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ABB MEASUREMENT & ANALYTICS | DATA SHEET

# VA Master FAM540

## Metal Cone Variable Area Flowmeter



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# Measurement made easy

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**For measuring liquids, gases and steam**

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**Graphical 2-line LCD display**

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**Magnet stick operation**

- Configuration also possible with closed housing

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**Easily adjustable for new operating conditions**

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**Approvals for explosion protection**

- ATEX
- IECEx
- FM, CSA

## Overview

Model	FAM541	FAM544
	Standard design	Hygienic design
		
<b>Measured error in accordance with VDE / VDI 3513</b>	1.6 % qg = 50 %	1.6 % qg = 50 %
<b>Reproducibility</b>	0.25 % of measured value	0.25 % of measured value
<b>Process connection</b>	Flange in accordance with DIN, ASME, JIS, female thread	Thread DIN 11851, SMS 1145
<b>Nominal connection diameters</b>	DN 15 (½ in) to DN 80 (3 in)	DN 25 (1 in) to DN 80 (3 in)
<b>Maximum measuring medium temperature</b>	400 °C (752 °F)	140 °C (284 °F)
<b>Maximum pressure rating</b>	PN 400 / class 2500	PN 40
<b>Wetted material</b>	Stainless steel 1.4404 (316L), 1.4571 (316Ti)	Stainless steel 1.4404 (316L), 1.4571 (316Ti)
<b>Housing material</b>	Stainless steel 1.4404 (316L)	Stainless steel 1.4404 (316L)
<b>Gasket material</b>	Viton A (DN 15 only)	Viton A (DN 25 only)
<b>Indicator / transmitter</b>		
<b>IP degree of protection in accordance with EN 60529</b>	IP 66, IP 67, NEMA 4X	
<b>Mechanical indicator</b>	Analog indicator with or without alarm signaling unit	
<b>Electronic indicator</b>	Analog indicator with transmitter 4 to 20 mA, with or without LCD indicator	
<b>Communication</b>	HART® protocol (only for analog indicators with transmitters)	
<b>Power supply</b>	Without alarm signalling unit: no power supply Analog indicator with alarm signaling unit: 8 V DC via switch amplifier Analog indicator with transmitter: 10 to 46 V DC (Ex: 10 to 30 V DC)	
<b>Indicator housing material</b>	Al Si 12 material number 3.2582 (copper content 0.1 %), stainless steel 1.4408	
<b>Paint</b>	Epoxy paint 80 to 100 µm; bottom color: RAL 7012, cover color: RAL 9002 (No housing paint for stainless steel indicator housing)	
<b>Approvals</b>		
<b>Ex approvals</b>	ATEX / IECEx: Zone 0 / 1 / 2 / 21 FM / cCSAus: XP, IS, DIP, NI, FM Zone 1 + 2	
<b>Sealing concept</b>	Dual sealing in accordance with ANSI / ISA-12.27.01	
<b>SIL approval</b>	Analog indicator with alarm signaling unit: SIL 2 Analog indicator with transmitter: FMEDA evaluation	

## Introduction and basics

### Installation conditions

- The installation recommendations of VDI / VDE Directive 3513 must be observed.
- The flowmeter is installed vertically in the piping. The measuring media must flow from bottom to top.
- Keep the device as far away as possible from pipe vibrations and powerful magnetic fields.
- The nominal diameter of the piping should be the same as the connection nominal diameter.
- Inlet and outlet sections are generally not required. Care should be taken to avoid flow turbulence, pulsations, pressure shocks and other flow instabilities in order to prevent measuring inaccuracies, increased wear or damage.
- When selecting devices, pay close attention to the chemical resistance of the wetted parts of the device and the process connection gaskets in relation to the measuring medium.
- Avoid pulsating flow of the measuring medium. Use the optional float damping if necessary.
- For gaseous measuring media we recommend an undisturbed inlet length of five times the inside diameter of the piping in accordance with VDI / VDE Directive 3513 sheet 3. Additional measures such as flow straighteners or perforated plates may be necessary for highly unbalanced flow profiles.
- Avoid contamination of gaseous measuring media (refer to BGR 132-7.3.2.2.2).
- For liquid measuring media, the nominal diameter of the piping should be dimensioned as large as possible (if economically viable).
- Avoid gas inclusions in liquid measuring media.
- Use valves which open slowly.
- If the flowmeter is installed in a pipeline where decommissioning is impossible or inexpedient, a bypass line should be provided.
- Stop and throttle valves should preferably be attached to the outlet of the flowmeter.

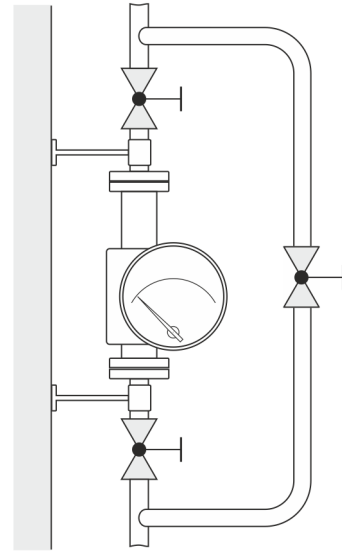


Figure 1: Installation of the flowmeter (example)

Refer to VDI/VDE Directive 3513 sheet 3, Selection and Installation Recommendations for Variable Area Flowmeters.

### Sensor insulation

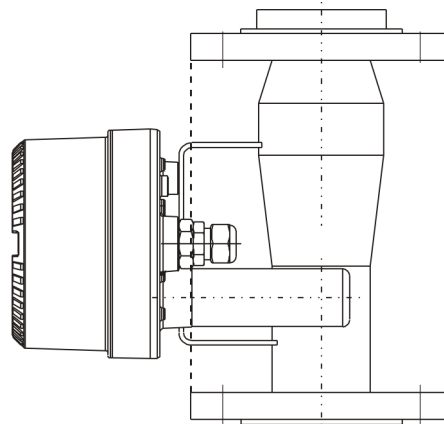


Figure 2: Insulation of the flowmeter

As shown in Figure 2, the flowmeter may only be insulated up to the flange diameter.

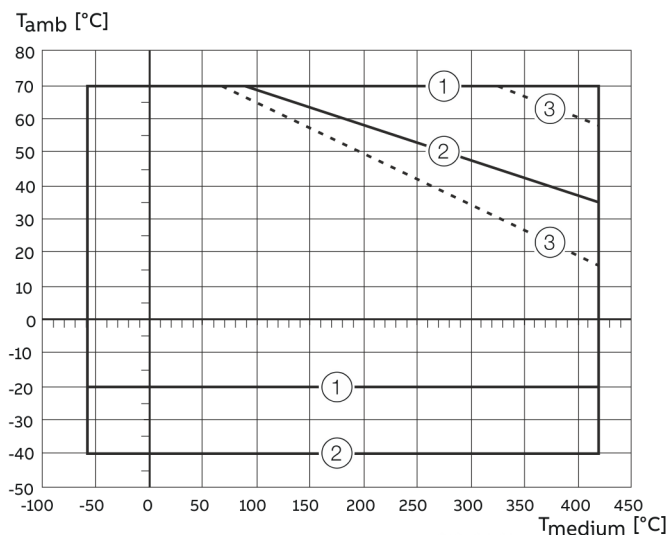
## Operating conditions

A variable area flowmeter is specified for a defined set of operating conditions of the measuring medium. 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 operating pressure and operating temperature. The specified accuracy of the device always refers to the operating conditions underlying the specification.

### Temperature Data

The following diagram shows the maximum permissible measuring medium temperature depending on the ambient temperature.



- ① Devices with alarm output  $-20$  to  $70$  °C ( $-4$  to  $158$  °F)
- ② Devices with current output  $-40$  to  $70$  °C ( $-40$  to  $158$  °F)
- ③ With insulation

Figure 3: Medium temperature ( $T_{\text{medium}}$ ), ambient temperature ( $T_{\text{amb}}$ )

### Note

When using in potentially explosive atmospheres, observe the temperature information in the ATEX / IECEx limit values starting from **Safety specifications ATEX / IECEx** on page 25 and the FM / cCSAus limit values tables starting from **Safety specifications FM, cCSAus** on page 34!

### Pressure loss

The available operating pressure at the measuring point must be higher than the pressure loss listed for the flowmeter in the specifications.

It is important to also consider the pressure loss downstream from the flowmeter due to losses in the piping and other fittings.

### Prevention of compression oscillations when measuring gases

During low flow amounts and low operating pressure, so-called compression oscillations of the float can occur. If the maximum upstream pressure listed in the specifications is not reached, the flowmeter can optionally be equipped with a gas damper.

To prevent self-generated compression oscillations, note the following information from VDI / VDE 3513 Sheet 3:

- Select a flowmeter with the lowest possible pressure loss.
- Minimize the piping length between the flowmeter and the nearest upstream or downstream throttling location.
- Set the limit of the regular measuring range from the usual 10 to 100 % to 25 to 100 %.
- When setting the flow rate value, always start by assuming larger values.
- Increase the operating pressure and consider its effect on the flow rate changes due to the change in gas density in the operating conditions.
- Minimize non-throttled, free volumes upstream and downstream of the device.

### Pressure shocks

Especially when measuring gases, it is possible that pressure or shock waves can occur when fast opening solenoid valves are employed and the piping cross-sections are not throttled, or if there are gas bubbles in liquids.

As a result of the sudden expansion of the gas in the piping, the float is forcibly driven against the upper floatstop. Under certain conditions, this can lead to destruction of the device.

Gas damping is not suited to compensating for pressure shocks!

## ... Introduction and basics

### Solids content in the measuring medium

Variable area flowmeters have only limited suitability for measuring media containing solids.

Depending on the concentration, particle size and type of solid, increased mechanical abrasion may occur, especially at the critical measuring edge of the float.

In addition, solidified deposits on the float can change its weight and shape.

These effects can lead to erroneous measurement results, depending on the float type.

In general, the use of appropriate filters is recommended in such applications.

For the flow measurement of measuring media containing magnetic particles, we recommend the installation of a magnetic separator upstream of the variable area flowmeter.

### Float designs

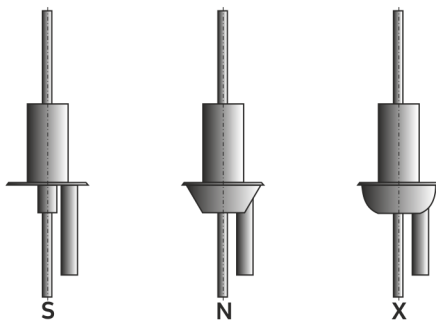


Figure 4: Float designs

#### Float 'S':

Basic shape of float.

Low flow rates, minimal pressure losses, essentially independent of viscosity; lower upstream pressure required for gas measurement.

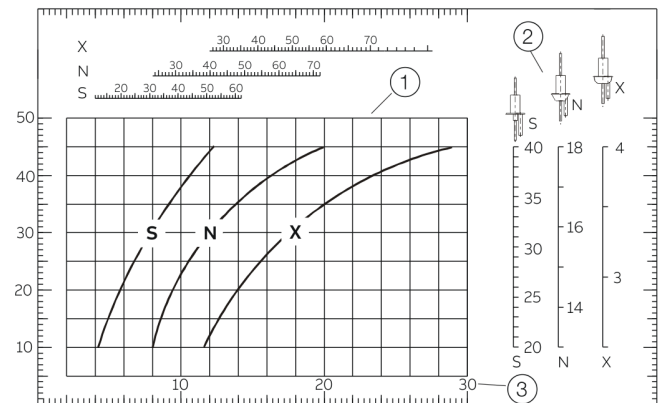
#### Float 'N':

Higher flow ranges, average pressure losses, well suited to liquids with minimum viscosity; higher minimum upstream pressure requirements for gas measurements.

#### Float 'X':

Highest flow rates, maximum pressure losses, well suited to liquids with minimum viscosity; higher minimum upstream pressure requirements for gas measurements.

### Measuring range limits



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

Figure 5: Flow rate depending on float shape and weight (example)

For measuring range limits depending on nominal size and float type, refer to the measuring range tables.

### Calculating the viscosity influence number (VIN)

The floats are designed geometrically so as to be independent of viscosity within broad limits. This means that the measuring medium viscosity can vary within these limits without resulting in a change of scale.

The viscosity influence number (VIN) is given in the device measuring range tables.

- If the calculated VIN is greater than the listed VIN, viscosity has no influence on the measured values.
- If the calculated VIN is greater than the listed viscosity, the flowmeters are equipped from the factory with a scale adjusted to the viscosity of the measuring medium.

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

#### Legend

$\eta$	Dynamic viscosity of the measuring medium [mPa s]
$\rho_s$	Density of the float in accordance with the selection in the measuring range table ( $r = 8.02 \text{ g/cm}^3$ )
$\rho_{s1}$	Density of the float being used
$\rho_1$	Density of the measuring medium

## Indicator and 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 pin.

For analog indicators, the flow value is shown by the indicator on the scale. For indicators with a two-wire transmitter, the indicator position is additionally 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 2 screws in a reproducible manner. To facilitate installation, the indicator can be removed. A name plate on the flowmeter bracket allows you to assign a unique identifier at a later date.

### Analog indicator with or without alarm signaling unit

The analog indicators are available with or without an alarm signaling unit. The alarm signaling units are housed on an alarm module that can also be retrofitted. It is available as a single (min. or max. alarm) or dual (min. or max. alarm) alarm module.

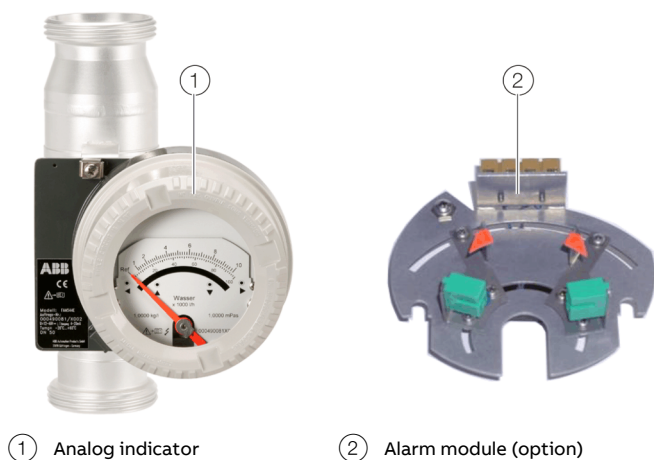


Figure 6: Analog indicator

### Product highlights

- Decouple-proof and hysteresis-free magnet follower system.
- The device conforms to NAMUR Recommendations NE43, NE53, NE107.
- The installation and disassembly of the analog indicator on the meter tube is possible without opening the indicator housing.
- Reading repeatability:  $\pm 0.25\%$  of scale end value.
- The alarm signaling unit can be retrofitted as an alarm module.
- The switching points of the alarm signaling units can be adjusted without removing the scale.
- The set switching points of the alarm signaling units are visible from the exterior.

### Alarm signaling unit

A switching amplifier is needed to operate the alarm signaling units.

See **Main ordering information FAM541** on page 41 for further information.

