °C	yes	yes
		41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1)]	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230°C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes
				30 °C	T6	30 °C	yes	yes

Special conditions for explosion protection type "Encapsulated device" (dust-ignition proof) for the models with Ex protection (A9):

$T_{Medium} \leq 250°C$ at T_{amb} = -20 ... 60 °C

$T_{Medium} \leq 340°C$ at T_{amb} = -20 ... 40 °C

$T_{Medium} \leq 430°C$ at T_{amb} = -20 ... 20 °C

1) If the meter will be operated subsequently with explosion protection type "intrinsically safe", then U_{max} may not be exceeded.

Table 4: Analog display with/without limit signal transmitter

Explosion protection type: "nA" (non-incendive component), encapsulated device (dust-ignition proof)

Order code	Designation	Connection terminals	Input values	T_{amb} -20 °C (-40 °C) ...	Temp. class	Max. Medium temp.	Therm. isola-tion	Heating jacket
A4 A9 B1	ATEX: II 1/3G Ex c nA II T6 ... T1 II 2D Ex tD A21 IP6X T85 °C ... T_{Medium} IECEx: Ex nA II T6 ... T1 Ex tD A21 IP6X T85 °C ... T_{Medium}	41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1)]	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
		41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
				40 °C	T6	60 °C	yes	yes
		41 / 42 and 51 / 52 for connection with a non-intrinsically safe circuit[1)]	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230°C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes
				30 °C	T6	30 °C	yes	yes
A4 A9 B1	ATEX: II 1/2G Ex c II T6 ... T1 II 2D Ex c T85 °C ... T_{Medium} II 2D Ex tD A21 IP6X T85 °C ... T_{Medium}	n.a.	n.a.	70 °C	T1	440 °C	yes	yes
				70 °C	T2	290 °C	yes	yes
				70 °C	T3	190 °C	yes	yes
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				70 °C	T6	80°C	yes	yes

Special conditions for explosion protection type "Encapsulated device" (dust-ignition proof) for the models with Ex protection (A4, A9 and B1):

$T_{Medium} \leq 250°C$ at T_{amb} = -40 ... 60 °C

$T_{Medium} \leq 340°C$ at T_{amb} = -40 ... 40 °C

$T_{Medium} \leq 430°C$ at T_{amb} = -40 ... 20 °C

1) If the meter will be operated subsequently with explosion protection type "intrinsically safe", then U_{max} may not be exceeded.

8.2 Safety specifications FM / CSA

8.2.1 Identification codes and protection types FM and cCSAus

Analog indicator without limit signal transmitter FAM54_A_

Analog indicator with limit signal transmitter FAM54_B/C/D_

	Designation	Explosion protection type	Explosion protection Order code	Limit value table no.	Certificate no.
FM	XP / CL I / DIV 1 / GP ABCD / T6…T1	Explosionproof	F3	FM2	Project ID 3033042
	CL I, ZN 1 AEx d IIC T6…T1				
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6..T1	Intrinsic Safety	F3 F4	FM1 FM2	
	CL I, ZN 1 AEx ia IIC T6…T1				
	DIP / CL II, III / DIV 1 / GP EFG / T6...T1	Dust-ignition-proof			
	NI /CL I,II / DIV 2 / GP ABCDFG / T5...T1 NI / CL III T5...T1	Non-incendive	F3 F4	FM1 FM2 FM3	
	CL II, ZN 2 AEx nA II T5...T1				
cCSAus	XP / CL I / DIV 1 / GP BCD / T6…T1	Explosionproof	F3	CSA2	1931925
	Ex d IIC T6...T1				
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6..T1	Intrinsic Safety	F3 F4	CSA1	
	Ex ia IIC T6...T1				
	DIP / CL II, III / DIV 1 / GP EFG / T6...T1	Dust-ignition-proof	F3 F4	CSA1 CSA2 CSA3	
	DIP A21 T_A 85°C to T_{Medium}				
	NI /CL I,II / DIV 2 / GP ABCDFG / T5...T1 NI / CL III T5...T1	Non-incendive	F3 F4	CSA3	
	Ex nA II T5...T1				

