ABB MEASUREMENT & ANALYTICS | COMMISSIONING INSTRUCTION

VA Master FAM540

Metal Cone Variable Area Flowmeter

Device firmware: Version B.20 or higher

Measurement made easy

FAM540

Introduction

Metal cone variable area flowmeter for the measurement of the flow rate of operating volume or mass flow units (at constant pressure / temperature), if a physical mass flow unit has been selected.

Additional Information

Additional documentation on VA Master FAM540 is available for download free of charge at www.abb.com/flow.
Alternatively simply scan this code:

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1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference.
Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.
For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.
The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times.
The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠ WARNING

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠ CAUTION

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word ***'NOTICE'*** indicates possible material damage.

Note

'**Note**' indicates useful or important information about the product.

… 1 Safety

Intended use

This device is intended for the following uses:
- To transmit fluid or gaseous measuring media.
- To measure volume flow rate in operating units, standard units or mass flow units.

The device has been designed for use exclusively within the technical limit values indicated on the identification plate and in the data sheets.

When using measuring media, the following points must be observed:
- Measuring media may only be used if, based on the state of the art or the operating experience of the user, it can be assured that the chemical and physical properties necessary for operational security of the materials of the wetted parts of the temperature sensor will not be adversely affected during the operating time.
- Media containing chloride in particular can cause corrosion damage to stainless steels which, although not visible externally, can damage wetted parts beyond repair and lead to the measuring medium escaping. It is the operator's responsibility to check the suitability of these materials for the respective application.
- Measuring media with unknown properties or abrasive measuring media may only be used if the operator is able to perform regular and suitable tests to ensure the safe condition of the device

The operator bears sole responsibility for the use of the devices in relation to suitability, intended use and corrosion resistance of the materials in relation to the measuring medium.
The manufacturer is not liable for damage arising from improper or non-intended use.

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible insofar as these are described in this manual. Approval by ABB Automation Products GmbH must be sought for any activities beyond this scope. Repairs performed by ABB-authorized specialist shops are excluded from this.

Improper use

The following are considered to be instances of especially improper use of the device:
- Operation as a flexible compensating adapter in piping, for example for compensating pipe offsets, pipe vibrations, pipe expansions, etc.
- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

Notes on data safety

This product is designed to be connected to and to communicate information and data via a network interface.
It is operator’s sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).
Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and / or theft of data or information.
ABB Automation Products GmbH and its affiliates are not liable for damages and / or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and / or theft of data or information.

Manufacturer’s address

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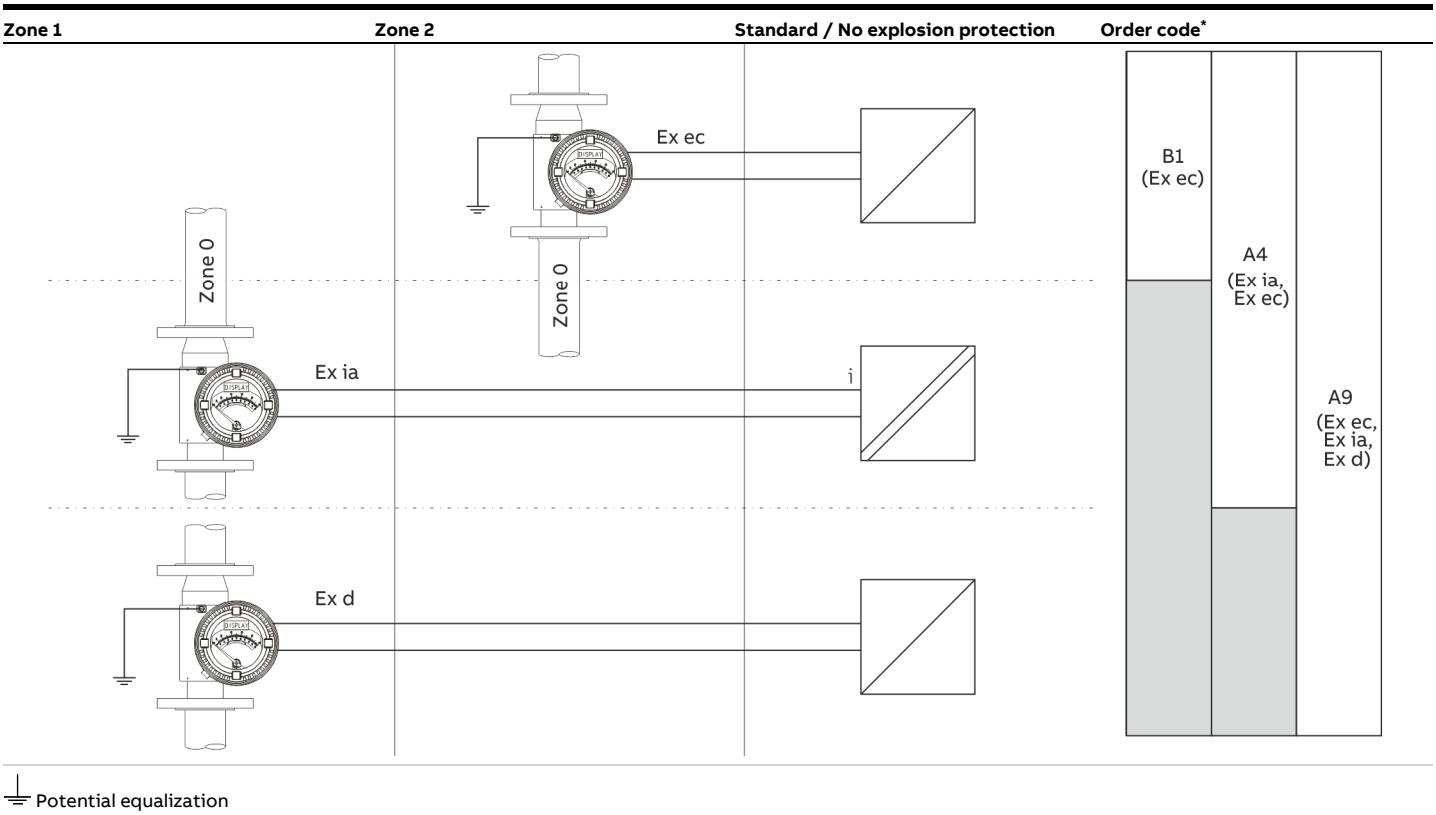
2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Note
Further information on the Ex-Approval of devices can be found in the type examination certificates or the relevant certificates at 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 10.



* Order code ‘Explosion protection and approvals’ (versions 9, 10); refer to **Ordering information in the data sheet** on page 45.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Device overview

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 17
	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 in the data sheet** on page 45.

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 14
	II 1/3 G Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials		**Table 4** on page 16
	II 2D Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 2** on page 14, **Table 4** on page 16
IECEx	Ex h ia IIC T6 … T1 Ga/Gb	Intrinsically Safe		**Table 2** on page 14
	Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials		**Table 4** on page 16
	Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 2** on page 14, **Table 4** on page 16
ATEX	II 1/2 G Ex db h IIC T6 … T1 Ga/Gb	Flameproof / Explosion-Proof	A9	**Table 3** on page 15
	II 1/2 G Ex h ia IIC T6 … T1 Ga/Gb	Intrinsically Safe		**Table 2** on page 14
	II 1/3 G Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials		**Table 4** on page 16
	II 2 D Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 2** on page 14, **Table 3** on page 15, **Table 4** on page 16
IECEx	Ex db h IIC T6 … T1 Ga/Gb	Flameproof / Explosion-Proof		**Table 3** on page 15
	Ex h ia IIC T6 … T1 Ga/Gb	Intrinsically Safe		**Table 2** on page 14
	Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials		**Table 4** on page 16
	Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 2** on page 14, **Table 3** on page 15, **Table 4** on page 16
ATEX	II 1/3 G Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials	B1	**Table 4** on page 16
	II 2 D Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 4** on page 16
IECEx	Ex ec h IIC T6 … T1 Ga/Gc	Non-sparking materials		**Table 4** on page 16
	Ex h tb IIIC T85°C … Tmedium Db	Dust-explosion protection		**Table 4** on page 16

* Order code ‘Explosion protection and approvals’ (versions 9, 10); refer to **Ordering information in the data sheet** on page 45.

Model FAM54xE/Fx (analog indicator with transmitter and with or without LCD indicator)

Marking		Type of protection	Order code*	Limit value table
ATEX	II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb	Intrinsically Safe	A4	**Table 1** on page 12
	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		
IECEx	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		
ATEX	II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb	Flameproof / Explosion-Proof	A9	**Table 1** on page 12
	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		
IECEx	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		
ATEX	II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc	Non-sparking materials	B1	**Table 4** on page 16
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db	Dust explosion protection		
IECEx	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 in the data sheet** on page 45.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Installation instructions

The installation, commissioning, maintenance and repair of devices in areas with explosion hazard must only be carried out by appropriately trained personnel.
The safety instructions for electrical apparatus in potentially explosive areas must be complied with, in accordance with Directive 2014/34/EU (ATEX) and IEC60079-14 (Installation of electrical equipment in potentially explosive areas).
To ensure safe operation, the requirements of EU Directive ATEX 118a (minimum requirements concerning the protection of workers) must be met.

When using in potentially explosive atmospheres, please note:

- Observe the information in **Installation conditions** on page 34 when installing the device.
- The maximum ambient temperature for use with combustible dusts (category II 2D) is T_{amb} = +60 °C.
- During commissioning, refer to EN 60079-0 regarding use in areas with combustible dust.
- For explosion-protected apparatus with PTFE liner, a minimum medium conductivity of > 10^{-8} S/m must be guaranteed.
- If Zone 0 is present in the meter tube, the devices may only be installed in an environment that provides sufficient ventilation to guarantee Zone 1.
- Variable area flowmeters used in accordance with maximum electric values for a category 3 device (zone 2) can also be retrofitted without modification as category 2 devices in zone 1 (see **Changing the type of protection** on page 18).

Protection against electrostatic discharges

⚠ DANGER

Risk of explosion!
The painted surface of the device can store electrostatic charges.
As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- The device is operated in environments with a relative humidity of ≤ 30 %.
- The painted surface of the device is thereby relatively free from impurities such as dirt, dust or oil.
- Instructions on avoiding ignition in potentially explosive environments due to electrostatic discharges in accordance with PD CLC/TR 60079-32-1 and IEC TS 60079-32-1 must be complied with!

Instructions on cleaning

The painted surface of the device must be cleaned only using a moist cloth.

Sensor insulation

The device may be insulated. The maximum permissible thickness of the insulation corresponds to the flange diameter. Refer to **Sensor insulation** on page 21.