#### Alarm signaling unit specifications

Operating mode	bistable
Reproducibility	$\pm 0.5\%$ of scale end value
Nominal voltage	8 V DC (Ri approx. 1 k $\Omega$ )
Operating voltage	5 to 25 V DC
Switching frequency, max.	3 kHz

### Switching amplifier

For analog indicators with alarm signaling units (model FAM54xB/C/Dx)

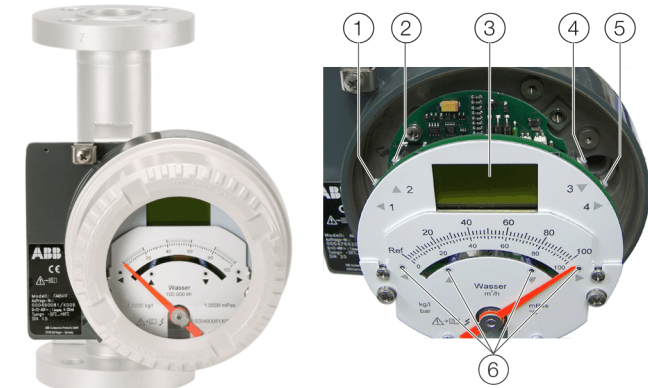
#### Specifications

Power supply	230 V AC, +10 % / -15 %, 45 to 60 Hz 115 V AC, +10 % / -15 %, 45 to 60 Hz 24 V DC, +10 % / -15 %
Output	One or two switching relays with potential-free changeover contacts
Switching capacity	Maximum 250 V, maximum 4 A, maximum 500 VA
Maximum permissible cable length	Between the switching amplifier and alarm signalling unit: 300 m (984 ft)
Permissible ambient temperature range	-20 to 60 °C (-4 to 140 °F)
Electrical connection	Screw terminals, maximum 2.5 mm <sup>2</sup> (14 AWG)
Type of assembly	35 mm top-hat rail in accordance with EN 60715:2001
IP rating	IP 20 in accordance with EN 60529
Weight	approx. 150 g (0.3 lb)

## ... Indicator and transmitter

### Analog indicator with transmitter

The electronic transmitter uses two-wire technology. An optional LCD indicator offers the possibility of adjusting on-site to changed measuring medium parameters. For models with an LCD indicator, ABB recommends that you use a bar graph scale to avoid differences between a product scale and the flow rate shown on the LCD indicator.



- |                 |                                     |
|-----------------|-------------------------------------|
| ① Button ◀      | ④ Button ▼                          |
| ② Button ▶      | ⑤ Button ▲                          |
| ③ LCD indicator | ⑥ Points for magnet stick operation |

Figure 7: LCD indicator with operating buttons and magnet stick markings

### Product highlights

- 4 to 20 mA current output.
- In the event of an alarm, current output can be adjusted to 21 to 23 mA (NAMUR NE43).
- Programmable binary output (min. / max. device alarm, general alarm or pulse output).
- Parameterization using HART communication via handheld terminal or DSV401 (SMART VISION).
- Damping: can be adjusted 1 to 100 s ( $5 \tau$ ).
- Low flow cut-off: 0 to 5 % for current and pulse output.
- Measuring medium parameters can be changed at any time (pressure and temperature influence, density, units, etc.).
- Simulation of current and binary output (manual process execution).
- EEPROM storage of counter readings and parameters specific to the measuring point (over 10 years).
- LCD indicator can be retrofitted.

### LCD Indicator

- High-contrast LCD indicator.
- Flow rate and flow totalizer value display.
- Plain text fault diagnostics
- Menu-guided parameterization with four buttons.
- Parameterization of the device using a magnet stick without opening the housing.



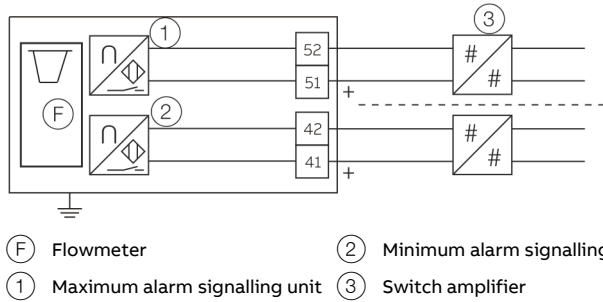
## Electrical connections

### Note

When using in potentially explosive atmospheres, observe the electrical data in the ATEX / IECEx limit value tables starting from **Safety specifications ATEX / IECEx** on page 25 and the FM / cCSAus limit value tables starting from **Safety specifications FM, cCSAus** on page 34!

### Analog indicator with alarm signaling unit

#### Model FAM54xB/C/Dx



- (F) Flowmeter
- (1) Maximum alarm signalling unit
- (2) Minimum alarm signalling unit
- (3) Switch amplifier

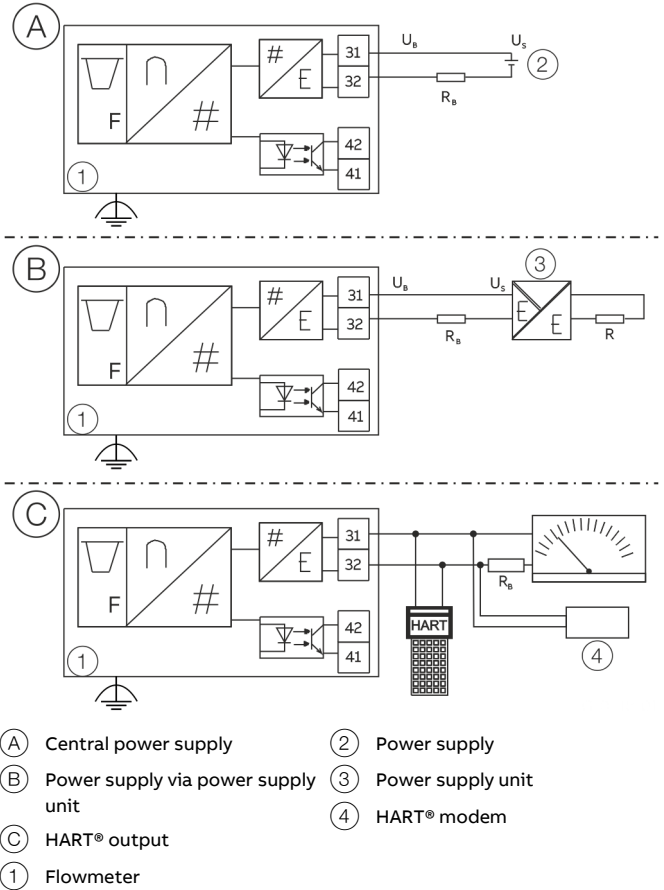
Figure 8: Alarm signalling unit

#### Alarm signaling unit specifications

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

### Analog indicator with transmitter

#### Model FAM54xE/Fx



- (A) Central power supply
- (B) Power supply via power supply unit
- (C) HART® output
- (1) Flowmeter
- (2) Power supply
- (3) Power supply unit
- (4) HART® modem

Figure 9: Analog indicator with transmitter

#### Legend

UB	Operating voltage
US	Input terminal voltage
RB	Maximum permissible load for power supply unit (e.g. indicator)
R	Maximum permissible load for output circuit; is determined by power supply unit
	Functional earth

## ... Electrical connections

### Cable

Maximum cable length 1500 m, AWG 24 twisted and shielded.

### Power supply / current output

Terminals 31 / 32 serve both as a connection for the power supply and as a 4 to 20 mA current output for the transmitter. The current output is also used for HART® communication.

#### Power supply

Terminals	31 / 32
Voltage	Standard: 10 to 46 V DC Explosion-proof design: 10 to 30 V DC.
Residual ripple	maximum 5 % or. $\pm 1.5$ Vss
Power consumption	< 1 W

#### Current output

Terminals	31 / 32
Output	4 to 20 mA, can be configured to 21 to 23 mA for an alarm (in accordance with NAMUR NE43)
Load	Minimum > 250 $\Omega$ , maximum 1500 $\Omega$ (for I at alarm = 23.0 mA)
At zero-point:	$\leq 8 \mu\text{A/K}$
Power consumption	< 1 W

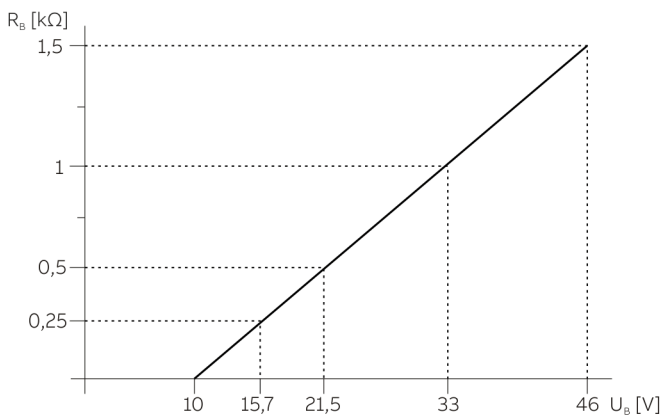


Figure 10: Current output load diagram

### HART output

#### Model FAM54xE/Fx

#### Specifications

Terminals	31 / 32
Configuration	<ul style="list-style-type: none"> <li>Directly on the device</li> <li>Using DAT200 Asset Vision Basic software and HART-DTM</li> </ul>
Transmission	FSK modulation on current output 4 to 20 mA in accordance with the Bell 202 standard
Baud rate	1200 baud
Display	Logic 1: 1200 Hz Logic 0: 2200 Hz
Maximum signal amplitude	1.2 mAss
Load (RB) at current output	250 to 1500 $\Omega$

See the separate interface description for detailed information.

#### System integration

In conjunction with the DTM (Device Type Manager) available for the device, the corresponding framework applications in accordance with FDT 0.98 or 1.2 (DAT200 Asset Vision Basic) can be used for communication (configuration, parameterization).

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

The necessary DTMs and other files can be downloaded from [www.abb.com/flow](http://www.abb.com/flow).

#### Programmable binary output

Terminals 41 / 42 are used as a primary programmable binary output. The pulse output, general alarm, min./max. alarm and general alarm functions, as well as "no function" can be configured using the software.

#### Binary output

Terminals	41 / 42
Output	<ul style="list-style-type: none"> <li>NAMUR contact (DIN 19234) or</li> <li>Standard optoelectronic coupler (UH = 16 to 30 V DC)</li> </ul>
Switching behavior	As normally closed or normally open contacts
Internal resistance	With contact open > 10 k $\Omega$
Switching current	Maximum 15 mA
Output Voltage	Minimum $U_s$ 2 V DC

#### Pulse output

Terminals	41 / 42
Pulse width	5 to 256 ms, maximum 50 % of the period
Frequency fmax	Maximum 50 Hz

## Model FAM541 - Standard design



Figure 11: Model FAM541

### Scale

Design optionally with percentage scale or product scale.

### Gas damping

Option, for preventing compression oscillations in case of gas measurements with low operating pressure.

### SIL approval

- SIL2 declaration of conformity for devices with alarm function.
- Manufacturer's declaration (SIL1) in accordance with IEC 61508 / IEC61511 for devices with a current output of 4 to 20 mA.

### Measuring accuracy

1.6 % qg = 50 % in accordance with VDE / VDI 3513, sheet 2, optional 1 % of upper range value.

### Measuring range limits and span limits

Measuring span: 10:1

For detailed information about measuring ranges, see

**Measuring range table** on page 13.

### Temperature limits °C (°F)

#### Medium temperature range

-55 to 400 °C (-67 to 752 °F)

#### Ambient temperature range

-40 to 85 °C (-40 to 185 °F)

### Note

- For use in potentially explosive atmospheres, observe the temperature information in the ATEX / IECEx limit values starting from **Safety specifications ATEX / IECEx** on page 25 and the FM / cCSAus limit values tables starting from **Safety specifications FM, cCSAus** on page 34!
- Additionally for specifications refer to **Temperature Data** on page 5!

### Process connections

- Flange in accordance with EN 1092-1 (PN 16, PN 40)
- Flange in accordance with DIN 2501 (PN 63, PN 100)
- Flange with groove in accordance with DIN 2501
- Flange in accordance with ASME B16.5
- Female thread G 1 in (½ in meter tube)
- Female thread G 1 ½ in (1 in meter tube)

### Pressure ratings

- Standard pressure rating PN 40
- Flange in accordance with DIN / EN: PN 16, PN 40, PN 63, PN 100
- Flange in accordance with ASME: CL 150, CL 300, CL 600

Other designs and pressure ratings are available upon request.

See also **Material load** on page 12.

### Maximum permissible operating pressure

64 bar, 100 bar, 160 bar, 250 bar

(CL 600 /CL 900 /CL 1500 / CL 2500)

## ... Model FAM541 - Standard design

### Materials

#### Materials for the indicator housing

Component	Material
Indicator housing	Standard: aluminum, powder-coated Option: stainless steel 1.4408
Powder coating	Epoxy paint 80 to 100 µm Bottom color: RAL 7012 Cover color: RAL 9002
Housing gasket (O-ring)	Buna N®
Sight glass	Shatterproof glass

#### Materials for wetted parts

Component	Material
Meter tube	Stainless steel 1.4404 (316 L)
Measuring element	Stainless steel 1.4571 (316 Ti), only DN 15 (½)
Flange	Stainless steel 1.4404 (316 L)
Variable area	Standard: stainless steel 1.4571 (316 Ti)
Gas damping (option)	Stainless steel 1.4571 (316 Ti)

### Material load

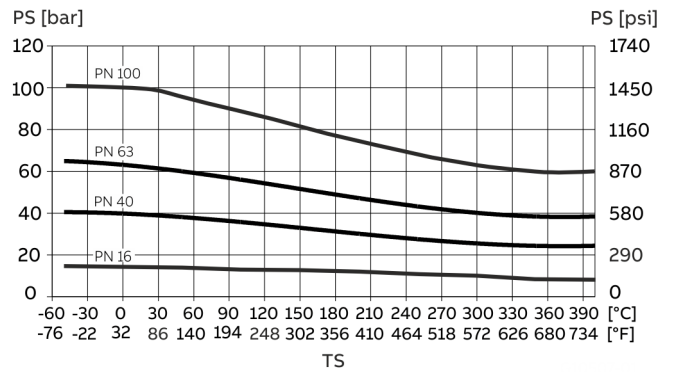


Figure 12: DIN flange made from stainless steel

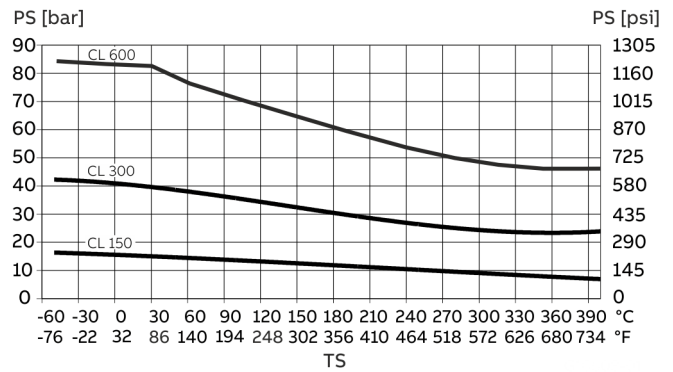


Figure 13: ASME flange made from stainless steel

## Measuring range table

### Note

The 'FlowCalc' program, which is available as a free download at [www.abb.com/flow](http://www.abb.com/flow) can be used to calculate flow rates, pressure losses, and upstream pressure requirements.

The data listed applies for water at 20 °C (68 °F), 1 kg/dm<sup>3</sup> (62.43 lb/ft<sup>3</sup>), 1 mPas (1 cP) and for air at 0 °C (70 °F), 1013 mbar (14.7 psia).