Analog indicator with transmitter with or without LCD display FAM54_E/F_

	Designation	Explosion protection type	Explosion protection Order code	Limit value table no.	Certificate no.
FM	XP / CL I / DIV 1 / GP ABCD / T6…T1	Explosionproof	F3	FM4	Project ID 3033042
	CL I, ZN 1 AEx d IIC T6…T1				
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4..T1	Intrinsic Safety	F3 F4	FM4	
	CL I, ZN 1 AEx ia IIC T4…T1				
	DIP / CL II, III / DIV 1 / GP EFG / T6...T1	Dust-ignition-proof			
	NI /CL I,II / DIV 2 / GP ABCDFG / T4...T1 NI / CL III T4...T1	Non-incendive			
	CL II, ZN 2 AEx nA [nL] IIC T6...T1				
cCSAus	XP / CL I / DIV 1 / GP BCD / T6…T1	Explosionproof	F3	CSA4	1931925
	Ex d IIC T6...T1				
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4..T1	Intrinsic Safety	F3 F4	CSA4	
	Ex ia IIC T4...T1				
	DIP / CL II, III / DIV 1 / GP EFG / T6...T1	Dust-ignition-proof			
	DIP A21 T_A 85°C to T_{Medium}				
	NI /CL I,II / DIV 2 / GP ABCDFG / T4...T1 NI / CL III T4...T1	Non-incendive			
	Ex nA [nL] IIC T6...T1				

XP: T_{amb} = -40 °C ... 70 °C (-40 °F ... 158 °F)

DIP, IS, NI: T_{amb} = -40 °C ... 60 °C (-40 °F ... 140 °F)

IS-Installation per drawing SDM-10-A0253

8.2.2 Limit value tables FM

Table FM1: Analog indicator with limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -58 °F ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 [1] or **F4** [1]	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6…T1 [2] IS installation per drawing SDM-10-A0253 DIP / CL II, III / DIV 1 / GP EFG / T6…T1 CL I, ZN 1 AEx ia IIC T6…T1	41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 25 mA P_i = 64 mW C_i = 50 nF L_i = 250 µH	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				158 °F	T5	203 °F	yes	yes
				140 °F	T6	176 °F	yes	yes
		41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 52 mA P_i = 169 mW C_i = 50 nF L_i = 250 µH	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				140 °F	T5	140 °F	yes	yes
				122 °F	T5	194 °F	no	yes
				104 °F	T6	140 °F	yes	yes
		41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 76 mA P_i = 242 mW C_i = 50 nF L_i = 250 µH	104 °F	T1	824 °F	no	no
				104 °F	T1	590 °F	yes	no
				104 °F	T2	374 °F	yes	yes
				122 °F	T2	644 °F	no	no
				122 °F	T2	446 °F	yes	yes
				140 °F	T2	446 °F	no	no
				140 °F	T3	320 °F	yes	yes
				158 °F	T4	248 °F	no	no
				158 °F	T4	212 °F	yes	yes
				104 °F	T5	140 °F	yes	yes
				86 °F	T6	86 °F	yes	yes

1) If connected to an intrinsically safe circuit
2) IS installation per drawing SDM-10-A0253

Table FM2: Analog indicator with limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -58 °F ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 1)	XP / CL I / DIV 1 / GP ABCD / T6…T1 DIP / CL II, III / DIV 1 / GP EFG / T6...T1 CL I, ZN 1 AEx d IIC T6...T1	41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				158 °F	T5	203 °F	yes	yes
				140 °F	T6	176 °F	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				140 °F	T5	140 °F	yes	yes
				122 °F	T5	194 °F	no	yes
				104 °F	T6	140 °F	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	590 °F	yes	no
				104 °F	T2	374 °F	yes	yes
				122 °F	T2	644 °F	no	no
				122 °F	T2	446 °F	yes	yes
				140 °F	T2	446°F	no	no
				140 °F	T3	320 °F	yes	yes
				158 °F	T4	248 °F	no	no
				158 °F	T4	212 °F	yes	yes
				104 °F	T5	140 °F	yes	yes
				86 °F	T6	86 °F	yes	yes

1) If connected to an intrinsically safe circuit

Table FM3: Analog display with/without limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -58 °F ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F4 [1] or **F3** [1]	NI /CL I,II / DIV 2 / GP ABCDFG / T5...T1 NI / CL III / T5...T1 CL II, ZN 2 AEx nA II T5...T1	41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				158 °F	T5	203 °F	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				140 °F	T5	140 °F	yes	yes
				122 °F	T5	194 °F	no	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	104 °F	T1	824 °F	no	no
				104 °F	T1	590 °F	yes	no
				104 °F	T2	374 °F	yes	yes
				122 °F	T2	644 °F	no	no
				122 °F	T2	446 °F	yes	yes
				140 °F	T2	446°F	no	no
				140 °F	T3	320 °F	yes	yes
				158 °F	T4	248 °F	no	no
				158 °F	T4	212 °F	yes	yes
				104 °F	T5	140 °F	yes	yes