Opening and closing the transmitter housing

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing open!

Before opening the transmitter housing, bear in mind the following:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 2 minutes before opening.

⚠ WARNING

Risk of injury due to live parts!

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

Before opening the housing cover, remove the cover protector, and reattach it after closing the housing cover.

Only original spare parts must be used to seal the housing.

Note

Spare parts can be ordered from ABB Service.
www.abb.com/contacts

Cable entries

The devices are connected electrically using a cable gland or alternatively by using conduit systems with pipe fittings.
For this purpose, the devices are delivered with cable glands or alternatively with ½“ NPT connection threads for pipe fittings.

ATEX / IECEx-approved flameproof cable glands made from metal are supplied with device versions that have type of protection Ex-d ‘Flameproof enclosure’ (order code A9).
ATEX / IECEx-approved cable glands made from plastic are supplied with device versions that have the Ex-ia and Ex-nA type of protection.

The various connection possibilities depend on the device-specific configuration of the explosion protection and the ‘Housing material / cable connection’ option in accordance with the ordering information in data sheet DS/FAM540.

To ensure proper routing of cables, the following cable diameters are required:

- Ex-d design: 7.2 to 11.7 mm (0.28 to 0.46 in)
- Other designs: 5.0 to 9.0 mm (0.20 to 0.35 in)

Devices with ½” NPT threads and ATEX and IECEx approvals can be ordered and operated without cable glands (with the exception of ‘Ex d’). In this case, the operator is responsible for properly installing pipe fittings in accordance with national regulations (e.g. NEC, CEC, ATEX137, IEC60079-14, etc.).

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Installation instructions

Type of protection Ex d - flameproof (enclosure)

Model FAM540, order code A9

The flowmeter is electrically connected via the ATEX / IECEx-approved cable gland with Ex-d type of protection (see Figure 1) located on the device.

Alternatively, the flowmeter can be connected using conduit systems. In Ex-d type of protection, the connection must be made using an ATEX / IECEx approved pipe fitting with a flame barrier. The mechanical ignition barrier must be installed directly on the housing.

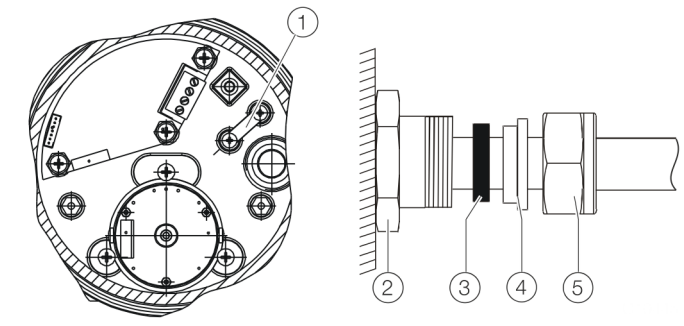
The preinstalled cable gland must be removed before connecting a pipe fitting. The M25 × 1.5 / ½ in NPT adapter remains unchanged on the device.

Note

Pipe fittings with flame barriers are not included in the scope of supply.

Only ATEX / IECEx approved pipe fittings with a flame barrier may be used with Ex-d type of protection. The use of cable and wire entries, pipe fittings or sealing plugs without an Ex-d type examination certificate is prohibited.

Unused openings must be closed with Ex-d-approved sealing plugs.

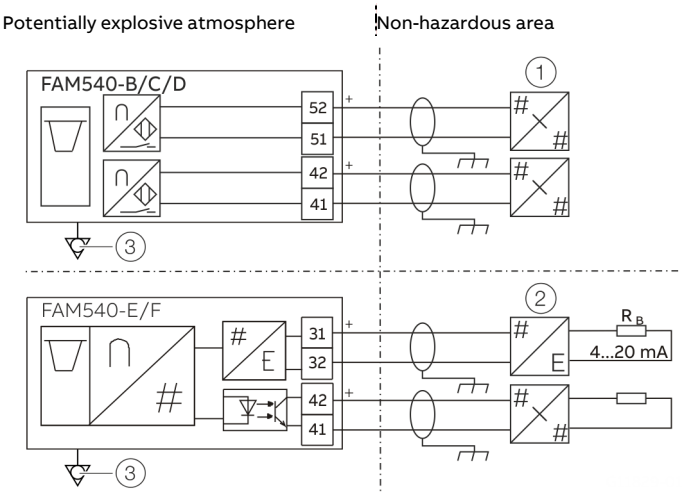


1 Strain relief
2 Adapter M25 × 1.5 / ½ in NPT
3 Gasket
4 Sleeve
5 Union nut

Figure 1: Connection using a flameproof cable gland

The outside diameter of the unshielded connection cable must be in a range from 7.2 to 11.7 mm (0.3 to 0.5 in). After installing the cable in the fitting, tighten the union nut using a torque of 3.25 Nm (2.40 lb/ft). Use additional strain relief in the housing to secure the connection cable.

Electrical connections



1 Namur switching amplifier
2 Safety barrier
3 Potential equalization

Figure 2: 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.)

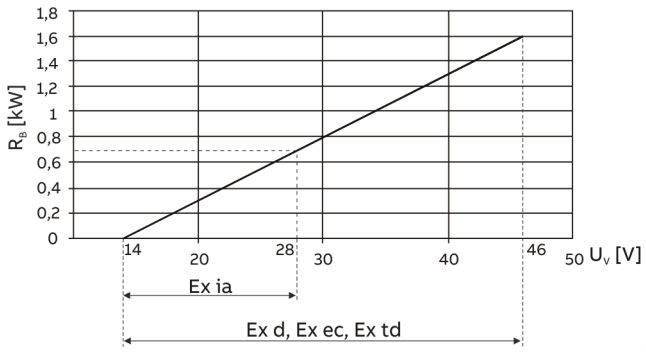


Figure 3: Terminals 31 / 32, power supply / load

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 Ω.

Signal cable

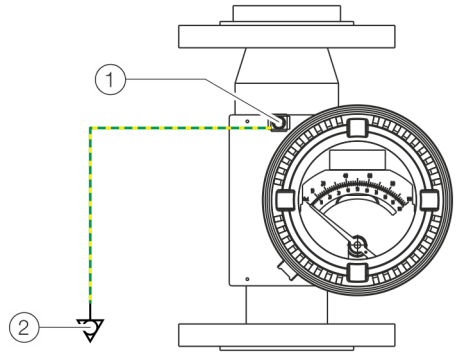
The Ex calculations are based on temperatures of 80 °C (176 °F) at the cable input. For this reason, cables with a specification of 80 °C (176 °F) must be used.
For cables limited to 70 °C (158 °F), a maximum ambient temperature of T_{amb} = 60 °C (140 °F) applies.
The resulting new maximum measuring 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 12, 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 4: 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^2 (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.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

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.

Order code	Ambient temperature T_{amb}	Maximum permissible measuring medium temperature T_{medium}
A4, A9, B1	−50 °C to +60 °C	250 °C
	−50 °C to +40 °C	340 °C
	−50 °C to +20 °C	430 °C

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_{amb} −20 °C to (−50 °C to)	Temp. class	T_{medium} Maximum	Insulation
A4, A9	**ATEX:**	31 / 32**	U_i = 30 V	40 °C	T1	440 °C	No
	II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb		I_i = 110 mA	40 °C	T1	375 °C	yes
	II 1/3 G Ex ec h ic T6 ... T1Ga/Gc		P_i = 770 mW	40 °C	T1	260 °C	yes
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db		C_i = 5.3 nF	50 °C	T1	300 °C	yes
			L_i = 266 µH	50 °C	T2	290 °C	yes
	IECEx:			50 °C	T2	220°C	yes
	Ex h ia IIC T4 ... T1 Ga/Gb	41 / 42**	U_i = 30 V	60 °C	T2	320 °C	No
	Ex ec h ic IIC T6 ... T1Ga/Gc		I_i = 30 mA	60 °C	T2	230 °C	yes
	Ex h tb IIIC T85°C ... Tmedium Db		P_i = 115 mW	60 °C	T3	170 °C	yes
			C_i = 4.8 nF	70 °C	T3	195 °C	No
			L_i = 133 µH	70 °C	T3	150 °C	yes
				70 °C	T4	125 °C	yes
A9	**ATEX:**	31 / 32***	U_{max} = 46 V	40 °C	T1	440 °C	No
	II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb			40 °C	T1	375 °C	yes
	II 1/2 G Ex h ia IIC T4 ... T1 Ga/Gb			40 °C	T1	260 °C	yes
	II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc			50 °C	T1	300 °C	yes
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db			50 °C	T2	290 °C	yes
				50 °C	T2	220°C	yes
	IECEx:	41 / 42***	U_{max} = 30 V	60 °C	T2	320 °C	No
	Ex db h IIC T6 ... T1 Ga/Gb		I_{max} = 30 mA	60 °C	T2	230 °C	yes
	Ex h ia IIC T4 ... T1 Ga/Gb		P_{max} = 115 mW	60 °C	T3	170 °C	yes
	Ex ec h ic IIC T6 ... T1 Ga/Gc			60 °C	T4	130 °C	yes
	Ex h tb IIIC T85°C ... Tmedium Db			60 °C	T5	95 °C	yes
				60 °C	T6	80 °C	yes

A4, A9, B1	**ATEX:**	31 / 32***	U_{max} = 46 V	40 °C	T1	440 °C	No
	II 1/3 G Ex ec h ic IIC T6 ... T1 Ga/Gc			40 °C	T1	375 °C	yes
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db			40 °C	T1	260 °C	yes
				50 °C	T1	300 °C	yes
	IECEx:			50 °C	T2	290 °C	yes
	Ex ec h ic IIC T6 ... T1 Ga/Gc			50 °C	T2	220°C	yes
	Ex h tb IIIC T85°C ... Tmedium Db	41 / 42***	U_{max} = 30 V	60 °C	T2	320 °C	No
			I_{max} = 30 mA	60 °C	T2	230 °C	yes
			P_{max} = 115 mW	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 in the data sheet** on page 45.