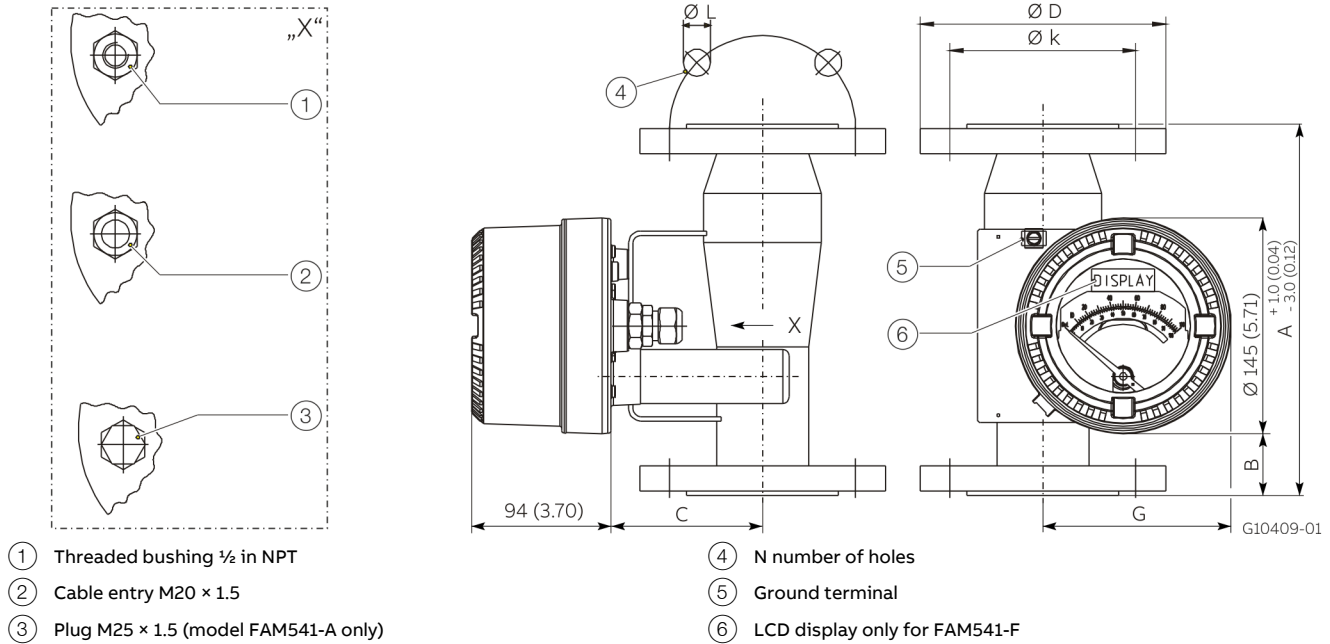
DN <sup>1</sup>	Upper range value <sup>2</sup> for		Meter tube / nominal flow rate H <sub>2</sub> O [l/h] / Order code <sup>3</sup>	VIN <sup>4</sup>	Pressure loss <sup>5</sup> [mbar (psi)]	Minimum upstream pressure for gas metering <sup>6</sup>	
	Water [l/h (USgal/h)]	Air [m <sup>3</sup> /h (scfh)]				Without gas damping [bar abs (psia)]	With gas damping <sup>7</sup> [bar abs (psia)]
DN 15 (½ in)	28 to 32 (7.4 to 8.5)	0.83 to 0.95 (37 to 45)	½ in / 30 / A78)	6	80 (1.16)	4.0 (58.02)	1.0 (14.5)
DN 25 (1 in)	37 to 43 (10 to 11.4)	1.10 to 1.28 (52 to 59)	½ in / 40 / B78)	6	80 (1.16)	4.0 (58.02)	1.0 (14.5)
G1 in	44 to 55 (11.6 to 14.5)	1.30 to 1.63 (54 to 66)	½ in / 50 / C78)	6	80 (1.16)	4.0 (58.02)	1.0 (14.5)
	56 to 64 (14.5 to 17)	1.66 to 1.90 (68 to 80)	½ in / 60 / D78)	6	80 (1.16)	4.0 (58.02)	1.0 (14.5)
	77 to 83 (20.5 to 21.5)	2.29 to 2.47 (84 to 90)	½ in / 80 / E7)	16	40 (0.58)	3.0 (43.51)	1.0 (14.5)
	96 to 104 (25.5 to 27)	2.85 to 3.09 (104 to 112)	½ in / 100 / F7)	16	45 (0.65)	3.2 (46.41)	1.0 (14.5)
	115 to 125 (30 to 33)	3.42 to 3.72 (125 to 135)	½ in / 120 / G7)	16	50 (0.73)	3.5 (50.76)	1.0 (14.5)
	144 to 156 (38 to 41)	4.28 to 4.64 (155 to 165)	½ in / 150 / H7)	16	60 (0.87)	3.8 (55.11)	1.0 (14.5)
	188 to 212 (50 to 56)	5.59 to 6.30 (205 to 230)	½ in / 200 / J7)	16	60 (0.87)	4.0 (58.02)	1.0 (14.5)
	235 to 265 (62 to 70)	6.98 to 7.88 (255 to 285)	½ in / 250 / K7)	16	65 (0.94)	4.2 (60.92)	1.0 (14.5)
	282 to 318 (74 to 84)	8.38 to 9.45 (310 to 340)	½ in / 300 / L7)	16	70 (1.02)	4.4 (63.82)	1.0 (14.5)
	376 to 424 (100 to 112)	11.17 to 12.60 (410 to 460)	½ in / 400 / M7)	16	75 (1.09)	4.6 (66.72)	1.0 (14.5)
470 to 530 (125 to 140)	13.97 to 15.75 (510 to 570)	½ in / 500 / N7)	16	75 (1.09)	4.8 (69.62)	1.0 (14.5)	
565 to 635 (150 to 165)	16.79 to 18.87 (620 to 680)	½ in / 600 / P7)	16	80 (1.16)	5.0 (72.52)	1.0 (14.5)	
750 to 850 (200 to 220)	22.29 to 25.26 (820 to 920)	½ in / 800 / R7)	16	85 (1.23)	5.4 (78.32)	1.0 (14.5)	

## ... Model FAM541 - Standard design

DN <sup>1</sup>	Upper range value <sup>2</sup> for		Meter tube / nominal flow rate H <sub>2</sub> O [l/h] / Order code <sup>3</sup>	VIN <sup>4</sup>	Pressure loss <sup>5</sup> [mbar (psi)]	Minimum upstream pressure for gas metering <sup>6</sup>	
	Water [l/h (USgal/h)]	Air [m <sup>3</sup> /h (scfh)]				Without gas damping [bar abs (psia)]	With gas damping <sup>7</sup> [bar abs (psia)]
DN 25 (1 in) G1 ½ in	280 to 656 (74 to 170)	8.32 to 19.50 (310 to 700)	1 in / 400 / A1	13 to 21	20 to 76 (0.3 to 1.1)	2.9 to 3.1 (42.1 to 45.0)	1.1 to 1.4 (16.0 to 20.3)
	393 to 870 (104 to 220)	11.70 to 25.85 (430 to 940)	1 in / 600 / B1	7 to 10	27 to 76 (0.4 to 1.1)	3.0 to 3.4 (43.5 to 49.3)	1.2 to 1.4 (17.4 to 20.3)
	660 to 1600 (170 to 450)	19.38 to 50.80 (720 to 1850)	1 in / 1000 / C1	16 to 22	20 to 76 (0.3 to 1.1)	3.3 to 4.3 (48.0 to 62.4)	1.1 to 1.4 (16.0 to 20.3)
	975 to 2370 (260 to 620)	28.98 to 70.44 (1060 to 2550)	1 in / 1600 / D1	8 to 10	27 to 82 (0.4 to 1.2)	3.3 to 5.3 (48.0 to 77.0)	1.2 to 1.5 (17.4 to 21.8)
	1650 to 4020 (440 to 1060)	49.04 to 119.50 (1800 to 4300)	1 in / 2500 / E1	17 to 6	20 to 76 (0.3 to 1.1)	4.2 to 6.4 (61.0 to 92.8)	1.1 to 1.4 (16.0 to 20.3)
	2585 to 6170 (680 to 1600)	76.83 to 183.50 (2800 to 6600)	1 in / 4000 / F1	8 to 10	27 to 82 (0.4 to 1.2)	5.2 to 8.0 (75.4 to 116)	1.2 to 1.5 (17.4 to 21.8)
	4220 to 12130 (1120 to 3200)	125.40 to 360.50 (4600 to 13000)	2 in / 8000 / A2	21 to 38	11 to 62 (0.2 to 0.9)	3.1 to 4.5 (45.0 to 65.3)	1.1 to 1.4 (16.0 to 20.3)
DN 50 (2 in)	7940 to 18460 (2100 to 4800)	236.0 to 584.6 (8600 to 20000)	2 in / 12000 / B2	13 to 17	24 to 74 (0.3 to 1.1)	3.8 to 6.2 (55.1 to 90.0)	1.1 to 1.4 (16.0 to 20.3)
	11760 to 24200 (3100 to 6400)	349.50 to 720.00 (13000 to 27000)	2 in / 18000 / C2	3 to 4	28 to 72 (0.4 to 1.0)	4.4 to 7.5 (63.8 to 109)	1.1 to 1.4 (16.0 to 20.3)
DN 80 (3 in)	7000 to 21010 (1850 to 5500)	208.00 to 624.40 (7600 to 22000)	3 in / 12000 / A3	22 to 54	6 to 48 (0.1 to 0.7)	3.4 to 5.4 (49.3 to 78.3)	1.1 to 1.3 (16.0 to 18.9)
	18090 to 35010 (4800 to 9200)	537.70 to 1040 (19500 to 38000)	3 in / 25000 / B3	18 to 25	24 to 65 (0.3 to 1.0)	4.8 to 7.4 (69.6 to 107)	1.1 to 1.4 (16.0 to 20.3)
	29750 to 53810 (7000 to 14000)	795 to 1600 (29000 to 58000)	3 in / 40000 / C3	4 to 5	26 to 68 (0.4 to 1.0)	6.0 to 9.2 (87.0 to 133)	1.1 to 1.4 (16.0 to 20.3)

- 1 Connection nominal diameter
- 2 The upper range value can be selected anywhere within these limits. The measuring span is 10:1.  
Example: upper range value 12 m<sup>3</sup>/h (USgal/h) water, measuring span of the device 1.2 to 12 m<sup>3</sup>/h (USgal/h) water.
- 3 Order code for meter tube / float construction (versions 18, 19), see **Main ordering information FAM541** on page 41.
- 4 Viscosity influence number (VIN), see **Calculating the viscosity influence number (VIN)** on page 6.
- 5 The listed pressure loss values are based on the respective upper range value.
- 6 The minimum required static pressure (abs) to prevent compression oscillations (float bounce) in the meter tube. The specifications for the minimum required pressures with and without damping are based on average installation conditions. Some installations may have higher values (high free volume upstream / downstream of the device).
- 7 These meter tube / float combinations always require gas piston damping for gas measurements.

**Dimensions**



**Figure 14: Dimensions for flange devices in mm (in), tolerances ±2 mm**

Meter size	Pressure rating	DN	Ø D [mm (in)]	Ø k [mm (in)]	Ø L [mm (in)]	N	A [mm (in)]	C [mm (in)]	G [mm (in)]
½ in	PN 40	DN 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)
	PN 63 / 100		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)
1 in	CL 150	½ in	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		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		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)
	PN 40	DN 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)
2 in	PN 63 / 100		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 in	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		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		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)
	PN 40	DN 40	150 (5.91)	110 (4.33)	18.0 (0.71)	4	250.0 (9.84)	102.0 (4.02)	130.0 (5.12)
	PN 63		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)
2 in	PN 100	DN 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)
	CL 150	2 in	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		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		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)

## ... Model FAM541 - Standard design

Meter size	Pressure rating	DN	Ø D [mm (in)]	Ø k [mm (in)]	Ø L [mm (in)]	N	A [mm (in)]	C [mm (in)]	G [mm (in)]	
3 in	PN 40	DN 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)	
			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)	
			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 in	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	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	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)

### Overall length for devices with female thread connectors

Process connection	Installation length [mm (in)]
Female thread 1 in	296 (11.65)
Female thread 1 ½ in	304 (11.97)

### Weight in kg (lb)

Indicator housing material	Device size (meter tube)			
	DN 15 (½ in)	DN 25 (1 in)	DN 50 (2 in)	DN 80 (3 in)
Al Si 12	4.5 / (9.9)	5.8 / (12.8)	9.5 / (20.9)	15.7 / (34.6)
Stainless steel 1.4408	7.0 / (15.4)	8.3 / (18.3)	12.0 / (26.4)	18.2 / (40.1)



## Model FAM544 - hygienic design



Figure 15: Model FAM544 in hygienic design

This model has been specially constructed with threaded connections in accordance with DIN 11851 to meet the more stringent hygienic requirements of the food and beverage industry in respect of biological cleaning. All parts of the flowmeter that come into contact with the measuring medium are welded and polished. There are no gaps or other empty areas. The device is suitable for cleaning or sterilization with steam, acids and alkali. The device is also CIP-cleanable.

### Scale

Design optionally with percentage scale or product scale.

### Gas damping

Not available.

### SIL approval

- SIL2 declaration of conformity for devices with alarm function.
- Manufacturer's declaration (SIL1) in accordance with IEC 61508 / IEC 61511 for devices with a current output of 4 to 20 mA.

### Measuring accuracy

1.6 % qg = 50 % in accordance with VDE / VDI 3513, sheet 2, optional 1 % of upper range value.

### Measuring range limits and span limits

Measuring span: 10:1

For detailed information about measuring ranges, see

**Measuring range table** on page 19.

### Temperature limits °C (°F)

#### Medium temperature range

-55 to 400 °C (-67 to 752 °F)

#### Ambient temperature range

-40 to 85 °C (-40 to 185 °F)

### Note

- For use in potentially explosive atmospheres, observe the temperature information in the ATEX / IECEx limit values starting from **Safety specifications ATEX / IECEx** on page 25 and the FM / cCSAus limit values tables starting from **Safety specifications FM, cCSAus** on page 34!
- Additionally for specifications refer to **Temperature Data** on page 5!

### Process connections

- Threaded spud in accordance with DIN 11851 (SC 25 to SC 80)
- Threaded spud in accordance with SMS 1145 (DN 38 to DN 76)

### Connection dimensions

Nominal diameter	Measuring tube sizes	SMS 1145	DIN 11851
DN 25	½ in	SC 25	—
DN 40	1 in	SC 40	DN 38
DN 50	2 in	SC 50	DN 51
DN 80	3 in	SC 80	DN 76

### Pressure ratings

Threaded spuds in accordance with DIN 11851:

- PN 25 for DN 50 to DN 80 (2 to 3 in)
- PN 40 for DN 25 to DN 40 (1 to 1 ½ in)

Threaded spud in accordance with DIN 1145:

- PN 6 for (DN 38 to DN 76)

See also **Material load** on page 18.

### Maximum permissible operating pressure

Refer to **Material load** on page 18.

## ... Model FAM544 - hygienic design

### Materials

#### Materials for the indicator housing

Component	Material
Indicator housing	Standard: aluminum, powder-coated Option: stainless steel 1.4408
Powder coating	Epoxy paint 80 to 100 µm Bottom color: RAL 7012 Cover color: RAL 9002
Housing gasket (O-ring)	Buna N®
Sight glass	Shatterproof glass

#### Materials for wetted parts

Component	Material
Meter tube	Stainless steel 1.4404 (316 L)
Measuring element	Stainless steel 1.4571 (316 Ti), DN 15 (½ in) only
Variable area	Stainless steel 1.4571 (316 Ti)

### Material load

Process connection	Nominal diameter	PSmax	TSmin	TSmax
DIN 11851	DN 15 to DN 40 (½ to 1 ½ in)	40 bar (580 psi)	-40 °C (-40 °F)	140 °C (284 °F)
	DN 50 to 80 (2 to 3 in)	25 bar (362 psi)	-40 °C (-40 °F)	140 °C (284 °F)
SMS 1145	DN 38 to 76 (1 ½ to 3 in)	6 bar (87 psi)	-40 °C (-40 °F)	140 °C (284 °F)

## Measuring range table

### Note

The 'FlowCalc' program, which is available as a free download at [www.abb.com/flow](http://www.abb.com/flow) can be used to calculate flow rates, pressure losses, and upstream pressure requirements.

The data listed applies for water at 20 °C (68 °F), 1 kg/dm<sup>3</sup> (62.43 lb/ft<sup>3</sup>), 1 mPas (1 cP) and for air at 0 °C (70 °F), 1013 mbar (14.7 psia).