1) For connection in Division 2 or Zone 2

Table FM4: Analog indicator with transmitter with or without LCD display

Order code	Designation	Connection terminals	Input values	T_{amb} -58 °F ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 [1] or **F4** [1]	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4…T1 DIP / CL II, III / DIV 1 / GP EFG / T6…T1 CL I, ZN 1 AEx ia IIC T4…T1	31 / 32 if connected to an intrinsically safe circuit [2]	U_i = 30 V I_i = 110 mA P_i = 770 mW C_i = 5.3 nF L_i = 266 µH	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
		41 / 42 if connected to an intrinsically safe circuit	U_i = 30 V I_i = 30 mA P_i = 115 mW C_i = 4.8 nF L_i = 133 µH	140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	257 °F	yes	yes
F3 [3]	XP / CL I / DIV 1 / GP ABCD / T6…T1 DIP / CL II, III / DIV 1 / GP EFG / T6...T1 CL I, ZN 1 AEx d IIC T6...T1	31 / 32 if connected to a non-intrinsically safe circuit	V_{max} = 46 V	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
		41 / 42 if connected to a non-intrinsically safe circuit	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	140 °F	T2	608 °F	no	no
				140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				140 °F	T4	266 °F	yes	yes
				140 °F	T5	203 °F	yes	yes
				140 °F	T6	176 °F	yes	yes
F4 [4] or **F3** [4]	NI /CL I,II / DIV 2 / GP ABCDFG / T4...T1 NI / CL III / T4...T1 CL II, ZN 2 AEx nA [nL] IIC T4...T1	31 / 32 if connected to a non-intrinsically safe circuit	V_{max} = 46 V	104 °F	T1	824 °F	no	no
				104 °F	T1	707 °F	yes	no
				104 °F	T1	500 °F	yes	yes
				122 °F	T1	572 °F	yes	no
				122 °F	T2	554 °F	yes	no
				122 °F	T2	428°F	yes	yes
				140 °F	T2	608 °F	no	no
		41 / 42 if connected to a non-intrinsically safe circuit	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	140 °F	T2	446 °F	yes	no
				140 °F	T3	338 °F	yes	yes
				158 °F	T3	383 °F	no	no
				158 °F	T3	302 °F	yes	no
				158 °F	T4	266 °F	yes	yes
				158 °F	T5	203 °F	yes	yes
				86 °F	T6	77 °F	yes	yes

1) If connected to an intrinsically safe circuit
2) IS installation per drawing SDM-10-A0253
3) If connected to a non-intrinsically safe circuit
4) For connection in Division 2 or Zone 2

8.2.3 Limit value tables cCSAus

Table CSA1: Analog indicator with limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -50 °C ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 [1] or **F4** [1]	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6…T1 [2] DIP / CL II, III / DIV 1 / GP EFG / T6…T1 Ex ia IIC T6…T1 DIP A21 TA 85°C to T_{Medium}	41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 25 mA P_i = 64 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
		41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 52 mA P_i = 169 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
				40 °C	T6	60 °C	yes	yes
		41 / 42 and 51 / 52 if connected to an intrinsically safe circuit	For each circuit U_i = 16 V I_i = 76 mA P_i = 242 mW C_i = 50 nF L_i = 250 µH	40 °C	T1	440°C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230 °C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes
				30 °C	T6	30 °C	yes	yes

1) If connected to an intrinsically safe circuit
2) IS installation per drawing SDM-10-A0253

Table CSA2: Analog indicator without limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -50 °C ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 [1]	XP / CL I / DIV 1 / GP BCD / T6…T1 DIP / CL II, III / DIV 1 / GP EFG / T6…T1 Ex d IIC T6…T1 DIP A21 TA 85°C to T_{Medium}	41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
				40 °C	T6	60 °C	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	40 °C	T1	440°C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230 °C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes
				30 °C	T6	30 °C	yes	yes