** 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_{max} = 60 V may not be exceeded.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Safety specifications ATEX / IECEx

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_{amb} −20 °C to (−50 °C to)	Temp. class	T_{medium} Maximum	Insulation
A4, A9	**ATEX:**	41 / 42**	U_i = 16 V	40 °C	T1	440 °C	No
	II 1/2 G Ex h ia IIC T6 … T1 Ga/Gb	51 / 52**	I_i = 25 mA	40 °C	T1	375 °C	yes
	II 2D Ex h tb IIIC T85°C … Tmedium Db		P_i = 64 mW	40 °C	T1	260 °C	yes
			C_i = 50 nF	50 °C	T1	300 °C	yes
	IECEx:		L_i = 250 µH	50 °C	T2	290 °C	yes
	Ex h ia IIC T6 … T1 Ga/Gb			50 °C	T2	220°C	yes
	Ex h tb IIIC T85°C … Tmedium Db			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_i = 16 V	40 °C	T1	440 °C	No
		51 / 52**	I_i = 52 mA	40 °C	T1	375 °C	yes
			P_i = 169 mW	40 °C	T1	260 °C	yes
			C_i = 50 nF	50 °C	T1	300 °C	yes
			L_i = 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_i = 16 V	40 °C	T1	440 °C	No
		51 / 52**	I_i = 76 mA	40 °C	T1	310 °C	yes
			P_i = 242 mW	40 °C	T2	190 °C	yes
			C_i = 50 nF	50 °C	T2	340 °C	No
			L_i = 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 in the data sheet** on page 45.

** for connection to an intrinsically safe circuit

Table 3: Analoganzeiger mit Grenzwertgeber

Model FAM54xB/C/Dx

Type of protection: flameproof enclosure, dust explosion protection.

Order code*	Marking	Terminals	Electrical values	T_{amb} −20 °C to (−50 °C to)	Temp. class	T_{medium} Maximum	Insulation
A9	**ATEX:**	41 / 42**	U_{max} = 16 V	40 °C	T1	440 °C	No
	II 1/2 G Ex db h IIC T6 ... T1 Ga/Gb	51 / 52**	I_{max} = 25 mA	40 °C	T1	375 °C	yes
	II 2 D Ex h tb IIIC T85°C ... Tmedium Db		P_{max} = 64 mW	40 °C	T1	260 °C	yes
				50 °C	T1	300 °C	yes
	IECEx:			50 °C	T2	290 °C	yes
	Ex db h IIC T6 ... T1 Ga/Gb			50 °C	T2	220°C	yes
	Ex h tb IIIC T85°C ... Tmedium Db			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_{max} = 16 V	40 °C	T1	440 °C	No
		51 / 52**	I_{max} = 52 mA	40 °C	T1	375 °C	yes
			P_{max} = 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_{max} = 16 V	40 °C	T1	440 °C	No
		51 / 52**	I_{max} = 76 mA	40 °C	T1	310 °C	yes
			P_{max} = 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 in the data sheet** on page 45.

** for connection to a non-intrinsically safe circuit If the device is to be operated subsequently with type of protection "intrinsically safe", then U_{max} = 60 V may not be exceeded.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Safety specifications ATEX / IECEx

Table 4: Analoganzeiger mit Grenzsignalgeber

Model FAM54xB/C/Dx

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

Order code*	Marking	Terminals	Electrical values	T_{amb} −20 °C to (−50 °C to)	Temp. class	T_{medium} Maximum	Insulation
A4, A9, B1	**ATEX:**	41 / 42**	U_{max} = 16 V	40 °C	T1	440 °C	No
	II 1/3 G Ex ec h IIC T6 … T1 Ga/Gc	51 / 52**	I_{max} = 25 mA	40 °C	T1	375 °C	yes
	II 2D Ex h tb IIIC T85°C … Tmedium Db		P_{max} = 64 mW	40 °C	T1	260 °C	yes
				50 °C	T1	300 °C	yes
	IECEx:			50 °C	T2	290 °C	yes
	Ex ec h IIC T6 … T1 Ga/Gc			50 °C	T2	220°C	yes
	Ex h tb IIIC T85°C … Tmedium Db			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_{max} = 16 V	40 °C	T1	440 °C	No
		51 / 52**	I_{max} = 52 mA	40 °C	T1	375 °C	yes
			P_{max} = 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
A4, A9, B1	**ATEX:**	41 / 42**	Umax= 16 V	40 °C	T1	440 °C	No
	II 1/3 G Ex ec h IIC T6 … T1 Ga/Gc	51 / 52**	Imax = 76 mA	40 °C	T1	310 °C	yes
	II 2 D Ex h tb IIIC T85°C … Tmedium Db		Pmax = 242 mW	40 °C	T2	190 °C	yes
				50 °C	T2	340 °C	No
	IECEx:			50 °C	T2	230 °C	yes
	Ex ec h IIC T6 … T1 Ga/Gc			60 °C	T2	230°C	No
	Ex h tb IIIC T85°C … Tmedium Db			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 in the data sheet** on page 45.

** for connection to a non-intrinsically safe circuit If the device is to be operated subsequently with type of protection "intrinsically safe", then U_{max} = 60 V may not be exceeded.

Table 5: Analoganzeiger ohne Grenzsignalgeber
Model FAM54xAx
Type of protection: constructional safety, dust explosion protection

Order code*	Marking	Terminals	Electrical values	T_{amb} −20 °C to (−50 °C to)	Temp. class	T_{medium} Maximum	Insulation
A4, A9, B1	**ATEX:**	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
	IECEx:			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 in the data sheet** on page 45.

Operating instructions

Protection against electrostatic discharges

⚠ DANGER

Risk of explosion!
The painted surface of the device can store electrostatic charges.
As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- The device is operated in environments with a relative humidity of ≤ 30 %.
- The painted surface of the device is thereby relatively free from impurities such as dirt, dust or oil.
- Instructions on avoiding ignition in potentially explosive environments due to electrostatic discharges in accordance with PD CLC/TR 60079-32-1 and IEC TS 60079-32-1 must be complied with!

Instructions on cleaning

The painted surface of the device must be cleaned only using a moist cloth.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Operating instructions

Changing the type of protection

Depending on the model, the device may be designed to be installed in one of the applications listed. If you plan to use a device that was installed in one type of protection rating in a different type of protection rating, some measures must be taken before connecting voltage to the device.

Measures for devices with alarm signaling unit FAM540-B/C/D

Original installation	New installation	Necessary test steps
XP or Ex d U_M = 60 V	**IS or Ex ia***	• 500 V AC / 1min test between terminals 51 / 52 and 41 / 42 and terminals 51 / 52 / 41 / 42 and the housing. • Visual inspection: no explosion, no damage.
	NI or Ex ec	• 500 V AC / 1min test between terminals 51 / 52 and 41 / 42 and terminals 51 / 52 / 41 / 42 and the housing. • Visual inspection: no explosion, no damage.
IS or Ex ia	**XP or Ex d**	• Visual inspection: no damage to threads (cover, surface, ½" NPT cable input), cable gland, glass, housing, locking device for cover, suited cable, etc.
	NI or Ex ec	No special measures required.
NI or Ex ec U_M = 60 V	**IS or Ex ia***	• 500 V AC / 1min test between terminals 51 / 52 and 41 / 42 and terminals 51 / 52 / 41 / 42 and the housing. • Visual inspection: no explosion, no damage.
	XP or Ex d	• Visual inspection: no damage to threads (cover, surface, ½" NPT cable input), cable gland, glass, housing, locking device for cover, suited cable, etc.

* Possible only if the maximum signal levels of U_M ≤ 60 V (e.g., PELV or SELV circuits) were not previously up-scaled.

Measures for devices with transmitter with or without LCD display FAM540-E/F

Original installation	New installation	Necessary test steps
XP or Ex d U_M = 60 V	**IS or Ex ia***	• 500 V AC / 1min test between terminals 31 / 32 and 41 / 42 and terminals 31 / 32 / 41 / 42 and the housing. • Visual inspection: No damage, especially to electronic boards. • Visual inspection: no explosion, no damage.
	NI or Ex ec	• 500 V AC / 1min test between terminals 31 / 32 and 41 / 42 and terminals 31 / 32 / 41 / 42 and the housing. • Visual inspection: No damage, especially to electronic boards. • Visual inspection: no explosion, no damage.
IS or Ex ia	**XP or Ex d**	• Visual inspection: no damage to threads (cover, surface, ½" NPT cable input), cable gland, glass, housing, locking device for cover, suited cable, etc.
	NI or Ex ec	No special measures required.
NI or Ex ec U_M = 60 V	**IS or Ex ia***	• 500 V AC / 1min test between terminals 31 / 32 and 41 / 42 and terminals 31 / 32 / 41 / 42 and the housing. • Visual inspection: No damage, especially to electronic boards.
	XP or Ex d	• Visual inspection: no damage to threads (cover, surface, ½" NPT cable input), cable gland, glass, housing, locking device for cover, suited cable, etc.

* Possible only if the maximum signal levels of U_M ≤ 60 V (e.g., PELV or SELV circuits) were not previously up-scaled.

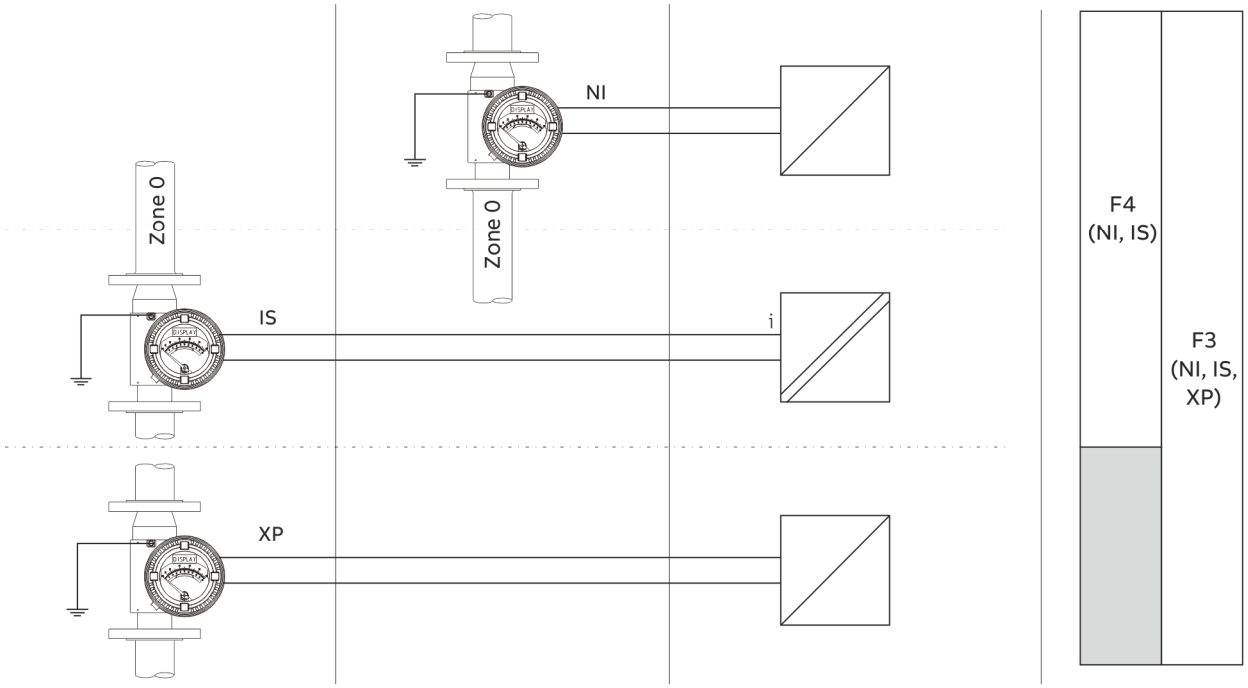
3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

Note
Further information on the Ex-Approval of devices can be found in the type examination certificates or the relevant certificates at 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 22.