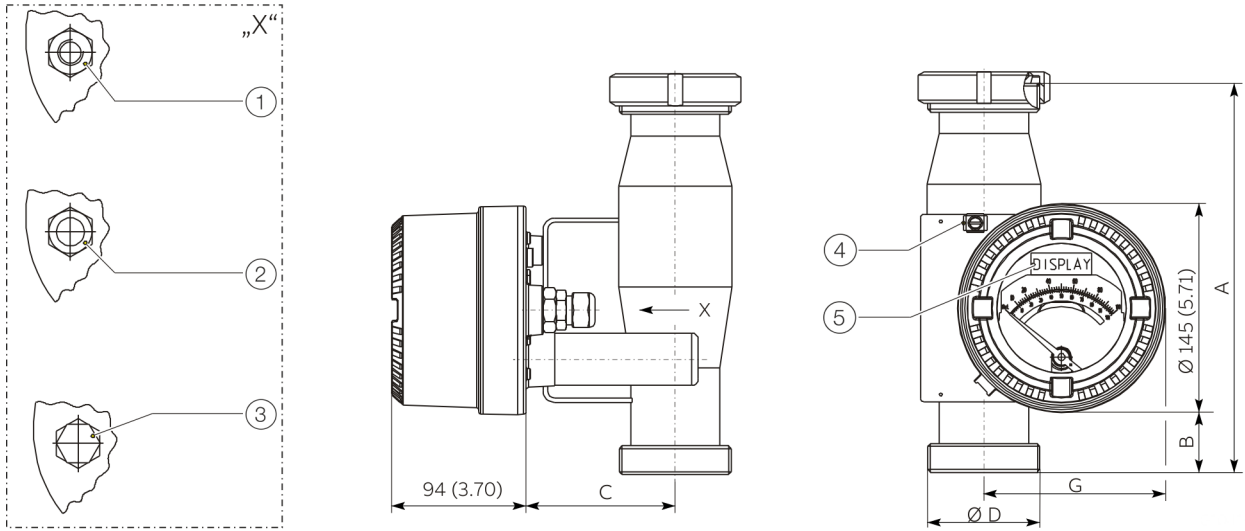
DN <sup>1</sup>	Upper range value <sup>2</sup> for		Meter tube / nominal flow rate H <sub>2</sub> O [l/h] / Order code <sup>3</sup>	VIN <sup>4</sup>	Pressure loss <sup>5</sup> [mbar (psi)]	Minimum upstream pressure for gas metering <sup>6</sup> [bar abs (psia)]	
	Water [l/h (USgal/h)]	Air [m <sup>3</sup> /h (scfh)]					
DN 25 (1 in <sup>7</sup> )	28 to 32 (7.4 to 8.5)	—	½ in / 30 / A7	6	80 (1.16)	—	
	37 to 43 (10 to 11.4)	—	½ in / 40 / B7	6	80 (1.16)	—	
	44 to 55 (11.6 to 14.5)	—	½ in / 50 / C7	6	80 (1.16)	—	
	56 to 64 (14.5 to 17)	—	½ in / 60 / D7	6	80 (1.16)	—	
	77 to 83 (20.5 to 21.5)	2.29 to 2.47 (84 to 90)	—	½ in / 80 / E7	16	40 (0.58)	3.0 (43.51)
	96 to 104 (25.5 to 27)	2.85 to 3.09 (104 to 112)	—	½ in / 100 / F7	16	45 (0.65)	3.2 (46.41)
	115 to 125 (30 to 33)	3.42 to 3.72 (125 to 135)	—	½ in / 120 / G7	16	50 (0.73)	3.5 (50.76)
	144 to 156 (38 to 41)	4.28 to 4.64 (155 to 165)	—	½ in / 150 / H7	16	60 (0.87)	3.8 (55.11)
	188 to 212 (50 to 56)	5.59 to 6.30 (205 to 230)	—	½ in / 200 / J7	16	60 (0.87)	4.0 (58.02)
	235 to 265 (62 to 70)	6.98 to 7.88 (255 to 285)	—	½ in / 250 / K7	16	65 (0.94)	4.2 (60.92)
	282 to 318 (74 to 84)	8.38 to 9.45 (310 to 340)	—	½ in / 300 / L7	16	70 (1.02)	4.4 (63.82)
	376 to 424 (100 to 112)	11.17 to 12.60 (410 to 460)	—	½ in / 400 / M7	16	75 (1.09)	4.6 (66.72)
	470 to 530 (125 to 140)	13.97 to 15.75 (510 to 570)	—	½ in / 500 / N7	16	75 (1.09)	4.8 (69.62)
	565 to 635 (150 to 165)	16.79 to 18.87 (620 to 680)	—	½ in / 600 / P7	16	80 (1.16)	5.0 (72.52)
	750 to 850 (200 to 220)	22.29 to 25.26 (820 to 920)	—	½ in / 800 / R7	16	85 (1.23)	5.4 (78.32)

## ... Model FAM544 - hygienic design

DN <sup>1</sup>	Upper range value <sup>2</sup> for		Meter tube / nominal flow rate H <sub>2</sub> O [l/h] / Order code <sup>3</sup>	VIN <sup>4</sup>	Pressure loss <sup>5</sup> [mbar (psi)]	Minimum upstream pressure for gas metering <sup>6</sup> [bar abs (psia)]
	Water [l/h (USgal/h)]	Air [m <sup>3</sup> /h (scfh)]				
DN 40 (1 ½ in)	280 to 656 (74 to 170)	8.32 to 19.50 (310 to 700)	1 in / 400 / A1	13 to 21	20 to 76 (0.3 to 1.1)	2.9 to 3.1 (42.1 to 45.0)
	393 to 870 (104 to 220)	11.70 to 25.85 (430 to 940)	1 in / 600 / B1	7 to 10	27 to 76 (0.4 to 1.1)	3.0 to 3.4 (43.5 to 49.3)
	660 to 1600 (170 to 450)	19.38 to 50.80 (720 to 1850)	1 in / 1000 / C1	16 to 22	20 to 76 (0.3 to 1.1)	3.3 to 4.3 (48.0 to 62.4)
	975 to 2370 (260 to 620)	28.98 to 70.44 (1060 to 2550)	1 in / 1600 / D1	8 to 10	27 to 82 (0.4 to 1.2)	3.3 to 5.3 (48.0 to 77.0)
	1650 to 4020 (440 to 1060)	49.04 to 119.50 (1800 to 4300)	1 in / 2500 / E1	17 to 6	20 to 76 (0.3 to 1.1)	4.2 to 6.4 (61.0 to 92.8)
	2585 to 6170 (680 to 1600)	76.83 to 183.50 (2800 to 6600)	1 in / 4000 / F1	8 to 10	27 to 82 (0.4 to 1.2)	5.2 to 8.0 (75.4 to 116)
	4220 to 12130 (1120 to 3200)	125.40 to 360.50 (4600 to 13000)	2 in / 8000 / A2	21 to 38	11 to 62 (0.2 to 0.9)	3.1 to 4.5 (45.0 to 65.3)
DN 50 (2 in)	7940 to 18460 (2100 to 4800)	236.0 to 584.6 (8600 to 20000)	2 in / 12000 / B2	13 to 17	24 to 74 (0.3 to 1.1)	3.8 to 6.2 (55.1 to 90.0)
	11760 to 24200 (3100 to 6400)	349.50 to 720.00 (13000 to 27000)	2 in / 18000 / C2	3 to 4	28 to 72 (0.4 to 1.0)	4.4 to 7.5 (63.8 to 109)
	7000 to 21010 (1850 to 5500)	208.00 to 620 (7600 to 22000)	3 in / 12000 / A3	22 to 54	6 to 48 (0.1 to 0.7)	3.4 to 5.4 (49.3 to 78.3)
DN 80 (3 in)	18090 to 35010 (4800 to 9200)	537.70 to 1040 (19500 to 38000)	3 in / 25000 / B3	18 to 25	24 to 65 (0.3 to 1.0)	4.8 to 7.4 (69.6 to 107)
	29750 to 53810 (7000 to 14000)	795 to 1550 (29000 to 58000)	3 in / 40000 / C3	4 to 5	26 to 68 (0.4 to 1.0)	6.0 to 9.2 (87.0 to 133)

- 1 Connection nominal diameter
- 2 The upper range value can be selected anywhere within these limits. The measuring span is 10:1.  
Example: upper range value 12 m<sup>3</sup>/h (USgal/h) water, measuring span of the device 1.2 to 12 m<sup>3</sup>/h (USgal/h) water.
- 3 Order code for meter tube / float construction (versions 18, 19), see **Main ordering information FAM544** on page **Fehler! Textmarke nicht definiert..**
- 4 Viscosity influence number (VIN), see **Calculating the viscosity influence number (VIN)** on page 6.
- 5 The listed pressure loss values are based on the respective flow rate end value.
- 6 The minimum required static pressure (abs) to prevent compression oscillations (float bounce) in the meter tube. The specifications for the minimum required pressures are based on average installation conditions. Some installations may have higher values (high free volume upstream / downstream of the device).
- 7 Only for threaded spuds in accordance with DIN 11851

**Dimensions**



- ① Threaded bushing 1/2 in NPT
- ② Cable entry M20 x 1.5
- ③ Plug M25 x 1.5 (model FAM541-A only)
- ④ Ground terminal
- ⑤ LCD display only for FAM541-F

Figure 16: Dimensions in mm (in), tolerances ±2 mm

**Dimensions for devices with threaded spuds in accordance with DIN 11851**

Meter size	DN [mm (in)]	Pressure rating	Ø D	A* [mm (in)]	B [mm (in)]	C [mm (in)]	G [mm (in)]
1/2 in	25 (1 in)	PN 40	Rd 52 x 1/8 in	270.0 (10.63)	51.5 (2.03)	87.0 (3.43)	118.0 (4.65)
1 in	40 (1 1/2 in)	PN 40	Rd 65 x 1/8 in	270.0 (10.63)	51.5 (2.03)	87.0 (3.43)	118.0 (4.65)
2 in	50 (2 in)	PN 25	Rd 78 x 1/8 in	270.0 (10.63)	51.5 (2.03)	102.0 (4.02)	130.0 (5.12)
3 in	80 (3 in)	PN 25	Rd 110 x 1/8 in	272.0 (10.71)	52.5 (2.07)	132.0 (5.20)	144.0 (5.67)

\* Dimension A: design with threaded spud DIN 11851

Dimension M: hygienic design with threaded spud in accordance with DIN 11851 (available upon request)

## ... Model FAM544 - hygienic design

### Dimensions for devices with threaded spuds in accordance with SMS 1145

Meter size	DN [mm]	Pressure rating	Ø D	A [mm (in)]	B [mm (in)]	C [mm (in)]	G [mm (in)]
1 in	38	PN 6	Rd 60 × 1/8 in	300.0 (11.81)	66.5 (2.62)	87.0 (3.43)	118.0 (4.65)
2 in	51		Rd 70 × 1/8 in			102.0 (4.02)	130.0 (5.12)
3 in	76		Rd 98 × 1/8 in			132.0 (5.20)	144.0 (5.67)

### Weight in kg (lb)

Indicator housing material	Device size (meter tube)			
	DN 15 (1/2 in)	DN 25 (1 in)	DN 50 (2 in)	DN 80 (3 in)
Al Si 12	4.5 (9.9)	5.8 (12.8)	9.0 (19.8)	15.7 (34.6)
Stainless steel 1.4408	7.0 (15.4)	8.3 (18.3)	11.5 (25.3)	18.2 (40.1)

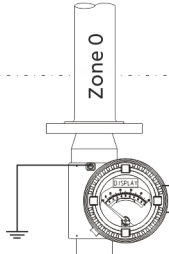
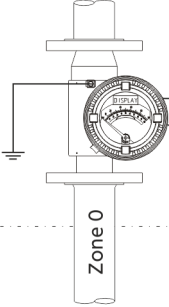
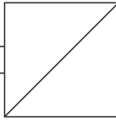
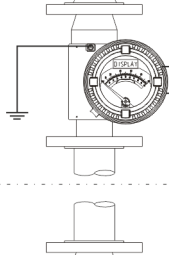
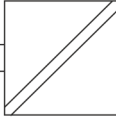
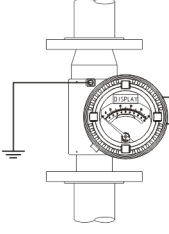
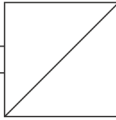
## Use in potentially explosive atmospheres in accordance with ATEX and IECEx


### Note

Further information on the approval of devices for use in potentially explosive atmospheres can be found in the type examination certificates or the relevant certificates at [www.abb.com/flow](http://www.abb.com/flow).

### Device overview

The devices are designed for maximum versatility. This is achieved through a combination of several types of protection within each device. All devices are suitable for use in potentially explosive atmospheres with combustible dust. For detailed installation instructions and terminal assignments, refer to **Electrical connections** on page 9.

Zone 1	Zone 2	Standard / No explosion protection	Order code*			
			<table border="1"> <tr> <td data-bbox="1203 685 1294 920">B1 (Ex ec)</td> <td data-bbox="1294 685 1385 920">A4 (Ex ia, Ex ec)</td> <td data-bbox="1385 685 1484 920"></td> </tr> </table>	B1 (Ex ec)	A4 (Ex ia, Ex ec)	
B1 (Ex ec)	A4 (Ex ia, Ex ec)					
			<table border="1"> <tr> <td data-bbox="1203 920 1294 1155"></td> <td data-bbox="1294 920 1385 1155"></td> <td data-bbox="1385 920 1484 1155">A9 (Ex ec, Ex ia, Ex d)</td> </tr> </table>			A9 (Ex ec, Ex ia, Ex d)
		A9 (Ex ec, Ex ia, Ex d)				
			<table border="1"> <tr> <td data-bbox="1203 1155 1294 1400"></td> <td data-bbox="1294 1155 1385 1400"></td> <td data-bbox="1385 1155 1484 1400"></td> </tr> </table>			

 Potential equalization

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

## ... Use in potentially explosive atmospheres in accordance with ATEX and IECEx

### Ex marking

#### Note

- Depending on the design, a specific marking in accordance with ATEX or IECEx applies.
- ABB reserves the right to modify the Ex-marking. Refer to the name plate for the exact marking.

#### Model FAM54xAx (analog indicator without alarm signaling unit)

Marking	Type of protection	Order code*	Limit value table
ATEX II 1/2 G Ex h T6 ... T1 Gb	Constructional safety	A4, A9, B1	Table 5 on page 30
II 2 D Ex h T85°C ... Tmedium Db	Constructional safety		
II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

#### Model FAM54xB/C/Dx (analog indicator with alarm signaling unit)

Marking	Type of protection	Order code*	Limit value table
ATEX II 1/2 G Ex h ia IIC T6 ... T1 Ga/Gb	Intrinsically Safe	A4	Table 2 on page 27
II 1/3 G Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials		Table 4 on page 29
II 2D Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 2 on page 27, Table 4 on page 29
IECEx Ex h ia IIC T6 ... T1 Ga/Gb	Intrinsically Safe		Table 2 on page 27
Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials		Table 4 on page 29
Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 2 on page 27, Table 4 on page 29
ATEX II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb	Flameproof / Explosion-Proof	A9	Table 3 on page 28
II 1/2 G Ex h ia IIC T6 ... T1 Ga/Gb	Intrinsically Safe		Table 2 on page 27
II 1/3 G Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials		Table 4 on page 29
II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 2 on page 27, Table 3 on page 28, Table 4 on page 29
IECEx Ex db h IIC T6 ... T1 Ga/Gb	Flameproof / Explosion-Proof		Table 3 on page 28
Ex h ia IIC T6 ... T1 Ga/Gb	Intrinsically Safe		Table 2 on page 27
Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials		Table 4 on page 29
Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 2 on page 27, Table 3 on page 28, Table 4 on page 29
ATEX II 1/3 G Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials	B1	Table 4 on page 29
II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 4 on page 29
IECEx Ex ec h IIC T6 ... T1 Ga/Gc	Non-sparking materials		Table 4 on page 29
Ex h tb IIIC T85°C ... Tmedium Db	Dust-explosion protection		Table 4 on page 29

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.