1) If connected to an intrinsically safe circuit

Table CSA3: Analog display with/without limit signal transmitter

Order code	Designation	Connection terminals	Input values	T_{amb} -50 °C ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F4 [1] or **F3** [1]	NI /CL I,II / DIV 2 / GP ABCDFG / T5…T1 NI / CL III / T5…T1 Ex nA II T6…T1 DIP A21 TA 85°C to T_{Medium}	41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 25 mA P_{max} = 64 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 52 mA P_{max} = 169 mW	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				60 °C	T5	60 °C	yes	yes
				50 °C	T5	90 °C	no	yes
		41 / 42 and 51 / 52 if connected to a non-intrinsically safe circuit[1]	For each circuit U_{max} = 16 V I_{max} = 76 mA P_{max} = 242 mW	40 °C	T1	440°C	no	no
				40 °C	T1	310 °C	yes	no
				40 °C	T2	190 °C	yes	yes
				50 °C	T2	340 °C	no	no
				50 °C	T2	230 °C	yes	yes
				60 °C	T2	230 °C	no	no
				60 °C	T3	160 °C	yes	yes
				70 °C	T4	120 °C	no	no
				70 °C	T4	100 °C	yes	yes
				40 °C	T5	60 °C	yes	yes

1) For connection in Division 2 or Zone 2

Table CSA4: Analog indicator with transmitter with or without LCD display

Order code	Designation	Connection terminals	Input values	T_{amb} -50 °C ...	Temp. class	Max. Medium temp.	Therm. isolation	Heating jacket
F3 1) or **F4** 1)	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4…T1 2) DIP / CL II, III / DIV 1 / GP EFG / T6…T1 Ex ia IIC T6…T1 DIP A21 TA 85°C to T_{Medium}	31 / 32 if connected to an intrinsically safe circuit 2)	U_i = 30 V I_i = 110 mA P_i = 770 mW C_i = 5.3 nF L_i = 266 µH	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
		41 / 42 if connected to an intrinsically safe circuit	U_i = 30 V I_i = 30 mA P_i = 115 mW C_i = 4.8 nF L_i = 133 µH	60 °C	T2	320 °C	no	no
				60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	125 °C	yes	yes
F3 3)	XP / CL I / DIV 1 / GP BCD / T6…T1 DIP / CL II, III / DIV 1 / GP EFG / T6…T1 Ex d IIC T6…T1 DIP A21 TA 85°C to T_{Medium}	31 / 32 if connected to a non-intrinsically safe circuit	V_{max} = 46 V	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220 °C	yes	yes
		41 / 42 if connected to a non-intrinsically safe circuit	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	60 °C	T2	320 °C	no	no
				60 °C	T2	230°C	yes	no
				60 °C	T3	170 °C	yes	yes
				60 °C	T4	130 °C	yes	yes
				60 °C	T5	95 °C	yes	yes
				60 °C	T6	80 °C	yes	yes
F4 4) or **F3** 4)	NI /CL I,II / DIV 2 / GP ABCDFG / T4…T1 NI / CL III / T4…T1 Ex nA [nL] IIC T4…T1 DIP A21 TA 85°C to T_{Medium}	31 / 32 if connected to a non-intrinsically safe circuit	V_{max} = 46 V	40 °C	T1	440 °C	no	no
				40 °C	T1	375 °C	yes	no
				40 °C	T1	260 °C	yes	yes
				50 °C	T1	300 °C	yes	no
				50 °C	T2	290 °C	yes	no
				50 °C	T2	220°C	yes	yes
				60 °C	T2	320 °C	no	no
		41 / 42 if connected to a non-intrinsically safe circuit	V_{max} = 30 V I_{max} = 30 mA P_{max} = 115 mW	60 °C	T2	230 °C	yes	no
				60 °C	T3	170 °C	yes	yes
				70 °C	T3	195 °C	no	no
				70 °C	T3	150 °C	yes	no
				70 °C	T4	130 °C	yes	yes
				70 °C	T5	95 °C	yes	yes
				30 °C	T6	25 °C	yes	yes

1) If connected to an intrinsically safe circuit
2) IS installation per drawing SDM-10-A0253
3) If connected to a non-intrinsically safe circuit
4) For connection in Division 2 or Zone 2

8.2.4 Connection diagram, FM / cCSAus

Terminals 31 / 32, auxiliary power or power feed

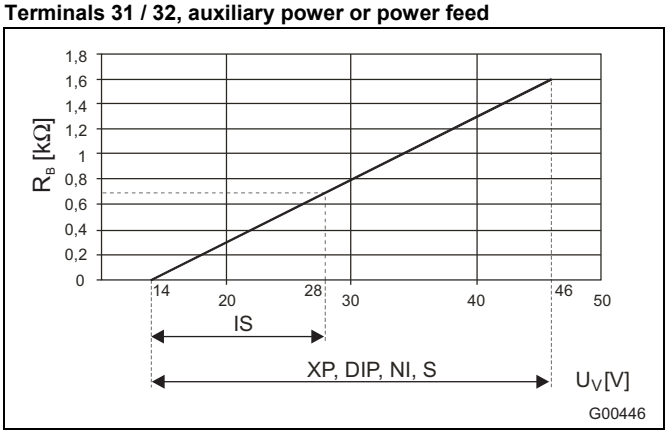

Fig. 26

The minimum voltage U_V of 10 V is based on a load of 0 Ω.