Class 1 Division 1 / Zone 1	Class 1 Division 2 / Zone 2	Standard / No explosion protection	Order code*



Potential equalization

* Order code ‘Explosion protection and approvals’ (versions 9, 10); refer to **Ordering information in the data sheet** on page 45.

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

… Device overview

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.

Model FAM54xAx (analog indicator without alarm signaling unit and model FAM54xB/C/Dx (analog indicator with alarm signaling unit)

Marking		Type of protection	Order code*	Limit value table
FM	XP / CL I / DIV 1 / GP ABCD / T6 … T1 CL I, ZN 1 AEx d IIC T6 … T1	Explosionproof	F3	**Table 2** on page 26
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 … T1 CL I, ZN 1 AEx ia IIC T6 … T1	Intrinsic Safety	F3, F4	**Table 1** on page 12, **Table 2** on page 26
	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	**Table 1** on page 25, **Table 2** on page 26, **Table 3** on page 27
cCSAus	XP / CL I / DIV 1 / GP BCD / T6 … T1 Ex d IIC T6 … T1	Explosionproof	F3	**Table 2** on page 26
	IS / CL I,II,III / DIV 1 / GP ABCDEFG / T6 … T1 Ex ia IIC T6 … T1	Intrinsic Safety	F3, F4	**Table 1** on page 25,
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1 DIP A21 TA 85°C … T_{medium}	Dust-Ignitionproof	F3, F4	**Table 1** on page 25, **Table 2** on page 26, **Table 3** on page 27
	NI /CL I,II / DIV 2 / GP ABCDFG / T5 … T1 NI / CL III T5 … T1 Ex ec II T5 bis T1	Non-Incendive	F3, F4	**Table 3** on page 27

* Order code ‘Explosion protection and approvals’ (version digit no. 9, 10); see **Ordering information in the data sheet** on page 45.

Model FAM54xE/Fx (analog indicator with transmitter / with or without LCD display)

Marking		Type of protection	Order code*	Limit value table
FM	XP / CL I / DIV 1 / GP ABCD / T6 … T1 CL I, ZN 1 AEx d IIC T6 … T1	Explosionproof	F3	**Table 4** on page 28
	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		
cCSAus	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_{medium}	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 in the data sheet** on page 45.

Installation instructions

The installation, commissioning, maintenance and repair of devices in areas with explosion hazard must only be carried out by appropriately trained personnel.
The operator must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices. (e. g. NEC, CEC).

Intrinsic Safety Control Drawing

Note
For intrinsically safe installations, the FAM540 must be installed in accordance with the 'Intrinsic Safety Control Drawing'. See **Intrinsic Safety Control Drawing SDM-10-A0253** on page 46.

Sensor insulation

The device may be insulated. The maximum permissible thickness of the insulation corresponds to the flange diameter. Refer to **Sensor insulation** on page 21.

Opening and closing the transmitter housing

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing open!
Before opening the transmitter housing, bear in mind the following:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 2 minutes before opening.

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

Before opening the housing cover, remove the cover protector, and reattach it after closing the housing cover.

Only original spare parts must be used to seal the housing.

Note
Spare parts can be ordered from ABB Service.
www.abb.com/contacts

Cable entries

Devices with FM and CSA approval are delivered for electrical connection using piping systems that have ½" NPT connection threads and are sealed with dust protection plugs.
Alternatively, cable glands with ½" NPT threads can be used for the connection. National guidelines (NEC, CEC) must be observed.
For operation in XP 'Explosionproof' type of protection, the installation instructions in '**Type of protection XP 'Explosion proof'** on page 21' must be observed.

Type of protection XP 'Explosion proof'

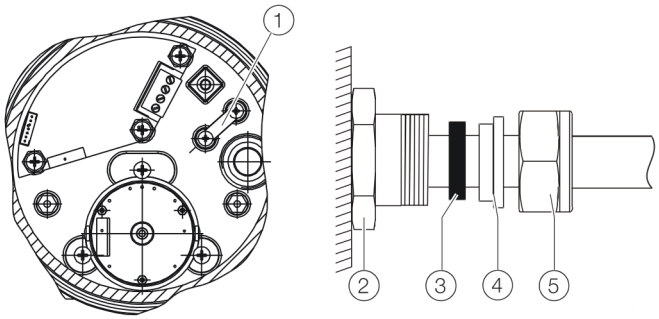
For operation in the XP 'Explosionproof' type of protection, the connection is made using Ex-approved pipe fittings with a flame barrier with type of protection XP.
In Group A and B hazardous areas, the flame barriers must be installed within a distance of 46 cm (18.1 in) from the device.

When using cable glands for the connection, Ex-approved cable glands with type of protection XP or Ex-d must be used (see Figure 5).

Note
There must be a separate XP type examination certificate for the pipe fitting.
The use of standard cable and wire entries and sealing plugs is prohibited.
The pipe fitting is not included in the scope of supply.

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

… Installation instructions

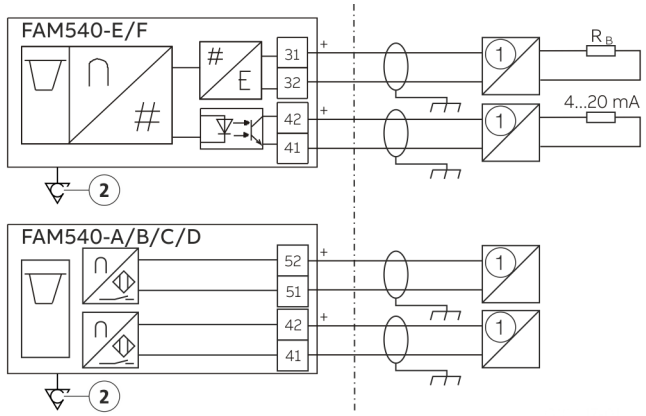


① Strain relief
② Adapter M25 × 1.5 / ½“-NPT
③ Gasket
④ Sleeve
⑤ Union nut

Figure 5: Connection using a flameproof cable gland

The outside diameter of the unshielded connection cable must be in a range from 8.0 to 11.7 mm (0.3 to 0.5 in).
The cable gland must be dimensioned accordingly.
After installing the cable in the gland, tighten the union nut to a torque of 3.25 Nm (2.40 lbf/ft).
Use an additional strain relief device in the housing to secure the connection cable.

Electrical connections



① FM Approved IS Barrier
② Potential equalization

Figure 6: 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.)

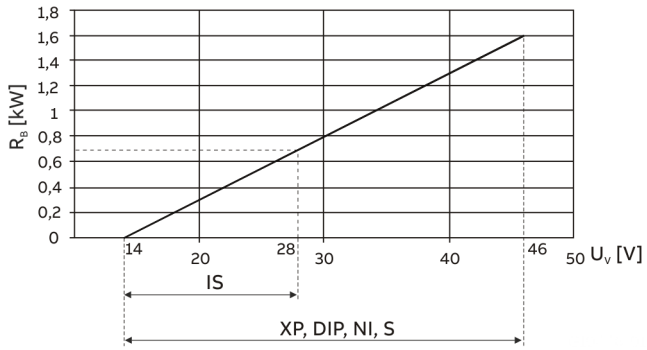


Figure 7: Terminals 31 / 32, power supply / load

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 Ω.

Installation instructions

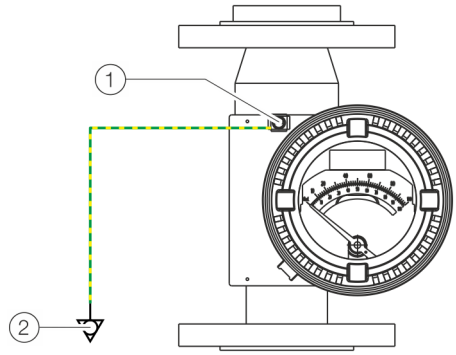
The concept of intrinsic safety enables multiple intrinsic safety devices with FM or CSA approval to be interconnected, without entity parameters being examined specifically, subject to observation of the following conditions:

- U_o or V_{oc} or $V_t \leq 0$ V max, I_o or I_{sc} or $I_t \leq I_{max}$, C_a or $C_o \geq C_i + C_{cable}$, L_a or $L_o \geq L_i + L_{cable}$, $P_o \leq P_i$.
- 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 in accordance with the 'Intrinsic Safety Control Drawing'. See **Intrinsic Safety Control Drawing SDM-10-A0253** on page 46.

Earthing



(1) Ground terminal

(2) Potential equalization in accordance with EN 60079-0

Figure 8: 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^2 (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.

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

… Installation instructions

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.

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_{amb} −58 °F to	T_{amb} −50 °C to	Temp. class		T_{medium} Maximum	Insulation
F3, F4	FM	41 / 42***	U_i = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
	IS / CL I,II,III / DIV 1 / GP ABCDEFG /	51 / 52***	I_i = 25 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
	T6 ... T1**		P_i = 64 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
			C_i = 50 nF	122 °F	50 °C	T1	572 °F	300 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 ... T1		L_i = 250 µH	122 °F	50 °C	T2	554 °F	290 °C	yes
				122 °F	50 °C	T2	428 °F	220°C	yes
	CL I, ZN 1 AEx ia IIC T6 ... T1			140 °F	60 °C	T2	608 °F	320 °C	No
				140 °F	60 °C	T2	446 °F	230 °C	yes
	cCSAus			140 °F	60 °C	T3	338 °F	170 °C	yes
	IS / CL I,II,III / DIV 1 / GP ABCDEFG /			158 °F	70 °C	T3	383 °F	195 °C	No
	T6 ... T1**			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
	Ex ia IIC T6 ... T1	41 / 42***	U_i = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
		51 / 52***	I_i = 52 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
	DIP A21 TA 85°C to T_{medium}		P_i = 169 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
			C_i = 50 nF	122 °F	50 °C	T1	572 °F	300 °C	yes
			L_i = 250 µH	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
				104 °F	40 °C	T6	140 °F	60 °C	yes
		41 / 42***	U_i = 16 V	104 °F	40 °C	T1	824 °F	440°C	No
		51 / 52***	I_i = 76 mA	104 °F	40 °C	T1	590 °F	310 °C	yes
			P_i = 242 mW	104 °F	40 °C	T2	374 °F	190 °C	yes
			C_i = 50 nF	122 °F	50 °C	T2	644 °F	340 °C	No
			L_i = 250 µH	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 in the data sheet** on page 45.