<b>Model FAM54xE/Fx (analog indicator with transmitter and with or without LCD indicator)</b>				
<b>Marking</b>		<b>Type of protection</b>	<b>Order code*</b>	<b>Limit value table</b>
<b>ATEX</b>	II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb	Intrinsically Safe	A4	Table 1 on page 26
	II 1/3 G Ex ec h ic T6 ... T1Ga/Gc	Non-sparking materials		
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
<b>IECEX</b>	Ex h ia IIC T4 ... T1 Ga/Gb	Intrinsically Safe		
	Ex ec h ic IIC T6 ... T1Ga/Gc	Non-sparking materials		
	Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
<b>ATEX</b>	II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb	Flameproof / Explosion-Proof	A9	Table 1 on page 26
	II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb	Intrinsically Safe		
	II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc	Non-sparking materials		
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
<b>IECEX</b>	Ex db h IIC T6 ... T1 Ga/Gb	Flameproof / Explosion-Proof		
	Ex h ia IIC T4 ... T1 Ga/Gb	Intrinsically Safe		
	Ex ec h ic IIC T6 ... T1 Ga/Gc	Non-sparking materials		
	Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
<b>ATEX</b>	II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc	Non-sparking materials	B1	Table 4 on page 29
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
<b>IECEX</b>	Ex ec h ic IIC T6 ... T1 Ga/Gc	Non-sparking materials		
	Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

## Safety specifications ATEX / IECEX

### Special conditions for type of protection 'Ex td' (dust explosion protection)

#### Model FAM54xB/C/D/E/Fx

The following differing temperature data applies to usage in areas with combustible dust.

<b>Order code</b>	<b>Ambient temperature <math>T_{amb}</math></b>	<b>Maximum permissible measuring medium temperature <math>T_{medium}</math></b>
A4, A9, B1	-50 °C to +60 °C	250 °C
	-50 °C to +40 °C	340 °C
	-50 °C to +20 °C	430 °C

## ... Use in potentially explosive atmospheres in accordance with ATEX and IECEx

**Table 1: Analog indicator with transmitter, with / without LCD indicator**

### Model FAM54xE/Fx

Type of protection: flameproof enclosure, intrinsic safety, non-sparking equipment, dust explosion protection.

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation
				-20 °C to (-50 °C to)		Maximum	
A4, A9	<b>ATEX:</b> II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb II 1/3 G Ex ec h ic T6 ... T1Ga/Gc II 2 D Ex h tb IIIC T85°C ... Tmedium Db	31 / 32**	U <sub>i</sub> = 30 V	40 °C	T1	440 °C	No
			I <sub>i</sub> = 110 mA	40 °C	T1	375 °C	yes
			P <sub>i</sub> = 770 mW	40 °C	T1	260 °C	yes
			C <sub>i</sub> = 5.3 nF	50 °C	T1	300 °C	yes
			L <sub>i</sub> = 266 µH	50 °C	T2	290 °C	yes
	<b>IECEx:</b> Ex h ia IIC T4 ... T1 Ga/Gb Ex ec h ic IIC T6 ... T1Ga/Gc Ex h tb IIIC T85°C ... Tmedium Db	41 / 42**	U <sub>i</sub> = 30 V	50 °C	T2	220°C	yes
			I <sub>i</sub> = 30 mA	60 °C	T2	320 °C	No
			P <sub>i</sub> = 115 mW	60 °C	T3	230 °C	yes
			C <sub>i</sub> = 4.8 nF	60 °C	T3	170 °C	yes
			L <sub>i</sub> = 133 µH	70 °C	T3	195 °C	No
A9	<b>ATEX:</b> II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc II 2 D Ex h tb IIIC T85°C ... Tmedium Db	31 / 32***	U <sub>max</sub> = 46 V	40 °C	T1	440 °C	No
				40 °C	T1	375 °C	yes
				40 °C	T1	260 °C	yes
				50 °C	T1	300 °C	yes
				50 °C	T2	290 °C	yes
	<b>IECEx:</b> Ex db h IIC T6 ... T1 Ga/Gb Ex h ia IIC T4 ... T1 Ga/Gb Ex ec h ic IIC T6 ... T1 Ga/Gc Ex h tb IIIC T85°C ... Tmedium Db	41 / 42***	U <sub>max</sub> = 30 V	60 °C	T2	320 °C	No
			I <sub>max</sub> = 30 mA	60 °C	T2	230 °C	yes
			P <sub>max</sub> = 115 mW	60 °C	T3	170 °C	yes
				60 °C	T4	130 °C	yes
				60 °C	T5	95 °C	yes
A4, A9, B1	<b>ATEX:</b> II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc II 2 D Ex h tb IIIC T85°C ... Tmedium Db	31 / 32***	U <sub>max</sub> = 46 V	60 °C	T6	80 °C	yes
				40 °C	T1	440 °C	No
				40 °C	T1	375 °C	yes
				40 °C	T1	260 °C	yes
				50 °C	T1	300 °C	yes
	<b>IECEx:</b> Ex ec h ic IIC T6 ... T1 Ga/Gc Ex h tb IIIC T85°C ... Tmedium Db	41 / 42***	U <sub>max</sub> = 30 V	50 °C	T2	290 °C	yes
			I <sub>max</sub> = 30 mA	50 °C	T2	220°C	yes
			P <sub>max</sub> = 115 mW	60 °C	T2	320 °C	No
				60 °C	T2	230 °C	yes
				60 °C	T3	170 °C	yes
	70 °C	T3	195 °C	No			
	70 °C	T3	150 °C	yes			
	70 °C	T4	130 °C	yes			

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* for connection to an intrinsically safe circuit

\*\*\* for connection to a non-intrinsically safe circuit If the device is to be operated subsequently with type of protection "intrinsically safe", then U<sub>max</sub> = 60 V may not be exceeded.

**Table 2: Analog indicator with alarm signaling unit****Model FAM54xB/C/Dx**

Type of protection: intrinsic safety, dust explosion protection.

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation	
				-20 °C to (-50 °C to)		Maximum		
A4, A9	ATEX: II 1/2 G Ex h ia IIC T6 ... T1 Ga/Gb II 2D Ex h tb IIIC T85°C ... Tmedium Db	41 / 42**	U <sub>i</sub> = 16 V	40 °C	T1	440 °C	No	
		51 / 52**	I <sub>i</sub> = 25 mA	40 °C	T1	375 °C	yes	
			P <sub>i</sub> = 64 mW	40 °C	T1	260 °C	yes	
		C <sub>i</sub> = 50 nF	50 °C	T1	300 °C	yes		
		L <sub>i</sub> = 250 µH	50 °C	T2	290 °C	yes		
			50 °C	T2	220°C	yes		
			60 °C	T2	320 °C	No		
			60 °C	T2	230 °C	yes		
			60 °C	T3	170 °C	yes		
			70 °C	T3	195 °C	No		
			70 °C	T3	150 °C	yes		
			70 °C	T4	130 °C	yes		
			70 °C	T5	95 °C	yes		
			60 °C	T6	80 °C	yes		
			41 / 42**	U <sub>i</sub> = 16 V	40 °C	T1	440 °C	No
			51 / 52**	I <sub>i</sub> = 52 mA	40 °C	T1	375 °C	yes
				P <sub>i</sub> = 169 mW	40 °C	T1	260 °C	yes
				C <sub>i</sub> = 50 nF	50 °C	T1	300 °C	yes
				L <sub>i</sub> = 250 µH	50 °C	T2	290 °C	yes
					50 °C	T2	220°C	yes
				60 °C	T2	320 °C	No	
				60 °C	T2	230 °C	yes	
				60 °C	T3	170 °C	yes	
				70 °C	T3	195 °C	No	
				70 °C	T3	150 °C	yes	
				70 °C	T4	130 °C	yes	
				60 °C	T5	60 °C	yes	
				50 °C	T5	90 °C	No	
				40 °C	T6	60 °C	yes	
		41 / 42**	U <sub>i</sub> = 16 V	40 °C	T1	440 °C	No	
		51 / 52**	I <sub>i</sub> = 76 mA	40 °C	T1	310 °C	yes	
			P <sub>i</sub> = 242 mW	40 °C	T2	190 °C	yes	
			C <sub>i</sub> = 50 nF	50 °C	T2	340 °C	No	
			L <sub>i</sub> = 250 µH	50 °C	T2	230 °C	yes	
				60 °C	T2	230°C	No	
				60 °C	T3	160 °C	yes	
				70 °C	T4	120 °C	No	
				70 °C	T4	100 °C	yes	
				40 °C	T5	60 °C	yes	
				30 °C	T6	30 °C	yes	

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* for connection to an intrinsically safe circuit

## ... Use in potentially explosive atmospheres in accordance with ATEX and IECEx

**Table 3: Analoganzeiger mit Grenzwertgeber**

**Model FAM54xB/C/Dx**

Type of protection: flameproof enclosure, dust explosion protection.

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation	
				-20 °C to (-50 °C to )		Maximum		
A9	<b>ATEX:</b> II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb II 2 D Ex h tb IIIC T85°C ... Tmedium Db	41 / 42**	U <sub>max</sub> = 16 V	40 °C	T1	440 °C	No	
		51 / 52**	I <sub>max</sub> = 25 mA	40 °C	T1	375 °C	yes	
			P <sub>max</sub> = 64 mW	40 °C	T1	260 °C	yes	
	<b>IECEx:</b> Ex db h IIC T6 ... T1 Ga/Gb Ex h tb IIIC T85°C ... Tmedium Db				50 °C	T1	300 °C	yes
					50 °C	T2	290 °C	yes
					50 °C	T2	220°C	yes
					60 °C	T2	320 °C	No
					60 °C	T2	230 °C	yes
					60 °C	T3	170 °C	yes
					70 °C	T3	195 °C	No
					70 °C	T3	150 °C	yes
					70 °C	T4	130 °C	yes
					70 °C	T5	95 °C	yes
					60 °C	T6	80 °C	yes
			41 / 42**	U <sub>max</sub> = 16 V	40 °C	T1	440 °C	No
			51 / 52**	I <sub>max</sub> = 52 mA	40 °C	T1	375 °C	yes
				P <sub>max</sub> = 169 mW	40 °C	T1	260 °C	yes
					50 °C	T1	300 °C	yes
					50 °C	T2	290 °C	yes
					50 °C	T2	220°C	yes
					60 °C	T2	320 °C	No
			60 °C	T2	230 °C	yes		
			60 °C	T3	170 °C	yes		
			70 °C	T3	195 °C	No		
			70 °C	T3	150 °C	yes		
			70 °C	T4	130 °C	yes		
			60 °C	T5	60 °C	yes		
			50 °C	T5	90 °C	No		
			40 °C	T6	60 °C	yes		
		41 / 42**	U <sub>max</sub> = 16 V	40 °C	T1	440 °C	No	
		51 / 52**	I <sub>max</sub> = 76 mA	40 °C	T1	310 °C	yes	
			P <sub>max</sub> = 242 mW	40 °C	T2	190 °C	yes	
				50 °C	T2	340 °C	No	
				50 °C	T2	230 °C	yes	
				60 °C	T2	230°C	No	
				60 °C	T3	160 °C	yes	
				70 °C	T4	120 °C	No	
				70 °C	T4	100 °C	yes	
				40 °C	T5	60 °C	yes	
				30 °C	T6	30 °C	yes	

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* for connection to a non-intrinsically safe circuit If the device is to be operated subsequently with type of protection "intrinsically safe", then U<sub>max</sub> = 60 V may not be exceeded.

**Table 4: Analoganzeiger mit Grenzsinalgeber****Model FAM54xB/C/Dx**

Type of protection: non-sparking materials, dust explosion protection.

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation	
				-20 °C to (-50 °C to )		Maximum		
A4, A9, B1	<b>ATEX:</b> II 1/3 G Ex ec h IIC T6 ... T1 Ga/Gc II 2D Ex h tb IIIC T85°C ... Tmedium Db	41 / 42**	U <sub>max</sub> = 16 V I <sub>max</sub> = 25 mA P <sub>max</sub> = 64 mW	40 °C	T1	440 °C	No	
				40 °C	T1	375 °C	yes	
				40 °C	T1	260 °C	yes	
	<b>IECEX:</b> Ex ec h IIC T6 ... T1 Ga/Gc Ex h tb IIIC T85°C ... Tmedium Db				50 °C	T1	300 °C	yes
					50 °C	T2	290 °C	yes
					50 °C	T2	220°C	yes
					60 °C	T2	320 °C	No
					60 °C	T2	230 °C	yes
					60 °C	T3	170 °C	yes
					70 °C	T3	195 °C	No
					70 °C	T3	150 °C	yes
					70 °C	T4	130 °C	yes
					70 °C	T5	95 °C	yes
					60 °C	T6	80 °C	yes
				40 °C	T1	440 °C	No	
				40 °C	T1	375 °C	yes	
				40 °C	T1	260 °C	yes	
				50 °C	T1	300 °C	yes	
				50 °C	T2	290 °C	yes	
				50 °C	T2	220°C	yes	
				60 °C	T2	320 °C	No	
				60 °C	T2	230 °C	yes	
				60 °C	T3	170 °C	yes	
				70 °C	T3	195 °C	No	
				70 °C	T3	150 °C	yes	
				70 °C	T4	130 °C	yes	
				60 °C	T5	60 °C	yes	
				50 °C	T5	90 °C	No	
40 °C	T6	60 °C	yes					
A4, A9, B1	<b>ATEX:</b> II 1/3 G Ex ec h IIC T6 ... T1 Ga/Gc II 2 D Ex h tb IIIC T85°C ... Tmedium Db	41 / 42**	U <sub>max</sub> = 16 V I <sub>max</sub> = 76 mA P <sub>max</sub> = 242 mW	40 °C	T1	440 °C	No	
				40 °C	T1	310 °C	yes	
				40 °C	T2	190 °C	yes	
	<b>IECEX:</b> Ex ec h IIC T6 ... T1 Ga/Gc Ex h tb IIIC T85°C ... Tmedium Db				50 °C	T2	340 °C	No
					50 °C	T2	230 °C	yes
					60 °C	T2	230°C	No
					60 °C	T3	160 °C	yes
					70 °C	T4	120 °C	No
					70 °C	T4	100 °C	yes
					40 °C	T5	60 °C	yes
					30 °C	T6	30 °C	yes

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.\*\* for connection to a non-intrinsically safe circuit If the device is to be operated subsequently with type of protection "intrinsically safe", then U<sub>max</sub> = 60 V may not be exceeded.