U_V = Supply voltage

R_B = Maximum permissible load in power supply circuit, e.g., indicator, recorder or power resistor

Terminal connection diagram

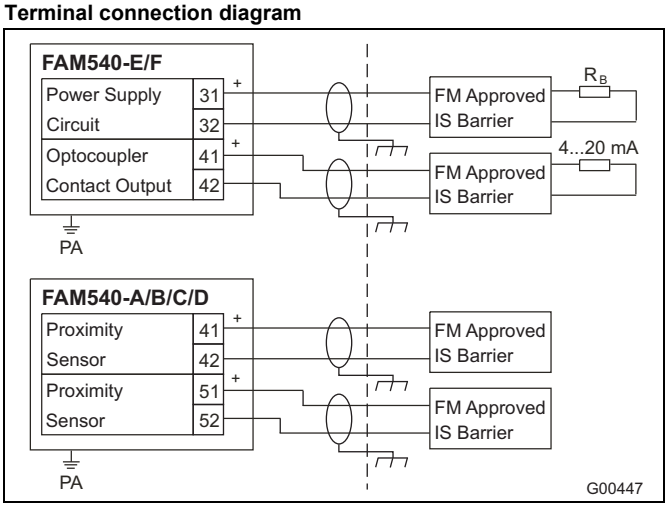

Fig. 27

Important

- The concept of intrinsic safety enables multiple intrinsic safety devices with FM or CSA approval to be interconnected, without entity parameters being examined specifically, subject to observation of the following conditions:

  Uo or Voc or Vt ≤ 0 V max, Io or Isc or It ≤ I max, Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, Po ≤ Pi.
- In the case of installation in Class II and III environments, dust-proof ignition blocks must be used.
- Meters connected to such apparatus must not use or generate rms or direct voltages in excess of 250 V.
- Installation must meet the requirements of ANSI/ISA RP 12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70) sections 504, 505 and CEC.
- The configuration of the associated apparatus must have Factory Mutual Research and CSA approval under the entity concept.
- Meters must be installed in compliance with the installation drawing supplied by the manufacturer of the associated apparatus.
- Changes to drawings are only permitted subject to prior approval from Factory Mutual Research and CSA.
- ONLY shielded twisted pair cables may be used (see above).

Information about the housing ground

The FAM540 housing must be correctly grounded in order to ensure proper function and safe operation. Use copper wires with a rating of at least AWG 10 for the ground connection between the ground screw and the protective conductor.

Information about power supply lines

Unless specified otherwise in regional or national standards, power supply lines must be dimensioned to AWG 20.

Information about explosion-proof installation

FAM540 devices installed as explosion-proof in Group A and B hazardous areas within 46 cm of the instrument must be fitted with ignition blocks.

Intrinsic Safety Control Drawing (SDM-10-A0253)

For intrinsically safe installations, the FAM540 must be installed as illustrated in the Intrinsic Safety Control Drawing. The drawing is also included in the packaging information supplied with the instrument.

Flowmeter insulation

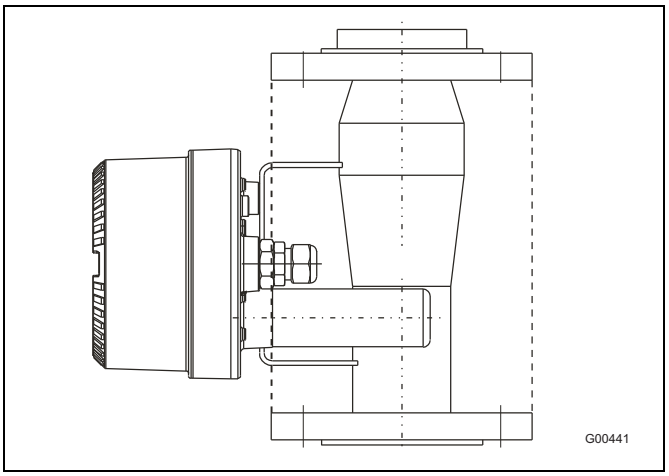

Fig. 28

Maximum insulation = Flange diameter

Special installation instructions for meters with explosion protection type "Explosion-proof"

The electrical connection can be made via an approved cable gland or an approved, suitable threaded conduit connection with flame arrester (located directly on the meter). The sealing cap must be removed first.