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

*** for connection to an intrinsically safe circuit

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

… Safety specifications FM, cCSAus

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_{amb} −58 °F to	T_{amb} −50 °C to	Temp. class		T_{medium} Maximum	Insulation
F3	FM	41 / 42**	U_{max} = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
	XP / CL I / DIV 1 / GP ABCD / T6 … T1	51 / 52**	I_{max} = 25 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
			P_{max} = 64 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1			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
	XP / CL I / DIV 1 / GP BCD / 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 d IIC T6 … T1			158 °F	70 °C	T5	203 °F	95 °C	yes
				140 °F	60 °C	T6	176 °F	80 °C	yes
	DIP A21 TA 85°C … T_{medium}	41 / 42**	U_{max} = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
		51 / 52**	I_{max} = 52 mA	104 °F	40 °C	T1	707 °F	375 °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
				104 °F	40 °C	T6	140 °F	60 °C	yes
		41 / 42**	U_{max} = 16 V	104 °F	40 °C	T1	824 °F	440°C	No
		51 / 52**	I_{max} = 76 mA	104 °F	40 °C	T1	590 °F	310 °C	yes
			P_{max} = 242 mW	104 °F	40 °C	T2	374 °F	190 °C	yes
				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 in the data sheet** on page 45.

** for connection to a non-intrinsically safe circuit

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} −58 °F to	T_{amb} −50 °C to	Temp. class		T_{medium} Maximum	Insulation
F3**, F4**	FM	41 / 42***	U_{max} = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
	NI /CL I,II / DIV 2 / GP ABCDFG /	51 / 52***	I_{max} = 25 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
	T5 ... T1		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			140 °F	60 °C	T3	338 °F	170 °C	yes
	NI /CL I,II / DIV 2 / GP ABCDFG /			158 °F	70 °C	T3	383 °F	195 °C	No
	T5 ... T1			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
		41 / 42***	U_{max} = 16 V	104 °F	40 °C	T1	824 °F	440 °C	No
	Ex ec II T6 ... T1	51 / 52***	I_{max} = 52 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
			P_{max} = 169 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
	DIP A21 TA 85°C to T_{medium}			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***	Umax= 16 V	104 °F	40 °C	T1	824 °F	440°C	No
		51 / 52***	Imax = 76 mA	104 °F	40 °C	T1	590 °F	310 °C	yes
			Pmax = 242 mW	104 °F	40 °C	T2	374 °F	190 °C	yes
				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

* Order code 'Explosion protection and approvals' (versions 9, 10); refer to **Ordering information in the data sheet** on page 45.

** For connection in Division 2 or Zone 2.

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

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

… Safety specifications FM, cCSAus

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

Order code[1]	Marking	Terminals	Electrical values	T_{amb} −58 °F to	T_{amb} −50 °C to	Temp. class	T_{medium} Maximum		Insulation
F3, F4	FM	31 / 32[2 3]	U_i = 30 V	104 °F	40 °C	T1	824 °F	440 °C	No
	IS / CL I,II,III / DIV 1 / GP ABCDEFG /		I_i = 110 mA	104 °F	40 °C	T1	707 °F	375 °C	yes
	T4 … T1		P_i = 770 mW	104 °F	40 °C	T1	500 °F	260 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1		C_i = 5.3 nF	122 °F	50 °C	T1	572 °F	300 °C	yes
	CL I, ZN 1 AEx ia IIC T4 … T1		L_i = 266 µH	122 °F	50 °C	T2	554 °F	290 °C	yes
	cCSAus			122 °F	50 °C	T2	428°F	220°C	yes
	IS / CL I,II,III / DIV 1 / GP ABCDEFG /	41 / 42[2]	U_i = 30 V	140 °F	60 °C	T2	608 °F	320 °C	No
	T4 … T1 [2]		I_i = 30 mA	140 °F	60 °C	T2	446 °F	230 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1		P_i = 115 mW	140 °F	60 °C	T3	338 °F	170 °C	yes
	Ex ia IIC T6 … T1		C_i = 4.8 nF	158 °F	70 °C	T3	383 °F	195 °C	No
	DIP A21 TA 85°C to T_{medium}		L_i = 133 µH	158 °F	70 °C	T3	302 °F	150 °C	yes
				158 °F	70 °C	T4	257 °F	125 °C	yes
F3	FM	31 / 32[4]	U_{max} = 46 V	104 °F	40 °C	T1	824 °F	440 °C	No
	XP / CL I / DIV 1 / GP ABCD / T6 … T1			104 °F	40 °C	T1	707 °F	375 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1			104 °F	40 °C	T1	500 °F	260 °C	yes
	CL I, ZN 1 AEx d IIC T6 … T1			122 °F	50 °C	T1	572 °F	300 °C	yes
	cCSAus			122 °F	50 °C	T2	554 °F	290 °C	yes
	XP / CL I / DIV 1 / GP BCD / T6 … T1			122 °F	50 °C	T2	428°F	220 °C	yes
	DIP / CL II, III / DIV 1 / GP EFG / T6 … T1	41 / 42[4]	U_{max} = 30 V	140 °F	60 °C	T2	608 °F	320 °C	No
	Ex d IIC T6 … T1		I_{max} = 30 mA	140 °F	60 °C	T2	446 °F	230°C	yes
	DIP A21 TA 85°C to T_{medium}		P_{max} = 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 in the data sheet** on page 45.

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.

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[1]	Marking	Terminals	Electrical values	T_{amb} −58 °F to	T_{amb} −50 °C to	Temp. class	T_{medium} Maximum		Insulation
F3[5], F4[5]	FM	31 / 32[4]	U_{max} = 46 V	104 °F	104 °F	T1	824 °F	440 °C	No
	NI /CL I,II / DIV 2 / GP ABCDFG / T4...T1			104 °F	104 °F	T1	707 °F	375 °C	yes
	NI / CL III / T4...T1			104 °F	104 °F	T1	500 °F	260 °C	yes
	CL II, ZN 2 AEx ec IIC T4...T1			122 °F	122 °F	T1	572 °F	300 °C	yes
				122 °F	122 °F	T2	554 °F	290 °C	yes
	cCSAus			122 °F	122 °F	T2	428°F	220 °C	yes
	NI /CL I,II / DIV 2 / GP ABCDFG / T4…T1			140 °F	140 °F	T2	608 °F	320 °C	No
	NI / CL III / T4…T1	41 / 42[4]	U_{max} = 30 V	140 °F	60 °C	T2	446 °F	230 °C	yes
	Ex ec IIC T4…T1		I_{max} = 30 mA	140 °F	60 °C	T3	338 °F	170 °C	yes
	DIP A21 TA 85°C to T_{medium}		P_{max} = 115 mW	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 in the data sheet** on page 45.

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.

… 3 Use in potentially explosive atmospheres in accordance with FM and cCSAus

Operating instructions

Protection against electrostatic discharges

⚠ DANGER

Risk of explosion!

The painted surface of the device can store electrostatic charges.

As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- The device is operated in environments with a relative humidity of ≤ 30 %.
- The painted surface of the device is thereby relatively free from impurities such as dirt, dust or oil.
- Instructions on avoiding ignition in potentially explosive environments due to electrostatic discharges in accordance with PD CLC/TR 60079-32-1 and IEC TS 60079-32-1 must be complied with!

Instructions on cleaning

The painted surface of the device must be cleaned only using a moist cloth.

Changing the type of protection

The device can be operated with various types of protection:

- When connecting to an intrinsically safe circuit in CL 1 Div. 1 or Zone 1, with 'Intrinsic Safety (IS)' type of protection.
- When connecting to a non-intrinsically safe circuit in CL 1 Div. 1 or Zone 1, with 'Explosionproof (XP)' type of protection.
- When connecting to a non-intrinsically safe circuit in CL 1 Div. 2 or Zone 2, with 'Non-Incendive (NI)' type of protection.

Depending on the model, the device may be designed to be installed in one of the applications listed. If you plan to use a device that was installed for one Ex type of protection with a different Ex type of protection, some measures must be taken before connecting voltage to the device.

For changing the type of protection, see **Changing the type of protection** on page 30.

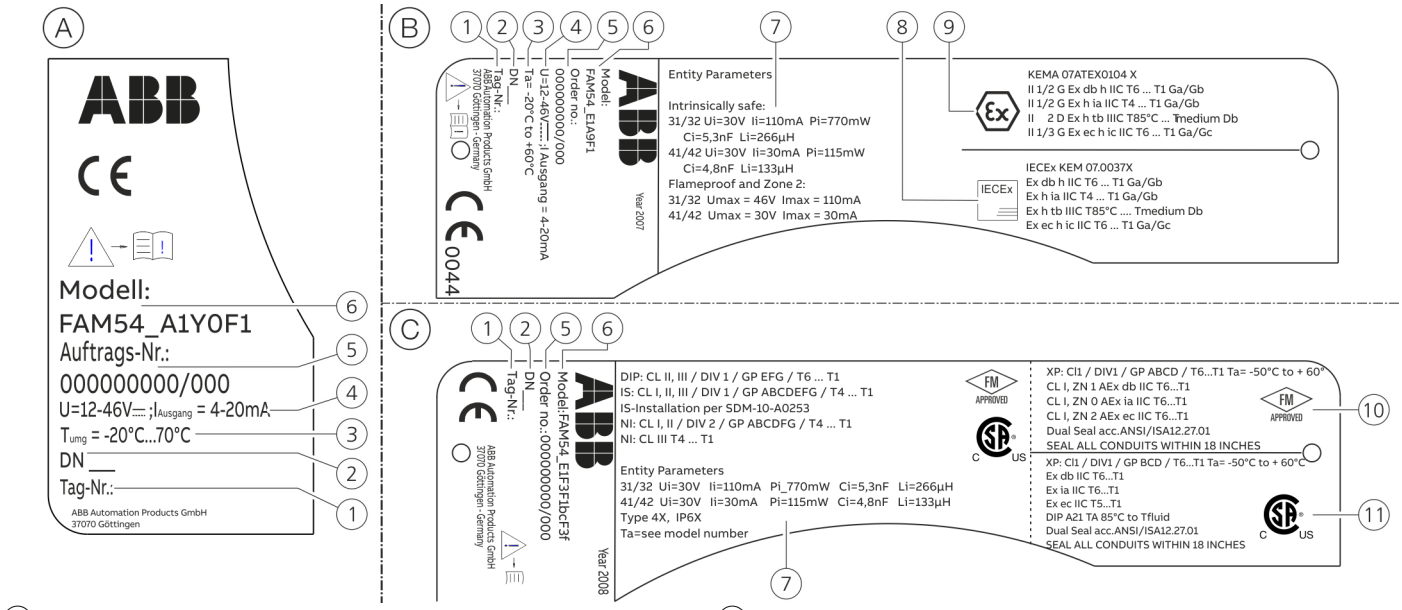
Special information

Replacing components can affect the device's approval for use in Class I, Div. 1 and Class I, Div. 2.