## ... Use in potentially explosive atmospheres in accordance with ATEX and IECEx

**Table 5: Analoganzeiger ohne Grenzsinalgeber**

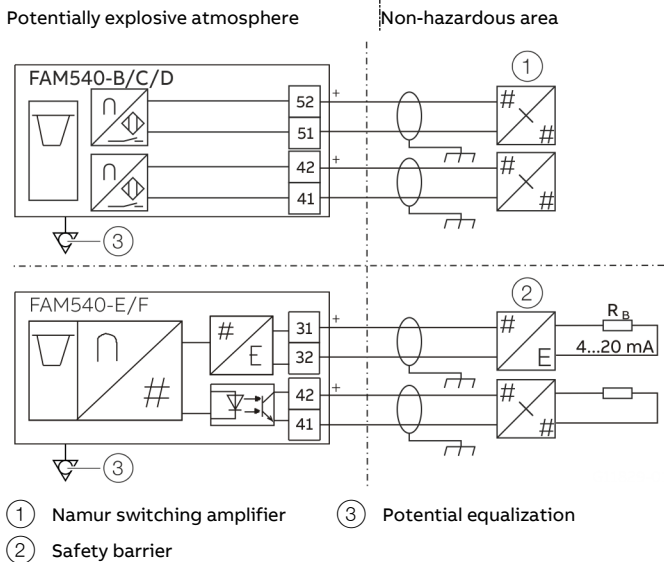
**Model FAM54xAx**

Type of protection: constructional safety, dust explosion protection

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation
				-20 °C to (-50 °C to)			
A4, A9, B1	<b>ATEX:</b>	n.a.	n. a	70 °C	T1	440 °C	yes
	II 1/2 G Ex h T6 ... T1 Gb			70 °C	T2	290 °C	yes
	II 2 D Ex h T85°C ... Tmedium Db			70 °C	T3	190 °C	yes
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db			70 °C	T4	130 °C	yes
	<b>IECEx:</b>			70 °C	T5	95 °C	yes
	Ex h tb IIIC T85°C ... Tmedium Db			70 °C	T6	80°C	yes

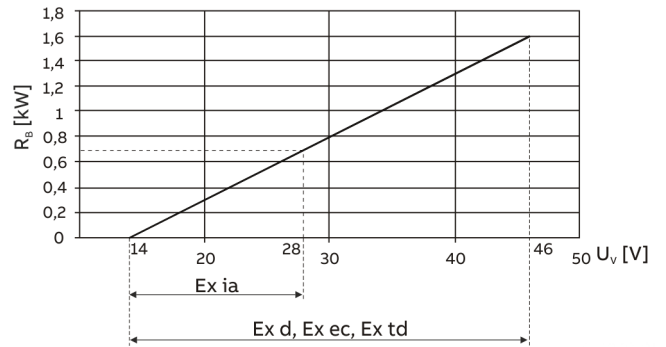
\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

### Electrical connections



**Figure 17: ATEX / IECEx electrical connection**

Terminal	Function
31 / 32	Power supply / current output / HART output
41 / 42	Programmable binary output Alarm signaling unit (min.)
51 / 52	Alarm signaling unit (max.)



**Figure 18: Terminals 31 / 32, power supply / load**

**U<sub>v</sub>** Power supply

**R<sub>B</sub>** Maximum permissible load in the power supply (z. B. indicator)

The minimum voltage  $U_v = 0 \text{ V}$  is based on a load of  $0 \Omega$ .

### Signal cable

The Ex calculations are based on temperatures of 80 °C (176 °F) at the cable input. For this reason, cables with a specification of 80 °C (176 °F) must be used.

For cables limited to 70 °C (158 °F), a maximum ambient temperature of  $T_{amb} = 60$  °C (140 °F) applies.

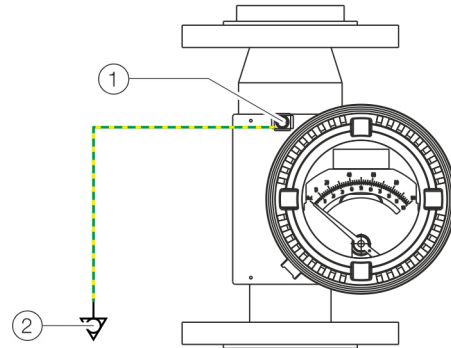
The resulting new maximum measuring medium temperatures are determined as follows:

- Calculate a new ambient temperature:  
 $T_{amb\ new} = T_{amb} + 10$  °C (18 °F).
- Use the calculated ambient temperature  $T_{amb\ new}$  to determine the new associated permissible measuring medium temperatures in the tables.
- Please use the limit value tables with the original ambient temperature  $T_{amb}$  to determine the relevant temperature class. See **Safety specifications ATEX / IECEx** on page 25, Tables 1 to 5.

### Example:

- $T_{amb} = 50$  °C (122 °F) becomes  $T_{amb\ new} = 60$  °C (140 °F).
- Determine the measuring medium temperature  $T_{amb} = 60$  °C (140 °F).
- Determine the temperature class for  $T_{amb} = 50$  °C (122 °F).

### Earthing



- ① Ground terminal
- ② Potential equalization in accordance with EN 60079-0

Figure 19: Grounding

The FAM540 housing must be correctly earthed in order to ensure proper function and safe operation.

Copper wires with a minimum cross-section of 6 mm<sup>2</sup> (AWG 10) must be used to connect to the potential equalization.

### Note

The operator must make sure that when connecting the protective ground (PE), there are no potential differences between protective ground (PE) and potential equalization, even in the event of a fault.

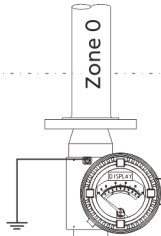
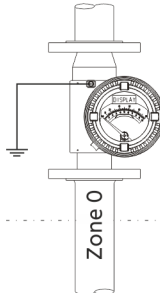
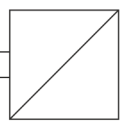
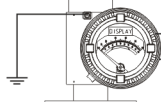
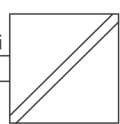
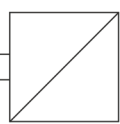
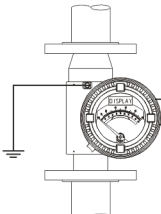
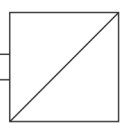
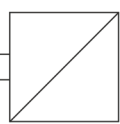
## Use in potentially explosive atmospheres in accordance with FM and cCSAus


### Note

Further information on the approval of devices for use in potentially explosive atmospheres can be found in the type examination certificates or the relevant certificates at [www.abb.com/flow](http://www.abb.com/flow).

### Device overview

The devices are designed for maximum versatility. This is achieved through a combination of several types of protection within each device. All devices are suitable for use in potentially explosive atmospheres with combustible dust. For detailed installation instructions and terminal assignments, refer to **Electrical connections** on page 9.

Class 1 Division 1 / Zone 1	Class 1 Division 2 / Zone 2	Standard / No explosion protection	Order code*			
			<table border="1"> <tr> <td>F4 (NI, IS)</td> <td rowspan="2">F3 (NI, IS, XP)</td> </tr> <tr> <td style="background-color: #cccccc;"></td> </tr> </table>	F4 (NI, IS)	F3 (NI, IS, XP)	
F4 (NI, IS)	F3 (NI, IS, XP)					
						
						

 Potential equalization

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.



## Ex marking

### Note

- Depending on the design, a specific marking in accordance with FM applies.
- ABB reserves the right to modify the Ex-marking. Refer to the name plate for the exact marking.

<b>Model FAM54xAx (analog indicator without alarm signaling unit and model FAM54xB/C/Dx (analog indicator with alarm signaling unit))</b>				
<b>Marking</b>	<b>Type of protection</b>	<b>Order code*</b>	<b>Limit value table</b>	
<b>FM</b> XP / CL I / DIV 1 / GP ABCD / T6 ... T1 CL I, ZN 1 AEx d IIC T6 ... T1	Explosionproof	F3	<b>Table 2</b> on page 35	
IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 ... T1 CL I, ZN 1 AEx ia IIC T6 ... T1	Intrinsic Safety	F3, F4	<b>Table 1</b> on page 34, <b>Table 2</b> on page 35	
DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1	Dust-Ignitionproof			
NI / CL I,II / DIV 2 / GP ABCDFG / T5 ... T1 NI / CL III T5 ... T1 CL II, ZN 2 AEx ec II T5 ... T1	Non-Incendive	F3, F4	<b>Table 1</b> on page 34, <b>Table 2</b> on page 35, <b>Table 3</b> on page 36	
<b>cCSAus</b> XP / CL I / DIV 1 / GP BCD / T6 ... T1 Ex d IIC T6 ... T1	Explosionproof	F3	<b>Table 2</b> on page 35	
IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 ... T1 Ex ia IIC T6 ... T1	Intrinsic Safety	F3, F4	<b>Table 1</b> on page 34,	
DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1 DIP A21 TA 85°C ... T <sub>medium</sub>	Dust-Ignitionproof	F3, F4	<b>Table 1</b> on page 34, <b>Table 2</b> on page 35, <b>Table 3</b> on page 36	
NI / CL I,II / DIV 2 / GP ABCDFG / T5 ... T1 NI / CL III T5 ... T1 Ex ec II T5 to T1	Non-Incendive	F3, F4	<b>Table 3</b> on page 36	

\* Order code 'Explosion protection and approvals' (version digit no. 9, 10); see **Ordering Information** on page 41.

<b>Model FAM54xE/Fx (analog indicator with transmitter / with or without LCD display)</b>				
<b>Marking</b>	<b>Type of protection</b>	<b>Order code*</b>	<b>Limit value table</b>	
<b>FM</b> XP / CL I / DIV 1 / GP ABCD / T6 ... T1 CL I, ZN 1 AEx d IIC T6 ... T1	Explosionproof	F3	<b>Table 4</b> on page 37	
IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4 ... T1 CL I, ZN 1 AEx ia IIC T4 ... T1	Intrinsic Safety	F3, F4		
DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1	Dust-Ignitionproof			
NI / CL I,II / DIV 2 / GP ABCDFG / T4 ... T1 NI / CL III T4 ... T1 CL II, ZN 2 AEx ec IIC T6 ... T1	Non-Incendive			
<b>cCSAus</b> XP / CL I / DIV 1 / GP BCD / T6 ... T1 Ex d IIC T6 ... T1	Explosionproof	F3		
IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4 ... T1 Ex ia IIC T4 ... T1	Intrinsic Safety	F3, F4		
DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1 DIP A21 TA 85°C to T <sub>medium</sub>	Dust-Ignitionproof			
NI / CL I,II / DIV 2 / GP ABCDFG / T4 ... T1 NI / CL III T4 ... T1 Ex ec IIC T6 ... T1	Non-Incendive			

\* Order code 'Explosion protection and approvals' (version digit no. 9, 10); see **Ordering Information** on page 41.

## ... Use in potentially explosive atmospheres in accordance with FM and cCSAus

### Safety specifications FM, cCSAus

Table 1: Analog indicator with alarm signaling unit (temperature data for FM in °F, for cCSAus in °C)

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>	Insulation	
				-58 °F to	-50 °C to		Maximum		
F3, F4	FM	41 / 42***	U <sub>i</sub> = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
				104 °F	40 °C	T1	707 °F	375 °C	yes
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 ... T1**	51 / 52***	I <sub>i</sub> = 25 mA	104 °F	40 °C	T1	500 °F	260 °C	yes
				122 °F	50 °C	T1	572 °F	300 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1		P <sub>i</sub> = 64 mW	122 °F	50 °C	T1	572 °F	300 °C	yes
				122 °F	50 °C	T2	554 °F	290 °C	yes
	CL I, ZN 1 AEx ia IIC T6 ... T1		C <sub>i</sub> = 50 nF	122 °F	50 °C	T2	554 °F	290 °C	yes
				122 °F	50 °C	T2	428 °F	220 °C	yes
	cCSAus		L <sub>i</sub> = 250 µH	140 °F	60 °C	T2	608 °F	320 °C	No
				140 °F	60 °C	T2	446 °F	230 °C	yes
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 ... T1**			140 °F	60 °C	T3	338 °F	170 °C	yes
				158 °F	70 °C	T3	383 °F	195 °C	No
DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1			158 °F	70 °C	T3	302 °F	150 °C	yes	
			158 °F	70 °C	T4	266 °F	130 °C	yes	
Ex ia IIC T6 ... T1			158 °F	70 °C	T4	266 °F	130 °C	yes	
			140 °F	60 °C	T6	176 °F	80 °C	yes	
DIP A21 TA 85°C to T <sub>medium</sub>	41 / 42***	U <sub>i</sub> = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No	
			104 °F	40 °C	T1	707 °F	375 °C	yes	
	51 / 52***	I <sub>i</sub> = 52 mA	104 °F	40 °C	T1	500 °F	260 °C	yes	
			122 °F	50 °C	T1	572 °F	300 °C	yes	
		P <sub>i</sub> = 169 mW	122 °F	50 °C	T1	572 °F	300 °C	yes	
			122 °F	50 °C	T2	554 °F	290 °C	yes	
		C <sub>i</sub> = 50 nF	122 °F	50 °C	T2	554 °F	290 °C	yes	
			122 °F	50 °C	T2	428 °F	220 °C	yes	
		L <sub>i</sub> = 250 µH	140 °F	60 °C	T2	608 °F	320 °C	No	
			140 °F	60 °C	T2	446 °F	230 °C	yes	
			140 °F	60 °C	T3	338 °F	170 °C	yes	
			158 °F	70 °C	T3	383 °F	195 °C	No	
		158 °F	70 °C	T3	302 °F	150 °C	yes		
		158 °F	70 °C	T4	266 °F	130 °C	yes		
		140 °F	60 °C	T5	140 °F	60 °C	yes		
		122 °F	50 °C	T5	194 °F	90 °C	No		
		104 °F	40 °C	T6	140 °F	60 °C	yes		
		104 °F	40 °C	T6	140 °F	60 °C	yes		
	41 / 42***	U <sub>i</sub> = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No	
			104 °F	40 °C	T1	590 °F	310 °C	yes	
	51 / 52***	I <sub>i</sub> = 76 mA	104 °F	40 °C	T1	590 °F	310 °C	yes	
			104 °F	40 °C	T2	374 °F	190 °C	yes	
		P <sub>i</sub> = 242 mW	104 °F	40 °C	T2	374 °F	190 °C	yes	
			122 °F	50 °C	T2	644 °F	340 °C	No	
		C <sub>i</sub> = 50 nF	122 °F	50 °C	T2	644 °F	340 °C	No	
			122 °F	50 °C	T2	446 °F	230 °C	yes	
		L <sub>i</sub> = 250 µH	140 °F	60 °C	T2	446 °F	230 °C	No	
			140 °F	60 °C	T3	320 °F	160 °C	yes	
			158 °F	70 °C	T4	248 °F	120 °C	No	
			158 °F	70 °C	T4	212 °F	100 °C	yes	
		104 °F	40 °C	T5	140 °F	60 °C	yes		
		86 °F	30 °C	T6	86 °F	30 °C	yes		

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* 'IS' installation in accordance with Installation Drawing SDM-10-A0253.