A relevant test certificate must be available for the conduit or cable fitting. The use of cable and wire entries as well as plugs of simple design is prohibited. Cable and conduit fittings are not included in the meter's scope of supply.

Connection via pressure-resistant cable gland

The outer diameter of the unshielded connecting cable must be between **8.0 ... 11.7 mm**. The cable fitting must be dimensioned accordingly. After installing the cable in the fitting, tighten the lock nut to a torque of **32.5 Nm**. Use an additional strain relief device in the housing to secure the connecting cable.

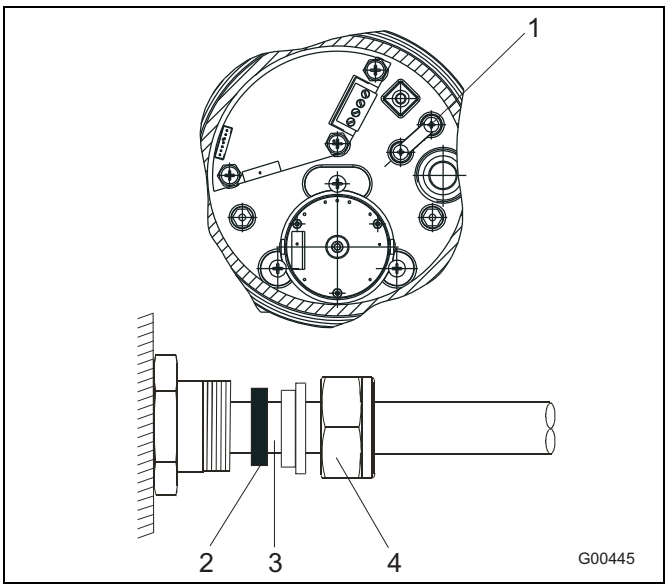

Fig. 29

1 Cable grip
2 Gaskets
3 Sleeve
4 Lock nut

Opening the flowmeter

After switching off the auxiliary power, wait t > 2 minutes before opening the flameproof enclosure.

9 Questionnaire

Customer:	**Date:**
Ms./Mr.:	**Department**
Telephone:	**Fax:**

Description of material to be measured: ☐ _____

☐ liquid
☐ gaseous
☐ transparent
☐ non-transparent
☐ translucent

purified ☐ yes ☐ no

Solids ☐ yes ☐ no

Size _____

Flowrate: min. _____ norm. _____ max. _____

☐ l/min ☐ l/h ☐ m^3/min ☐ m^3/min
☐ cm^3/min ☐ kg/min ☐ g/min ☐ kg/h
☐ other _____

If a vol. gas measurement refers to standard state, (Qv)s should be added to the flowrate unit.

Operating temperature: normal _____ max. _____

Operating pressure: Upstream pressure (P1) _____ Downstream pressure (P1) _____ max. _____

Gases: Standard density (ρn) _____ kg/m^3 Viscosity _____ mPa s

Fluid: Concentration _____ Vol. % _____ Wgt. %

Density at operating temperature _____ kg/dm^3

Viscosity at operating temperature _____ mPa s

Materials:

Metering tube _____

Float _____

Gaskets _____

Other metal parts that come into contact with metered materials _____

Connections:

Inlet ☐ left ☐ right ☐ front ☐ rear ☐ from below

Outlet ☐ left ☐ right ☐ front ☐ rear ☐ from above

☐ Threads ☐ Flange ☐ Hose nozzle

☐ Threaded connector acc. to DIN 11851 other _____

Installation type: ☐ Cable assembly ☐ Wall mount ☐ Panel mount ☐ Flush mounting

Display on meter: ☐ % scale ☐ Dk/Ds up to 1/4" size with flowrate table ☐ Directly readable product scale

Transmitter, electrical: ☐ 0 ... 20 mA ☐ 4 ... 20 mA ☐ Ex ☐ non-Ex

Limit switch ☐ Min. contact ☐ Max. contact ☐ Min. and max. contact

Notes:

ABB has Sales & Customer Support expertise in over 100 countries worldwide.

www.abb.com/flow

The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

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