If the device was not operated with type of protection XP or IS, but with type of protection NI, the device is only suitable for use in Class I, Div. 2, Group A, B, C, D or in non-hazardous areas.

4 Product identification

Name plate



(A) Standard
(B) ATEX / IECEx
(C) FM / cCSAus
(1) TAG Number
(2) Nominal diameter and IP rating
(3) Ambient temperature
(4) Power supply / Output current
(5) Order number
(6) Model number
(7) Electric data (Ex)
(8) IECEx Approval
(9) ATEX Approval
(10) FM Approval
(11) cCSAus Approval

Figure 9: Name plates (examples)

Note

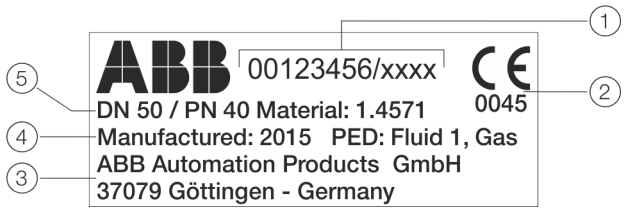
The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

… 4 Product identification

Factory tag

The factory plate is on the flowmeter in addition to the name plate. Depending on the nominal diameter of the flowmeter (> DN 25 or ≤ DN 25), it is identified with two different factory plates (also refer to article 4, paragraph 3, Pressure Equipment Directive 2014/68/EU):

Pressure equipment in the scope of the Pressure Equipment Directive

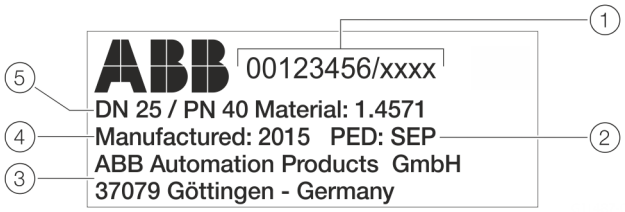


1. Serial number of the sensor
2. CE mark with notified body
3. Manufacturer address
4. Year of manufacture and specification of the fluid group in accordance with the PED
5. Nominal diameter / nominal pressure rating and material of the pressure-bearing part (wetted part)

Figure 10: Factory plate for nominal diameter > DN 25 (example)

The number of the notified body is specified underneath the CE mark to confirm that the device meets the requirements of the Pressure Equipment Directive.
The respective fluid group in accordance with the Pressure Equipment Directive is indicated under PED.
Example: Fluid Group 1 = hazardous fluids, gaseous.

Pressure equipment outside the scope of the Pressure Equipment Directive



1. Serial number of the sensor
2. Reason for exception article 4, paragraph 3 of the Pressure Equipment Directive
3. Manufacturer address
4. Year of manufacture
5. Nominal diameter / nominal pressure rating and material of the pressure bearing part (wetted part)

Figure 11: Factory plate for nominal diameter ≤ DN 25 (example)

In PED the exception to article 4 paragraph 3 of the Pressure Equipment Directive is specified.
The pressure equipment is classified in the SEP (= Sound Engineering Practice) "Good Engineering Practice" category.

Note
If the factory plate is missing all together, the device is not in compliance with the requirements of the Pressure Equipment Directive 2014/68/EU. Networks for the supply, distribution and discharge of water and related specific accessories are classed as an exception in accordance with guideline 1/16 of Art. 1, Para. 3.2 of the Pressure Equipment Directive.

5 Transport and storage

Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.
All claims for damages must be submitted to the shipper without delay and before installation.

Transport

⚠ DANGER

Life-threatening danger due to suspended loads.
In the case of suspended loads, a danger of the load falling exists.

- Standing under suspended loads is prohibited.

When transporting the device, please note:

- The center of gravity of some devices is not at the center of the equipment.
- The protection plates or dust caps mounted at the process connections of devices equipped with PTFE/PFA may only be removed immediately before installation. To prevent possible leakage, ensure that the liner on the flange is not cut or damaged.
- Ensure that small internal parts such as floats or cones do not fall out and become damaged.

Storage

Bear the following points in mind when storing devices:

- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device.
Adhere to the device data sheet!

Returning devices

Address for returns:
Please contact Customer Center Service according to page 4 for nearest service location.

6 Installation

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.

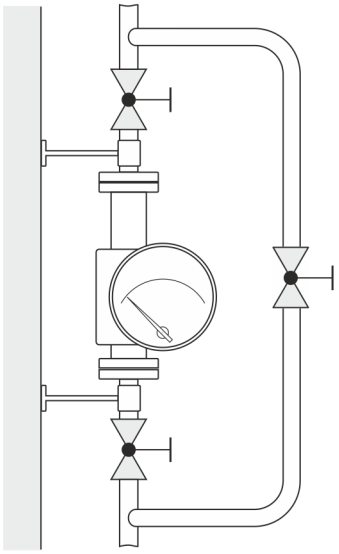


Figure 12: Installation of the flowmeter (example)

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

Sensor insulation

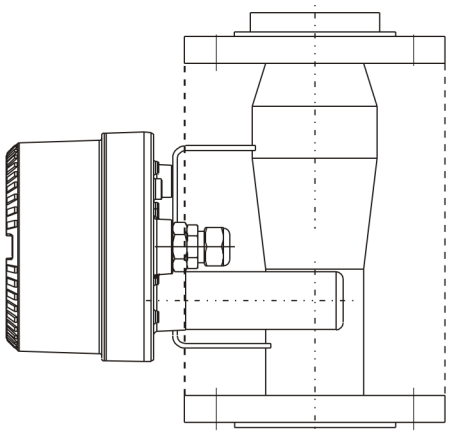


Figure 13: Insulation of the flowmeter

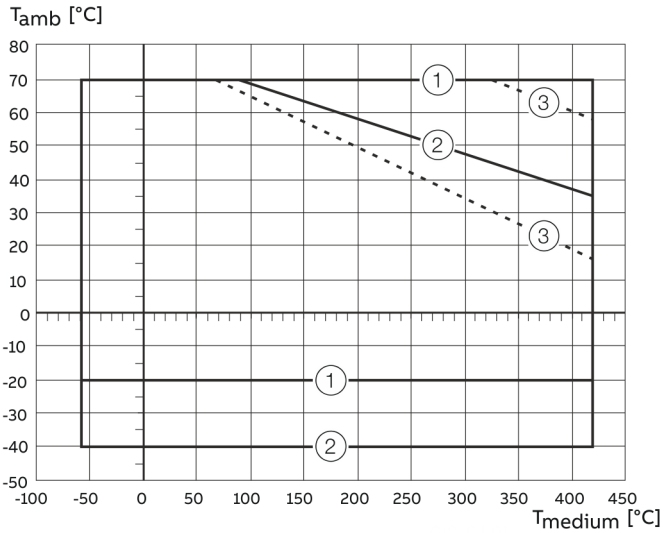
As shown in Figure 13, the flowmeter may only be insulated up to the flange diameter.

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 14: Medium temperature (T_{medium}), ambient temperature (T_{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 12 and the FM / cCSAus limit values tables starting from **Safety specifications FM, cCSAus** on page 25!

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!

… 6 Installation

… Operating conditions

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

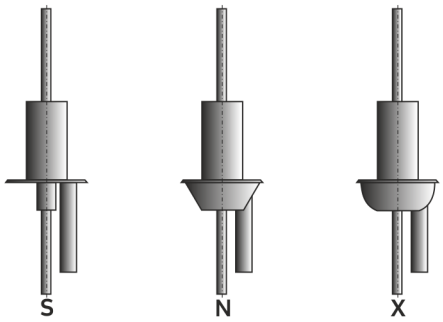


Figure 15: Float designs

Float ‘S’:

Basic shape of float.

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

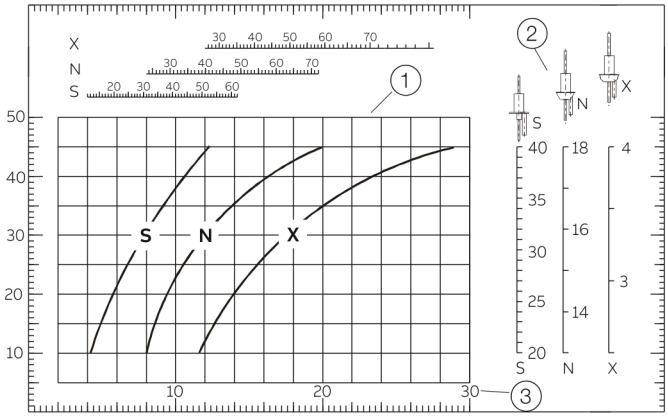
Float ‘N’:

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 16: 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.

Mounting

The following points must be observed during installation:

- The flow direction must correspond to the direction indicated on the device (if labeled).
- The maximum torque must be complied with for all flange screws
- The devices must be installed without mechanical tension (torsion, bending)
- Install flange devices with plane parallel counterflanges and use suited gaskets only.
- Only gaskets made from a material that is compatible with the measuring medium and measuring medium temperature may be used
- Gaskets must not extend into the flow area, since possible turbulence could influence the accuracy of the device
- The piping may not exert any inadmissible forces or torques on the device
- Do not remove the sealing plugs in the cable glands until you are ready to install the electrical cable
- Make sure the gaskets for the housing cover are seated correctly. Carefully seal the cover. Tighten the cover fittings
- Do not expose the transmitter to direct sunlight; where necessary, provide appropriate sun protection.

Installation of the flowmeter

The device can be installed at any location in a pipeline under consideration of the installation conditions.

1. Remove protective plates, if present, from above and below the meter tube. Ensure that internal parts such as floats or the conical meter pipe do not fall out and become damaged.
2. Remove the wooden stick serving as a transport securing device from the meter tube.
3. Position the meter tube coplanar and centered between the piping.
4. Install gaskets between the sealing surfaces.