\*\*\* for connection to an intrinsically safe circuit

**Table 2: Analog indicator with alarm signaling unit (temperature data for FM in °F, for cCSAus in °C)**

Order code*	Marking	Terminals	Electrical values	T <sub>amb</sub>	T <sub>amb</sub>	Temp. class	T <sub>medium</sub>		Insulation	
				-58 °F to	-50 °C to		Maximum			
F3	FM	41 / 42**	U <sub>max</sub> = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No	
	XP / CL I / DIV 1 / GP ABCD / T6 ... T1	51 / 52**	I <sub>max</sub> = 25 mA	104 °F	40 °C	T1	707 °F	375 °C	yes	
	DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1			P <sub>max</sub> = 64 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
					122 °F	50 °C	T1	572 °F	300 °C	yes
					122 °F	50 °C	T2	554 °F	290 °C	yes
	CL I, ZN 1 AEx d IIC T6 ... T1				122 °F	50 °C	T2	428 °F	220 °C	yes
					140 °F	60 °C	T2	608 °F	320 °C	No
	cCSAus				140 °F	60 °C	T2	446 °F	230 °C	yes
					140 °F	60 °C	T3	338 °F	170 °C	yes
	XP / CL I / DIV 1 / GP BCD / T6 ... T1				158 °F	70 °C	T3	383 °F	195 °C	No
					158 °F	70 °C	T3	302 °F	150 °C	yes
					158 °F	70 °C	T4	266 °F	130 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1				158 °F	70 °C	T5	203 °F	95 °C	yes
					140 °F	60 °C	T6	176 °F	80 °C	yes
					140 °F	60 °C	T6	176 °F	80 °C	yes
	Ex d IIC T6 ... T1	41 / 42**	51 / 52**	U <sub>max</sub> = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
					104 °F	40 °C	T1	707 °F	375 °C	yes
					104 °F	40 °C	T1	500 °F	260 °C	yes
					122 °F	50 °C	T1	572 °F	300 °C	yes
					122 °F	50 °C	T2	554 °F	290 °C	yes
					122 °F	50 °C	T2	428 °F	220 °C	yes
		51 / 52**	I <sub>max</sub> = 52 mA	P <sub>max</sub> = 169 mW	140 °F	60 °C	T2	608 °F	320 °C	No
					140 °F	60 °C	T2	446 °F	230 °C	yes
					140 °F	60 °C	T3	338 °F	170 °C	yes
158 °F					70 °C	T3	383 °F	195 °C	No	
158 °F					70 °C	T3	302 °F	150 °C	yes	
158 °F					70 °C	T4	266 °F	130 °C	yes	
51 / 52**		I <sub>max</sub> = 76 mA	P <sub>max</sub> = 242 mW	140 °F	60 °C	T5	140 °F	60 °C	yes	
				122 °F	50 °C	T5	194 °F	90 °C	No	
				104 °F	40 °C	T6	140 °F	60 °C	yes	
				104 °F	40 °C	T1	824 °F	440 °C	No	
				104 °F	40 °C	T1	590 °F	310 °C	yes	
				104 °F	40 °C	T2	374 °F	190 °C	yes	
51 / 52**	I <sub>max</sub> = 76 mA	P <sub>max</sub> = 242 mW	122 °F	50 °C	T2	644 °F	340 °C	No		
			122 °F	50 °C	T2	446 °F	230 °C	yes		
			140 °F	60 °C	T2	446 °F	230 °C	No		
			140 °F	60 °C	T3	320 °F	160 °C	yes		
			158 °F	70 °C	T4	248 °F	120 °C	No		
			158 °F	70 °C	T4	212 °F	100 °C	yes		
			104 °F	40 °C	T5	140 °F	60 °C	yes		
			86 °F	30 °C	T6	86 °F	30 °C	yes		

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* for connection to a non-intrinsically safe circuit

## ... Use in potentially explosive atmospheres in accordance with FM and cCSAus

**Table 3: Analog indicator with / without alarm signaling unit (temperature data for FM in °F, for cCSAus in °C)**

Order code*	Marking	Terminals	Electrical values	$T_{amb}$	$T_{amb}$	Temp. class	$T_{medium}$	Insulation	
				-58 °F to	-50 °C to		Maximum		
F3** F4**	FM NI / CL I,II / DIV 2 / GP ABCDFG / T5 ... T1	41 / 42***	$U_{max} = 16 V$	104 °F	40 °C	T1	824 °F	440 °C	No
				104 °F	40 °C	T1	707 °F	375 °C	yes
		51 / 52***	$I_{max} = 25 mA$	104 °F	40 °C	T1	707 °F	375 °C	yes
				104 °F	40 °C	T1	500 °F	260 °C	yes
			$P_{max} = 64 mW$	104 °F	40 °C	T1	500 °F	260 °C	yes
				122 °F	50 °C	T1	572 °F	300 °C	yes
	NI / CL III / T5 ... T1			122 °F	50 °C	T2	554 °F	290 °C	yes
				122 °F	50 °C	T2	428 °F	220 °C	yes
	CL II, ZN 2 AEx ec II T5 ... T1			140 °F	60 °C	T2	608 °F	320 °C	No
				140 °F	60 °C	T2	446 °F	230 °C	yes
	cCSAus NI / CL I,II / DIV 2 / GP ABCDFG / T5 ... T1			140 °F	60 °C	T3	338 °F	170 °C	yes
				158 °F	70 °C	T3	383 °F	195 °C	No
				158 °F	70 °C	T3	302 °F	150 °C	yes
				158 °F	70 °C	T4	266 °F	130 °C	yes
NI / CL III / T5 ... T1			158 °F	70 °C	T5	203 °F	95 °C	yes	
Ex ec II T6 ... T1	DIP A21 TA 85°C to $T_{medium}$	41 / 42***	$U_{max} = 16 V$	104 °F	40 °C	T1	824 °F	440 °C	No
				104 °F	40 °C	T1	707 °F	375 °C	yes
		51 / 52***	$I_{max} = 52 mA$	104 °F	40 °C	T1	707 °F	375 °C	yes
				104 °F	40 °C	T1	500 °F	260 °C	yes
			$P_{max} = 169 mW$	104 °F	40 °C	T1	500 °F	260 °C	yes
				122 °F	50 °C	T1	572 °F	300 °C	yes
				122 °F	50 °C	T2	554 °F	290 °C	yes
				122 °F	50 °C	T2	428 °F	220 °C	yes
				140 °F	60 °C	T2	608 °F	320 °C	No
				140 °F	60 °C	T2	446 °F	230 °C	yes
				140 °F	60 °C	T3	338 °F	170 °C	yes
				158 °F	70 °C	T3	383 °F	195 °C	No
				158 °F	70 °C	T3	302 °F	150 °C	yes
				158 °F	70 °C	T4	266 °F	130 °C	yes
			140 °F	60 °C	T5	140 °F	60 °C	yes	
			122 °F	50 °C	T5	194 °F	90 °C	No	
	41 / 42***	51 / 52***	$U_{max} = 16 V$	104 °F	40 °C	T1	824 °F	440 °C	No
				104 °F	40 °C	T1	590 °F	310 °C	yes
			$I_{max} = 76 mA$	104 °F	40 °C	T2	374 °F	190 °C	yes
				122 °F	50 °C	T2	644 °F	340 °C	No
			$P_{max} = 242 mW$	122 °F	50 °C	T2	446 °F	230 °C	yes
				140 °F	60 °C	T2	446 °F	230 °C	No
				140 °F	60 °C	T3	320 °F	160 °C	yes
				158 °F	70 °C	T4	248 °F	120 °C	No
				158 °F	70 °C	T4	212 °F	100 °C	yes
				104 °F	40 °C	T5	140 °F	60 °C	yes

\* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

\*\* For connection in Division 2 or Zone 2.

\*\*\* for connection to a non-intrinsically safe circuit

**Table 4: Analog indicator with transmitter, with or without LCD indicator (temperature data for FM in °F, for cCSAus in °C)**

Order code <sup>1</sup>	Marking	Terminals	Electrical values	T <sub>amb</sub>	T <sub>amb</sub>	Temp. class	T <sub>medium</sub> Maximum	Insulation	
				-58 °F to	-50 °C to				
F3, F4	FM 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 cCSAus	31 / 32 <sup>2,3</sup>	U <sub>i</sub> = 30 V	104 °F	40 °C	T1	824 °F	440 °C	No
			I <sub>i</sub> = 110 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
			P <sub>i</sub> = 770 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
			C <sub>i</sub> = 5.3 nF	122 °F	50 °C	T1	572 °F	300 °C	yes
			L <sub>i</sub> = 266 µH	122 °F	50 °C	T2	554 °F	290 °C	yes
				122 °F	50 °C	T2	428°F	220°C	yes
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T4 ... T1 <sup>2</sup> DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1 Ex ia IIC T6 ... T1 DIP A21 TA 85°C to T <sub>medium</sub>	41 / 42 <sup>2</sup>	U <sub>i</sub> = 30 V	140 °F	60 °C	T2	608 °F	320 °C	No
			I <sub>i</sub> = 30 mA	140 °F	60 °C	T2	446 °F	230 °C	yes
			P <sub>i</sub> = 115 mW	140 °F	60 °C	T3	338 °F	170 °C	yes
			C <sub>i</sub> = 4.8 nF	158 °F	70 °C	T3	383 °F	195 °C	No
			L <sub>i</sub> = 133 µH	158 °F	70 °C	T3	302 °F	150 °C	yes
				158 °F	70 °C	T4	257 °F	125 °C	yes
				140 °F	60 °C	T2	608 °F	320 °C	No
				140 °F	60 °C	T2	446 °F	230 °C	yes
F3	FM 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 cCSAus	31 / 32 <sup>4</sup>	U <sub>max</sub> = 46 V	104 °F	40 °C	T1	824 °F	440 °C	No
				104 °F	40 °C	T1	707 °F	375 °C	yes
				104 °F	40 °C	T1	500 °F	260 °C	yes
				122 °F	50 °C	T1	572 °F	300 °C	yes
	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 <sub>medium</sub>	41 / 42 <sup>4</sup>	U <sub>max</sub> = 30 V	140 °F	60 °C	T2	608 °F	320 °C	No
			I <sub>max</sub> = 30 mA	140 °F	60 °C	T2	446 °F	230 °C	yes
			P <sub>max</sub> = 115 mW	140 °F	60 °C	T3	338 °F	170 °C	yes
				140 °F	60 °C	T4	266 °F	130 °C	yes
				140 °F	60 °C	T5	203 °F	95 °C	yes
				140 °F	60 °C	T6	176 °F	80 °C	yes

1) Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering Information** on page 41.

2) For connection to an intrinsically safe circuit.

3) Installation in accordance with Installation Drawing SDM-10-A0253.

4) For connection to a non-intrinsically safe circuit.

## ... Use in potentially explosive atmospheres in accordance with FM and cCSAus

Continuation of Table 4: Analog indicator with transmitter, with or without LCD indicator (temperature data for FM in °F, for cCSAus in °C)

Order code <sup>1</sup>	Marking	Terminals	Electrical values	T <sub>amb</sub>	T <sub>amb</sub>	Temp. class	T <sub>medium</sub> Maximum	Insulation
				-58 °F to	-50 °C to			
F3 <sup>5</sup> , F4 <sup>5</sup>	FM NI / CL I,II / DIV 2 / GP ABCDFG / T4...T1 NI / CL III / T4...T1 CL II, ZN 2 AEx ec IIC T4...T1	31 / 32 <sup>4</sup>	U <sub>max</sub> = 46 V	104 °F	104 °F	T1	824 °F 440 °C	No
				104 °F	104 °F	T1	707 °F 375 °C	yes
				104 °F	104 °F	T1	500 °F 260 °C	yes
				122 °F	122 °F	T1	572 °F 300 °C	yes
				122 °F	122 °F	T2	554 °F 290 °C	yes
	cCSAus NI / CL I,II / DIV 2 / GP ABCDFG / T4...T1 NI / CL III / T4...T1 Ex ec IIC T4...T1 DIP A21 TA 85°C to T <sub>medium</sub>	41 / 42 <sup>4</sup>	U <sub>max</sub> = 30 V I <sub>max</sub> = 30 mA P <sub>max</sub> = 115 mW	140 °F	60 °C	T2	608 °F 320 °C	No
				140 °F	60 °C	T2	446 °F 230 °C	yes
				140 °F	60 °C	T3	338 °F 170 °C	yes
				158 °F	70 °C	T3	383 °F 195 °C	No
				158 °F	70 °C	T3	302 °F 150 °C	yes
			158 °F	70 °C	T4	266 °F 130 °C	yes	
			158 °F	70 °C	T5	203 °F 95 °C	yes	
			86 °F	30 °C	T6	77 °F 25 °C	yes	

1) Order code 'Explosion protection and approvals' (versions 9, 10), see **Ordering Information** on page 41.

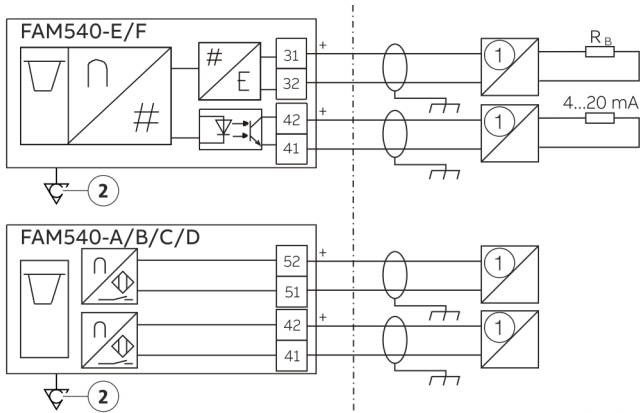
2) For connection to an intrinsically safe circuit.

3) Installation in accordance with Installation Drawing SDM-10-A0253.

4) For connection to a non-intrinsically safe circuit.

5) For connection in Division 2 or Zone 2.

**Electrical connections**



① FM Approved IS Barrier      ② Potential equalization

Figure 20: FM / cCSAus electrical connection

Terminal	Function
31 / 32	Power supply / current output / HART output
41 / 42	Binary output
	Alarm signaling unit (min.)
51 / 52	Alarm signaling unit (max.)

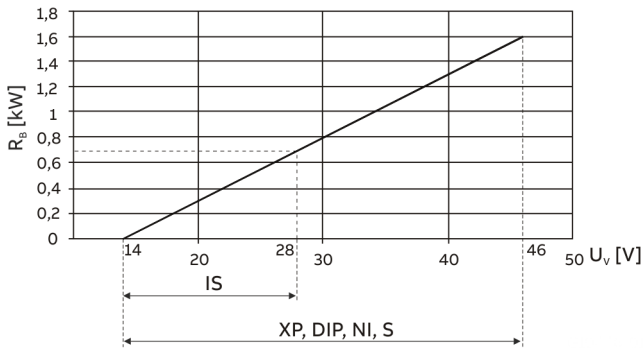


Figure 21: Terminals 31 / 32, power supply / load

$U_V$  Power supply

$R_B$  Maximum permissible load in the power supply (z. B. indicator)

The minimum voltage  $U_V = 0 V$  is based on a load of  $0 \Omega$ .

**Installation instructions**

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:

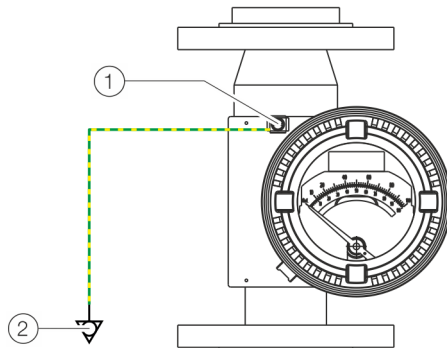
- $U_o$  or  $V_{oc}$  or  $V_t \leq 0 V \text{ max}$ ,  $I_o$  or  $I_{sc}$  or  $I_t \leq I_{\text{max}}$ ,  $C_a$  or  $C_o \geq C_i + C_{\text{cable}}$ ,  $L_a$  or  $L_o \geq L_i + L_{\text{cable}}$ ,  $P_o \leq P_i$ .
- For installation in Class II and III environments, dust-proof ignition blocks must be used.
- Devices connected to such equipment must not use or generate rms or DC voltage in excess of 250 V.
- The installation must meet the requirements in accordance with ANSI / ISA RP 12.6 'Installation of Intrinsically Safe Systems for Hazardous 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 in accordance with the entity concept.
- Devices must be installed in accordance with the manufacturer-supplied installation drawing of the associated equipment.
- 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).

**Note**

For intrinsically safe installations, the FAM540 must be installed as illustrated in the "Intrinsic Safety Control Drawing SDM-10-A0253".

## ... Use in potentially explosive atmospheres in accordance with FM and cCSAus

### Earthing



- ① Ground terminal  
 ② Potential equalization in accordance with EN 60079-0

Figure 22: Grounding

The FAM540 housing must be correctly earthed in order to ensure proper function and safe operation. Copper wires with a minimum cross-section of 6 mm<sup>2</sup> (AWG 10) must be used to connect to the potential equalization.

### Note

The operator must make sure that when connecting the protective ground (PE), there are no potential differences between protective ground (PE) and potential equalization, even in the event of a fault.

### Signal cable

For ambient temperatures below 5 °C (41 °F) or above 40 °C (104 °F), signal cables that are suited for the minimum/maximum ambient temperatures in question must be used.

Only use signal cables made from copper, copper-coated aluminum, or aluminum.

The recommended tightening torque for the terminals is 0.8 Nm (7 in lb) or higher, in accordance with the specification.

### Power supply

Installation must comply with the requirements of the National Electric Code® (ANSI / NFPA70).

Unless specified otherwise in regional or national standards, power supply lines must be dimensioned to AWG 20. Installation must be carried out as outlined in the latest edition of the manufacturer's instruction manual.