Note

For achieve the best results, ensure the gaskets fit concentrically with the meter tube

5. Use the appropriate screws for the holes.
6. Slightly grease the threaded nuts.
7. Tighten the nuts in a crosswise manner as shown in the figure.

Note

Torques for screws depend on temperature, pressure, screw and gasket materials. The relevant applicable regulations must be taken into consideration.

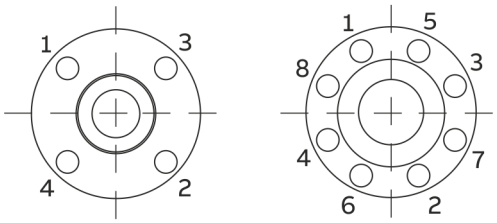


Figure 17: Tightening sequence for the flange screws

Material loads for process connections

NOTICE

Potential damage to the device!

Exceeding the permissible measuring medium temperature can damage the gaskets and the device.

Do not exceed the maximum permissible measuring medium temperature specified on the factory and name plate as well as in the following tables.

Model FAM541 - Standard design

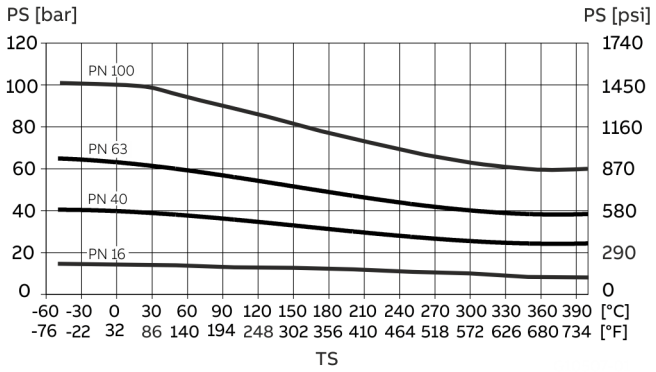


Figure 18: DIN flange made from stainless steel

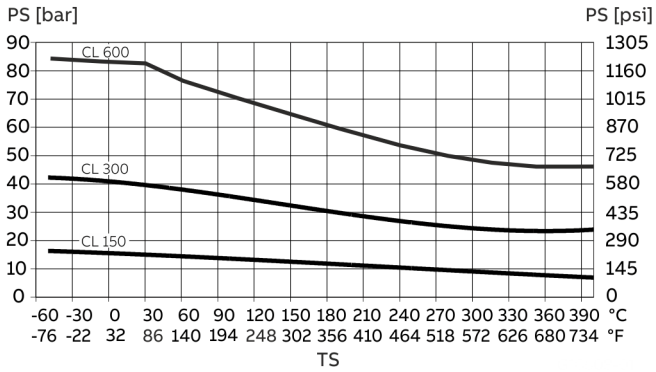


Figure 19: ASME flange made from stainless steel

Model FAM544 - Hygienic design

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

… 6 Installation

Electrical connections

⚠ DANGER

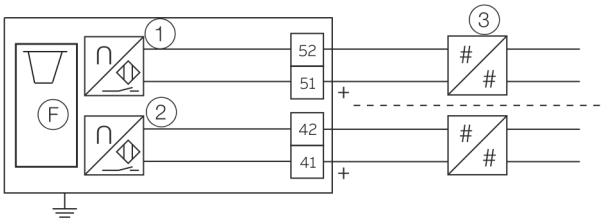
Improper installation and commissioning of the device carries a risk of explosion.
For use in potentially explosive atmospheres, observe the information in **Use in potentially explosive atmospheres in accordance with ATEX and IECEx** on page 5 and **Use in potentially explosive atmospheres in accordance with FM and cCSAus** on page 19!

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.

The electrical connection information in this manual must be observed; otherwise, the IP rating may be adversely affected. Ground the measurement system according to requirements.

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 20: Alarm signalling unit

Additional switching amplifiers are needed to operate the alarm signaling units.
See **Switching amplifier** on page 38 and the 'Ordering Information' section of the data sheet for further information.

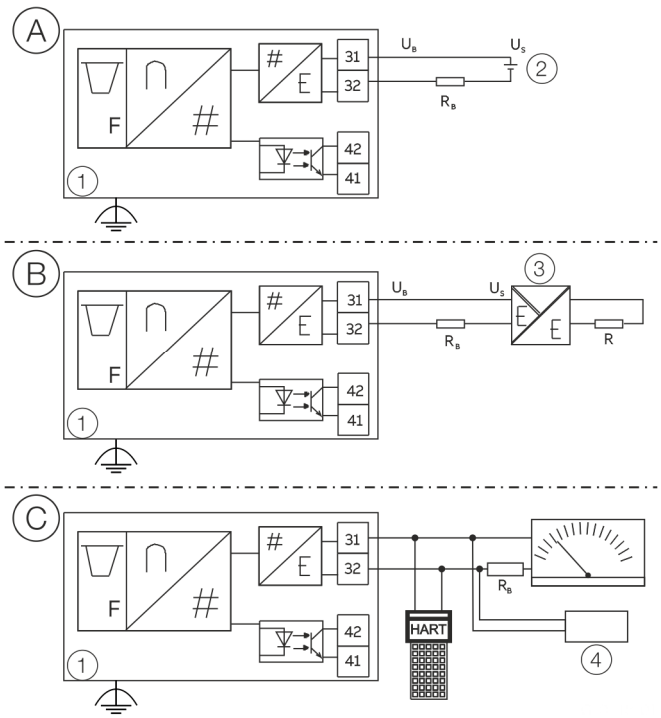
Alarm signaling unit specifications	
Operating mode	bistable
Reproducibility	±0.5% of scale end value
Nominal voltage	8 V DC (Ri approx. 1 kΩ)
Operating voltage	5 to 25 V DC
Switching frequency, max.	3 kHz

Switching amplifier

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 mm² (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)

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 21: 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

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. ± 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 Ω, maximum 1500 Ω (for I at alarm = 23.0 mA)
At zero-point:	≤ 8 µ A/K
Power consumption	< 1 W

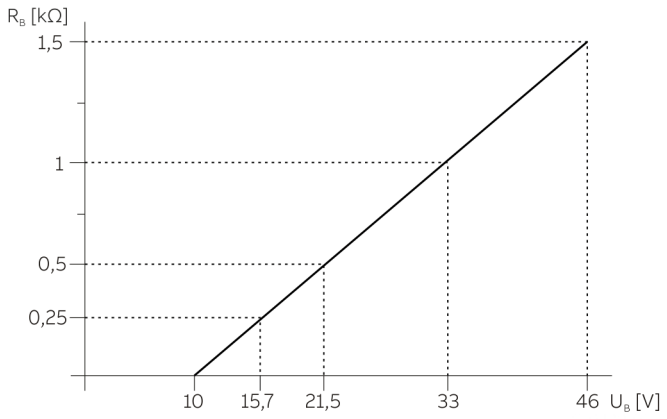


Figure 22: Current output load diagram

HART output
Model FAM54xE/Fx

Specifications	
Terminals	31 / 32
Configuration	• Directly on the device • Using DAT200 Asset Vision Basic software and HART-DTM
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 Ω

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.

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	• NAMUR contact (DIN 19234) or • Standard optoelectronic coupler (UH = 16 to 30 V DC)
Switching behavior	As normally closed or normally open contacts
Internal resistance	With contact open > 10 kΩ
Switching current	Maximum 15 mA
Output Voltage	Minimum Us 2 V DC

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

7 Commissioning

⚠ DANGER

Improper installation and commissioning of the device carries a risk of explosion.
For use in potentially explosive atmospheres, observe the information in **Use in potentially explosive atmospheres in accordance with ATEX and IECEx** on page 5 and **Use in potentially explosive atmospheres in accordance with FM and cCSAus** on page 19!

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing open!
Before opening the transmitter housing, bear in mind the following:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 2 minutes before opening.

General Notes

The commissioning activities described here are performed after the device has been installed and electrically connected.

Bear in mind the following during commissioning:

- The power supply must be switched off.
- When using liquid measuring media, the piping must be vented carefully to avoid pressure shocks due to gas bubbles.
- When using gaseous measuring media, increase the flow pressure slowly.
- Basically, you should vary the flow with help of adjustable valves (control valves) to protect the float from shock waves. Otherwise, the flowmeter may be damaged.
- If fast opening solenoid valves are used, pressure shocks on the float must be prevented by using suited damping measures.

Switching on the power supply

The following points must be checked before commissioning the device:

- Correct wiring in accordance with **Electrical connections** on page 38.
- Correct grounding of the sensor.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

Inspection after power-up of the power supply

The configuration of the measuring medium parameters (standard and operating density) must be checked after commissioning the device. The measuring medium parameters must be adapted to the measuring medium being used if necessary.

Adjusting the alarm signalling unit

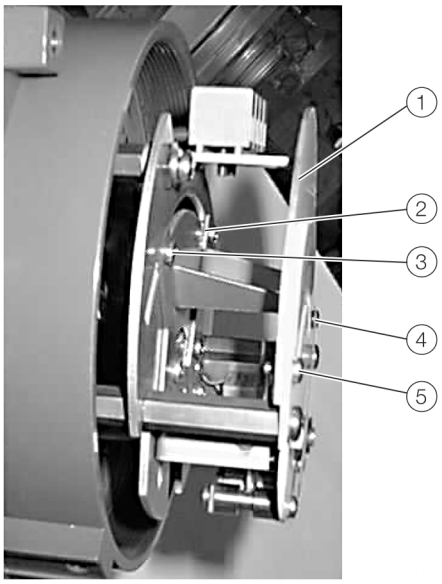


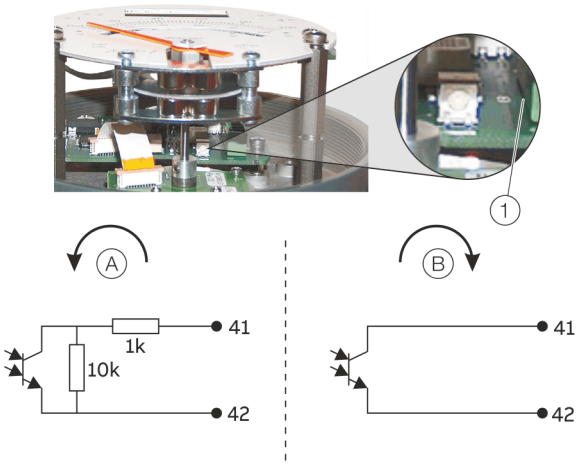
Figure 23: Adjusting the alarm signalling unit

1. Unscrew the housing cover.
2. Loosen screws (1) and remove cover plate (2).
3. Loosen screws (3) + (4).
4. Move the alarm signalling unit (5) to the desired position.
5. Tighten screws (3) + (4).
6. Insert cover plate (2) and tighten screws (1).
7. Screw on housing cover.