A power supply with the following requirements must be used to provide power:

- SELV (safety extra-low voltage) with LPS (current-limited source) and double or reinforced insulation.
- Maximum output current of 8 A (current-limited output).
- In accordance with National Electric Code® (ANSI / NFPA70) connected to NEC class 2.



## Ordering Information

### Main ordering information FAM541

VA Master FAM541 Metal Cone Variable Area Flowmeter, standard, for general purposes	FAM541	X	X	XX	XX	X	X	XX	X	XX
<b>Display Type / Output Signal</b>										
Analog indicator / Without		A								
Analog indicator / Min-Alarm (Amplifier D163A011U01 bis U03 as a separate item)		B								
Analog indicator / Max-Alarm (Amplifier D163A011U01 bis U03 as a separate item)		C								
Analog indicator / Min- and Max-Alarm (Amplifier D163A011U04 bis U06 as a separate item)		D								
Analog indicator / 4 bis 20 mA with HART protocol		E								
Analog indicator with LCD display / 4 bis 20 mA with HART protocol		F								
<b>Housing Material / Cable Gland</b>										
Aluminium / Cable gland M20 × 1.5 (Indicator type A with blind plug M25 × 1.5)			1							
Aluminium / Thread ½ in NPT (Indicator type A with blind plug M25 × 1.5)			2							
Stainless steel / Cable gland M20 × 1.5 (Indicator type A with blind plug M25 × 1.5)			3 <sup>1</sup>							
Stainless steel / Thread ½ in NPT (Indicator type A with blind plug M25 × 1.5)			4 <sup>1</sup>							
<b>Explosion Protection Certification and Approvals</b>										
Without								Y0		
ATEX / IECEx, (Zone 2 / 21), Ex ec								B1 <sup>2</sup>		
ATEX / IECEx, (Zone 1 / 21), Ex i, Ex ec								A4 <sup>2</sup>		
ATEX / IECEx, (Zone 1 / 21), Ex d, Ex i								A9 <sup>3</sup>		
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI								F3 <sup>4</sup>		
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI								F4 <sup>4</sup>		
<b>Process Connection</b>										
Flange								F1		
Flange with groove (DIN 2512)								F2		
Female thread metric (DN 25 [1 in] = PN 100, DN 40 [1 ½ in] = PN 40)								T1 <sup>5</sup>		
<b>Connection Size</b>										
DN 15 (½ in)								A		
DN 25 (1 in)								B		
DN 40 (1-½ in)								N		
DN 50 (2 in)								C		
DN 80 (3 in)								D		
<b>Float Design</b>										
Standard									1	
With gas damping									3	

Continued see next page

- 1 Not available with Ex d or XP applications
- 2 Version with analog indicator without output signal: Type of protection "c" only available with ATEX approval
- 3 With Ex d approved cable gland. Not available for analog indicator without output signal
- 4 Only with cable entry ½ in NPT
- 5 Not available with FM / CSA approval, only available in 1 in and 1 ½ in size

## ... Ordering Information

<b>VA Master FAM541 Metal Cone Variable Area Flowmeter, standard, for general purposes</b>	XX	X	XX
<b>Pressure Rating</b>			
PN 16	D2		
PN 40	D4		
PN 63	D5*		
PN 100	D6*		
ASME CL 150	A1		
ASME CL 300	A3		
ASME CL 600	A6*		
JIS 10K	J1*		
<b>Design Level</b>			
(Specified by ABB)		X	
<b>Tube / Float Combination</b>			
(Specified by ABB) See flow range tables.			XX

\* Not available with DN 40 (1 ½ in)

### Additional ordering information

<b>VA Master FAM541 Metal Cone Variable Area Flowmeter, standard, for general purposes</b>	XX	XX	XX	XX	XX	XX
<b>Primary</b>						
Without, secondary only	Y0*					
Standard	Y1**					
<b>Measuring Deviation</b>						
Class 1.6 acc. VDE / VDI 3513		A1**				
1 % of full scale		AA				
4 % of full scale (high viscosity, without calculation)		AK				
4 % of full scale (high viscosity, with calculation)		AL				
<b>Material: 3.1, 3.2 Inspection / NACE</b>						
Material monitoring with inspection certificate 3.1 acc. EN 10204			C2			
Material monitoring with inspection certificate 3.2 acc. EN 10204			C3			
Material monitoring NACE MR 01-75 with inspection certificate 3.1 acc. EN 10204			CN			
<b>Material: 2.1 Compliance</b>						
Declaration of compliance with the order 2.1 acc. EN 10204				C4		
<b>Certificates: 3.1 Visual, Dimensional and Functional Test</b>						
Inspection certificate 3.1 acc. EN 10204 of visual, dimensional and functional test					C6	
<b>Certificates: 3.1 PMI Test</b>						
Inspection certificate 3.1 acc. EN 10204 of positive material identification PMI						CA

\* For Ex devices upon request

\*\* Standard, automatically specified by ABB if not specified by customer

<b>Additional ordering information</b>	XX	XX	XXX	XX	XX
<b>Certificates: 3.1 Pressure Test</b>					
Pressure test acc. AD2000	CB				
Test package (pressure test, non-destructive test, welder and welding procedure certificate) (Non-destructive test = X-ray for welding neck flanges, dye penetration test for slip-on flanges)	CP				
<b>Certificates: Calibration, Test Report</b>					
Certificate of compliance for calibration 2.1 acc. EN 10204		CM			
Inspection certificate 3.1 acc. EN 10204 of calibration, with test report		CE			
<b>Other Explosion Protection Certifications and Approvals</b>					
INMETRO (Brazil)			EB1		
<b>Documentation Language</b>					
German				M1	
English				M5*	
Language package Western Europe / Scandinavia (Languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)				MW	
Language package Eastern Europe (Languages: DE, EL, CS, ET, LV, LT, HU, PL, SK, SL, RO, BG)				ME	
<b>Applications</b>					
Degreased for oxygen applications					P1

\* Standard, automatically specified by ABB if not specified by customer

<b>Additional ordering information</b>	XX	XX	XX	XX
<b>Device Identification Plate</b>				
Stainless steel plate with TAG no.	T0			
Adhesive label with TAG no.	TC*			
<b>Float Material</b>				
AISI 316Ti SST (1.4571)		F1*		
<b>Scale Design</b>				
Direct reading scale			SD*	
Percentage scale			SP	
Bargraph			SB**	
<b>Ambient Temperature Range</b>				
Extended -40 bis 70 °C (-40 bis 158 °F) / -40 bis 60 °C (-40 bis 140 °F) with Ex protection Exd + Ex tD				R5***
Standard -20 bis 70 °C (-4 bis 158 °F) / -20 bis 60 °C (-4 bis 140 °F) with Ex protection Exd + Ex tD				R6*

\* Standard, automatically specified by ABB if not specified by customer

\*\* Recommended for indicator with transmitter 4 bis 20 mA with LCD display

\*\*\* Not available with analog indicator with alarm

## ... Ordering Information

### Main ordering information FAM544

VA Master FAM544 Metal Cone Variable Area Flowmeter, hygienic design, for specific food and pharmacy applications	FAM544	X	X	XX	XX	X	X	XX	X	XX
Display Type / Output Signal										
Analog indicator / Without		A								
Analog indicator / Min-Alarm (Amplifier D163A011U01 to U03 as a separate item)		B								
Analog indicator / Max-Alarm (Amplifier D163A011U01 to U03 as a separate item)		C								
Analog indicator / Min- and Max-Alarm (Amplifier D163A011U04 to U06 as a separate item)		D								
Analog indicator / 4 to 20 mA with HART protocol		E								
Analog indicator with LCD display / 4 to 20 mA with HART protocol		F								
<b>Housing Material / Cable Gland</b>										
Aluminium / Cable gland M20 × 1.5 (Indicator type A with blind plug M25 × 1.5)			1							
Aluminium / Thread ½ in NPT (Indicator type A with blind plug M25 × 1.5)			2							
Stainless steel / Cable gland M20 × 1.5 (Indicator type A with blind plug M25 × 1.5)			3 <sup>1</sup>							
Stainless steel / Thread ½ in NPT (Indicator type A with blind plug M25 × 1.5)			4 <sup>1</sup>							
<b>Explosion Protection Certification and Approvals</b>										
Without				Y0						
ATEX / IECEx, (Zone 2 / 21), Ex nA, c, Ex tD				B1 <sup>2</sup>						
ATEX / IECEx, (Zone 1 / 21), Ex ia, Ex nA, c, Ex tD				A4 <sup>2</sup>						
ATEX / IECEx, (Zone 1 / 21), Ex d, Ex ia, Ex nA, c, Ex tD				A9 <sup>3</sup>						
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), XP + IS, NI				F3 <sup>4</sup>						
FM / CSA, Class I, Div 1, 2 (Zone 1, 2), IS, NI				F4 <sup>4</sup>						
<b>Process Connection</b>										
Thread DIN 11851					S1					
SMS 1145					S2					
<b>Connection Size</b>										
DN 25 (1 in)						B				
DN 40 (1 ½ in)						N				
DN 50 (2 in)						C				
DN 80 (3 in)						D				
DN 100 (4 in)						E				
<b>Float Design</b>										
Standard								1		
<b>Pressure Rating</b>										
PN 6									D0	
PN 25									D3 <sup>5</sup>	
PN 40									D4 <sup>6</sup>	
<b>Design Level</b>										
(Specified by ABB)										X
<b>Tube / Float Combination</b>										
(Specified by ABB.) See flow range tables.										XX

1) Not available with Ex d or XP applications

2) Version with analog indicator without output signal: Type of protection "c" only available with ATEX approval

3) With Ex d approved cable gland. Not available for analog indicator without output signal

4) Only with cable entry ½ in NPT

5) For DN 50 and DN 80 (2 in and 3 in)

6) For DN 25 and DN 40 (1 in and 1-½ in)

**Additional ordering information FAM544**

VA Master FAM544 Metal Cone Variable Area Flowmeter, hygienic design, for specific food and pharmacy applications	XX	XX	XX	XX	XX	XX	XX	XX
Primary								
Without, secondary only	Y0*							
Standard	Y1**							
Measuring Deviation								
Class 1.6 acc. VDE / VDI 3513		A1**						
1 % of full scale		AA						
4 % of full scale (high viscosity, without calculation)		AK						
4 % of full scale (high viscosity, with calculation)		AL						
Material: 3.1, 3.2 Inspection / NACE								
Material monitoring with inspection certificate 3.1 acc. EN 10204						C2		
Material monitoring with inspection certificate 3.2 acc. EN 10204						C3		
Material monitoring NACE MR 01-75 with inspection certificate 3.1 acc. EN 10204						CN		
Material: 2.1 Compliance								
Declaration of compliance with the order 2.1 acc. EN 10204						C4		
Certificates: 3.1 Visual, Dimensional and Functional Test								
Inspection certificate 3.1 acc. EN 10204 of visual, dimensional and functional test							C6	
Certificates: 3.1 PMI Test								
Inspection certificate 3.1 acc. EN 10204 of positive material identification PMI								CA
Certificates: 3.1 Pressure Test								
Pressure test acc. AD2000								CB
Test package (pressure test, non-destructive test, welder and welding procedure certificate) (Non-destructive test = X-ray for welding neck flanges, dye penetration test for slip-on flanges)								CP
Certificates: Calibration, Test Report								
Certificate of compliance for calibration 2.1 acc. EN 10204								CM
Inspection certificate 3.1 acc. EN 10204 of calibration, with test report								CE

\* For Ex devices upon request

\*\* Standard, automatically specified by ABB if not specified by customer

## ... Ordering Information

Additional ordering information	XXX	XX	XX	XX	XX	XX	XX
Other Explosion Protection Certifications and Approvals							
INMETRO (Brazil)	EB1						
<b>Documentation Language</b>							
German		M1					
English		M5*					
Language package Western Europe / Scandinavia (Languages: DE, EN, DA, ES, FR, IT, NL, PT, FI, SV)		MW					
Language package Eastern Europe (Languages: DE, EL, CS, ET, LV, LT, HU, HR, PL, SK, SL, RO, BG)		ME					
<b>Applications</b>							
Degreased for oxygen applications			P1				
<b>Device Identification Plate</b>							
Stainless steel plate with TAG no.					T0		
Adhesive label with TAG no.					TC*		
<b>Float Material</b>							
AISI 316Ti SST (1.4571)						F1*	
<b>Scale Design</b>							
Direct reading scale							SD*
Percentage scale							SP
Bargraph							SB**
<b>Ambient Temperature Range</b>							
Extended -40 to 70 °C (-40 to 158 °F) / -40 to 60 °C (-40 to 140 °F) with Ex protection Exd + Ex tD							R5***
Standard -20 to 70 °C (-4 to 158 °F) / -20 to 60 °C (-4 to 140 °F) with Ex protection Exd + Ex tD							R6*

\* Standard, automatically specified by ABB if not specified by customer

\*\* Recommended for indicator with transmitter 4 to 20 mA with LCD display

\*\*\* Not available with analog indicator with alarm

## Trademarks

HART is a registered trademark of FieldComm Group, Austin, Texas, USA

Buna-N is a registered trademark of DuPont Dow Elastomers.

™ Hastelloy C-2 is a Haynes International trademark

# Questionnaire

<b>Customer:</b> _____	<b>Date:</b> _____
<b>Ms./Mr.:</b> _____	<b>Department:</b> _____
<b>Telephone:</b> _____	<b>Fax:</b> _____

<b>Measuring medium</b>	<input type="checkbox"/> _____ <input type="checkbox"/> liquid contaminated <input type="checkbox"/> Yes <input type="checkbox"/> gaseous <input type="checkbox"/> No <input type="checkbox"/> transparent Solids content <input type="checkbox"/> Yes <input type="checkbox"/> non-transparent <input type="checkbox"/> No <input type="checkbox"/> translucent Size _____		
<b>Flow rate:</b>	min. _____	norm. _____	max. _____
	<input type="checkbox"/> l/min	<input type="checkbox"/> l/h <input type="checkbox"/> m <sup>3</sup> /min	<input type="checkbox"/> m <sup>3</sup> /min
	<input type="checkbox"/> cm <sup>3</sup> /min	<input type="checkbox"/> kg/min <input type="checkbox"/> g/min	<input type="checkbox"/> kg/h
	<input type="checkbox"/> other _____		
	If a vol. gas measurement refers to standard state, (Qv)s should be added to the flowrate unit.		
<b>Operating temperature:</b>	standard _____	max. _____	
<b>Operating pressure:</b>	Upstream pressure (P1) _____	Downstream pressure (P1) _____	max. _____
<b>Gases:</b>	Standard density (ρn) _____ kg/m <sup>3</sup>	Viscosity _____ mPa s	
<b>Fluid:</b>	Concentration _____ Vol. %	_____ Weight %	
	Density at operating temperature _____	_____ kg/dm <sup>3</sup>	
	Viscosity at operating temperature _____	_____ mPa s	
<b>Materials:</b>	Meter tube _____ Float _____ Gaskets _____ Other wetted parts _____		
<b>Connections:</b>	<input type="checkbox"/> Thread	<input type="checkbox"/> Flange	other _____
	<input type="checkbox"/> Threaded spuds in accordance with DIN 11851		
<b>Installation type:</b>	<input type="checkbox"/> Cable assembly	<input type="checkbox"/> Wall mounting	
<b>Display on device:</b>	<input type="checkbox"/> % scale	<input type="checkbox"/> Directly readable product scale	
<b>Transmitter, electrical:</b>	<input type="checkbox"/> 4 ... 20 mA	<input type="checkbox"/> Ex	<input type="checkbox"/> Non-Ex
<b>Limit switch:</b>	<input type="checkbox"/> Min. contact	<input type="checkbox"/> Max. contact	<input type="checkbox"/> Min. and max. contact
<b>Notes:</b>			

---

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