Note
For explosion proof apparatus, remove the safety locking device before opening the housing cover and reattach it after closing the housing!

Configuring the programmable output

The switch output of the transmitter is configured by default as a NAMUR contact.
The contact can also be configured as an optoelectronic coupler output.



(A) Switch to left stop: NAMUR contact
(B) Switch to right stop: optoelectronic coupler function
(1) Rotary switch for output configuration

Figure 24: Configuration of the output

1. Unscrew the housing cover.
2. Bring rotary switch into the desired position.
3. Screw on housing cover.

Note
For explosion proof apparatus, remove the safety locking device when opening the housing cover and reattach it after closing the housing!

… 7 Commissioning

Operating instructions

When operating the device, please note the following:

- Aggressive or corrosive media can lead to damage of wetted parts. As a result, pressurized media may escape prematurely.
- Wear to the flange gasket or process connection gaskets (such as aseptic pipe fittings, Tri-Clamp, etc.) can cause pressurized media to escape.
- When using internal flat gaskets, these can become brittle as a result of CIP / SIP processes.

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

8 Operation

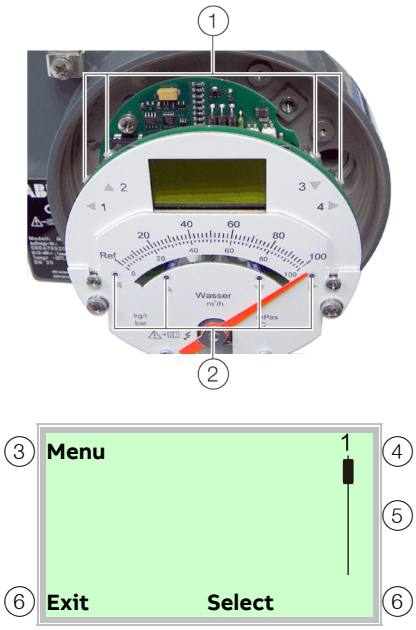
⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing open!

Before opening the transmitter housing, bear in mind the following:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 2 minutes before opening.

Menu navigation



1. Operating buttons for menu navigation
2. Points for magnet stick operation
3. Display of the menu designation
4. Display of the menu number
5. Marking to indicate the relative position within the menu
6. Display of the operating button function ▲ and ▼

Figure 25: LCD display

You can use the ▲ or ▼ operating buttons to browse through the menu or select a number or character within a parameter value.

Different functions can be assigned to the ◄ and ► operating buttons. The function that is currently assigned ((6)) is shown on the LCD display.

Operating button functions

◄	Meaning
Exit	Exit menu
Back	Go back one submenu
Cancel	Cancel parameter entry
Next	Select the next position for entering numerical and alphanumeric values

►	Meaning
Select	Select submenu / parameter
Edit	Edit parameter
OK	Save parameter entered

Magnet stick operation

The magnet stick provides an alternative means of parameterizing the device even when the housing cover is closed.
To execute the functions, hold the active side of the magnet stick against the corresponding areas on the LCD indicator.

User levels

The device features four user levels. The user levels are selected in the ‘Prog. level’ menu.

The following user levels are available.

User level	Description
Standard	This user level is used for quick parameterization of the device. All of the customer-specific menus / parameters required for device operation can be configured here.
Specialist	In this user level, all menus / parameters are visible.
Service	The service menu is reserved exclusively for the after-sales-service of ABB Automation Products. It includes the default settings of the device. It can only be accessed with the service code. Changes may cause the device to display incorrect information.
Locked	In the "Specialist" user level, all menus / parameters of the "Standard" are visible, but cannot be edited. After an interruption of the power supply, the device is basically set to this user level.

Changing the user level

Before changing parameters, select the proper user level.

1. Press the ► button to switch to the Main Menu.
2. Use the ▲ or ▼ button as needed to select the entry Prog.Level.
3. Press the ► button to switch to the Prog.Level.
4. Use the ▲ or ▼ button to select the desired user level and select OK (►button) to confirm.

You can now complete parameterization in accordance with the selected user level.

9 Maintenance

Safety instructions

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing open!

Before opening the transmitter housing, bear in mind the following:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 2 minutes before opening.

⚠ WARNING

Risk of injury due to live parts!

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

⚠ CAUTION

Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

NOTICE

Damage to components!

The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines).

- Make sure that the static electricity in your body is discharged before touching electronic components.

Note

For detailed information on the maintenance of the device, consult the associated operating instructions (OI)!

10 Dismounting and disposal

Dismounting

⚠ WARNING

Risk of injury due to process conditions.

The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when dismantling the device.

- If necessary, wear suited personal protective equipment during disassembly.
- Before disassembly, make sure that the process conditions do not pose any safety risks.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Bear the following points in mind when dismantling the device:

- Switch off the power supply.
- Disconnect electrical connections.
- Allow the device / piping to cool and depressurize and empty. Collect any escaping medium and dispose of it in accordance with environmental guidelines.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notices in **Returning devices** on page 33.

Disposal

Note

Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following points in mind when disposing of them:

- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, our Service can take care of its pick-up and disposal for a fee.

11 Specification

Note

The device data sheet is available in the ABB download area at www.abb.com/flow.

12 Additional documents

Note

All documentation, declarations of conformity, and certificates are available in ABB's download area.
www.abb.com/flow

Trademarks

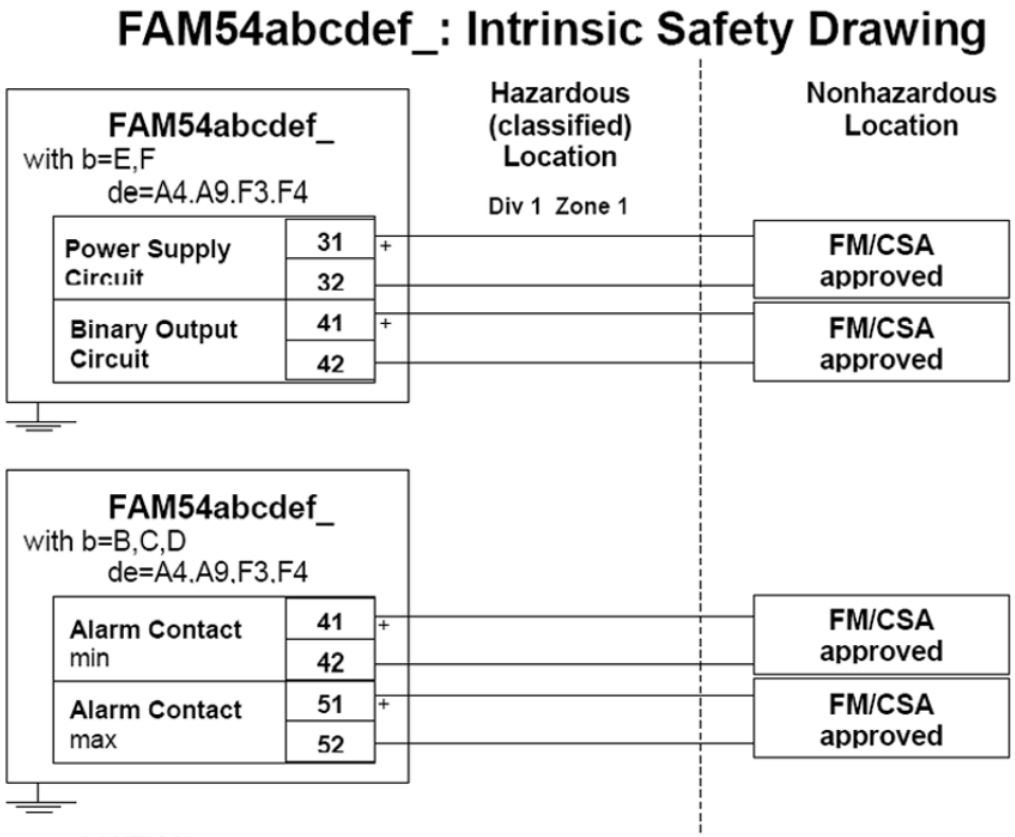
HART is a registered trademark of FieldComm Group, Austin, Texas, USA

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

™ Hastelloy C-2 is a Haynes International trademark

13 Appendix

Intrinsic Safety Control Drawing SDM-10-A0253



CAUTION:

$U_i \geq U_0$; $I_i \geq I_0$; $C_0 \geq C_i + C_{Cable}$; $L_0 \geq L_i + L_{Cable}$

SUBTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY:
DO NOT DICONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS:

LA SUBSTITUTION DE COMPOSANTES PEUT COMPROMETTRÉ LA SÉCURITÉ INTRINSÉQUE

additional informations see instruction manual

Notes:

1. The Intrinsic Safety Entity concept allows the interconnection of FM and CSA Approved Intrinsically safe devices with entity parameters not specifically examined in combination as a system when:
2. Dust-tight conduit seal must be used when installed in Class II and Class III environments.
3. Control equipment connected to the Associated Apparatus must not use or generate more than 250Vrms of Vdc.
4. Installation should be in accordance with the ANSI/ISA RP12.6 “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations” an the National Electrical Code® (ANSI/NFPA 70) Section 504, 505 and CEC.
5. The configuration of the associated Apparatus must be Factory Mutual Research or CSA Approved under Entity Concept.
6. Associated Apparatus manufacturer’s installation drawing must be followed when installing this equipment.
7. No revision do drawing without prior Factory Mutual Research and CSA Approval

EX CERTIFICATED PRODUCT
NO MODIFIKATIONS PERMITTED
WITHOUT REFERENCE TO THE CERTIFICATION BODY

Intrinsic Safety Control Drawing
SDM-10-A0253, Rev. 02, 20.07.2007

Page 1/1

Return form

Statement on the contamination of devices and components

Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.
Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

Customer details:

Company:

Address:

Contact person: Telephone:

Fax: Email:

Device details:

Type: Serial no.:

Reason for the return/description of the defect:

Was this device used in conjunction with substances which pose a threat or risk to health?

☐ Yes ☐ No

If yes, which type of contamination (please place an X next to the applicable items):

☐ biological ☐ corrosive / irritating ☐ combustible (highly / extremely combustible)

☐ toxic ☐ explosive ☐ other toxic substances

☐ radioactive

Which substances have come into contact with the device?

1.

2.

3.

We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date Signature and company stamp

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