

**EN**  
English

**Commissioning Instructions**  
Metal Cone Variable Area Flowmeter  
FAM540



**HART**  
COMMUNICATION PROTOCOL

**ABB**



# Metal Cone Variable Area Flowmeter VA Master FAM540

## Commissioning Instruction - EN

CI/FAM540-EN

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Rev.A

### Manufacturer:

**ABB Automation Products GmbH**

Dransfelder Straße 2

D-37079 Göttingen

Germany

Tel.: +49 551 905-534

Fax: +49 551 905-555

CCC-support.deapr@de.abb.com

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## **1 Safety**

### **1.1 General information and notes for the reader**

Read these instructions carefully prior to installing and commissioning the device.

These instructions are an important part of the product and must be kept for later use.

These instructions are intended as an overview and do not contain detailed information on all designs for this product or every possible aspect of installation, operation and maintenance.

For additional information or in case specific problems occur that are not discussed in these instructions, contact the manufacturer.

The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship nor is it intended to change the same.

This product is built based on state-of-the-art technology and is operationally safe. It has been tested and left the factory in a safe, maintenance-free state. The information in the manual must be observed and followed in order to maintain this state throughout the period of operation.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Only by observing all of the safety information and all safety/warning symbols in these instructions can optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device, be ensured.

Information and symbols directly on the product must be observed. They may not be removed and must be fully legible at all times.

### **1.2 Target groups and qualifications**

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator to do so. The specialist personnel must have read and understood the manual and comply with its instructions.

Prior to using corrosive and abrasive materials for measurement purposes, the operator must check the level of resistance of all parts coming into contact with the materials to be measured. ABB Automation Products GmbH will gladly support you in selecting the materials, but cannot accept any liability in doing so.

The operators must strictly observe the applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical products.

### 1.3 Intended use

This device is intended for the following uses:

- To transmit fluid or gaseous measuring substances.
- To measure the flowrate of the operating volume or mass flow units (at constant pressure / temperature), if a physical unit is selected.

The following items are included in the intended use:

- Read and follow the instructions in this manual.
- Observe the technical ratings; refer to the section 1.6 “Technical limit values”.
- Use only allowed liquids for measurement; refer to the section “Allowed Fluids”.

### 1.4 Improper use

The following are considered to be instances of improper use of the device:

- Operation as a flexible adapter in piping, e.g., to compensate for pipe offsets, pipe vibrations, pipe expansions, etc.
- As a climbing aid, e. g., for mounting purposes
- As a support for external loads, e. g., as a support for piping, etc.
- Adding material, e. g., by painting over the name plate or welding/soldering on parts
- Removing material, e. g., by spot drilling the housing

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible insofar as these are described in the 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.

## 1.5 Plates and symbols

### 1.5.1 Safety-/ warning symbols, note symbols

**DANGER – <Serious damage to health / risk to life>**

This symbol in conjunction with the signal word "Danger" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.

**DANGER – <Serious damage to health / risk to life>**

This symbol in conjunction with the signal word "Danger" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.

**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a possibly dangerous situation. Failure to observe this safety information may result in death or severe injury.

**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.

**CAUTION – <Minor injury>**

This symbol in conjunction with the signal word "Caution" indicates a possibly dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This may also be used for property damage warnings.

**ATTENTION – <Property damage>!**

The symbol indicates a potentially damaging situation.

Failure to observe this safety information may result in damage to or destruction of the product and/or other system components.

**IMPORTANT (NOTICE)**

This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. It does not indicate a dangerous or damaging situation.

## 1.6 Technical limit values

The device is designed for use exclusively within the stated values on the model plate and within the technical limit values specified in the data sheets.

The following technical limit values must be observed:

- The permissible pressure (PS) in the permissible temperature (TS) may not exceed the pressure-temperature ratings.
- The maximum operating temperature may not be exceeded.
- The permitted operating temperature may not be exceeded.
- The housing protection system must be observed.

## 1.7 Allowed Fluids

When measuring fluids, the following points must be observed:

- Fluids may only be used if, based on state-of-the-art technology or the operating experience of the user, it is assured that chemical and physical properties of the components coming into contact with the fluids (signal electrodes, ground electrodes, liners and, possibly, process connections, protective plates or protective flanges) are not affected during the operating life.
- Fluids with unknown properties or abrasive fluids may only be used if the operator can perform regular and suitable tests to ensure the safe condition of the device.
- Observe the information on the name plate.

## 1.8 Transport safety information

- Depending on the device, the center of gravity may not be in the center of the equipment.
- The protection plates or protective caps installed on the process connections of devices lined with PTFE / PFA must not be removed until just before installation; to prevent possible leakage, make sure that the liner on the flange is not cut or damaged.

## 1.9 Installation safety information

Observe the following instructions:

- The flow direction must correspond to the direction indicated on the device, if labeled.
- Comply with the maximum torque for all flange bolts.
- Install the devices without mechanical tension (torsion, bending).
- Install flange and wafer type units with coplanar counter flanges.
- Only install devices for the intended operating conditions and with suitable seals.
- Secure the flange bolts and nuts against pipeline vibrations.

## 1.10 Safety instructions for electrical installation

The electrical connection may only be made by authorized specialist personnel according to the electrical plans.

The electrical connection information in the manual must be observed; otherwise, the electrical protection type may be adversely affected.

Ground the measurement system according to requirements.

## 1.11 Safety instructions for operation

During operation with hot fluids, contact with the surface may result in burns.

Aggressive fluids may result in corrosion or abrasion of the parts that come into contact with the medium. As a result, pressurized fluids may escape prematurely.

Wear to the flange gasket or process connection gaskets (e.g., aseptic threaded pipe connections, Tri-Clamp, etc.) may enable a pressurized medium to escape.

When using internal flat gaskets, these can become embrittled through CIP/SIP processes.

If pressure shocks exceeding the device's permissible nominal pressure occur continuously during operation, this can have a detrimental effect on the device's service life.



### Warning – Risk to persons!

Bacteria and chemical substances can contaminate or pollute pipeline systems and the materials they are made of.

The appropriate installation conditions must be observed in order to achieve an installation that complies with EHEDG requirements.

For an installation to comply with EHEDG requirements, the process connection/gasket combinations created by the operator must always be made of parts that conform to EHEDG stipulations (EHEDG Position Paper: "Hygienic Process connections to use with hygienic components and equipment").



### Important

- In general when operating the device, the details on electric safety and electromagnetic compatibility of this manual are to be observed.
- For operation in potentially explosive areas, observe the relevant information in this manual.
- For use in hygienic applications (EHEDG design), observe the hygienically suitable process connection.

## 2 Transport

### 2.1 Inspection

Check the devices for possible damage that may have occurred during transport. Damages in transit must be recorded on the transport documents. All claims for damages must be claimed without delay against the shipper and before the installation.

### 2.2 General information on transport

Observe the following when transporting the device to the measurement site:

- The center of gravity may not be in the center of the device.
- The protective panes or dust caps mounted at the process connections of devices equipped with PTFE (FAM545) may only be removed immediately before installation. Make sure that small internal parts such as floats or cones do not fall out and become damaged.

## 3 Installation

### 3.1 Installation Requirements

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

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

#### Installation recommendations

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

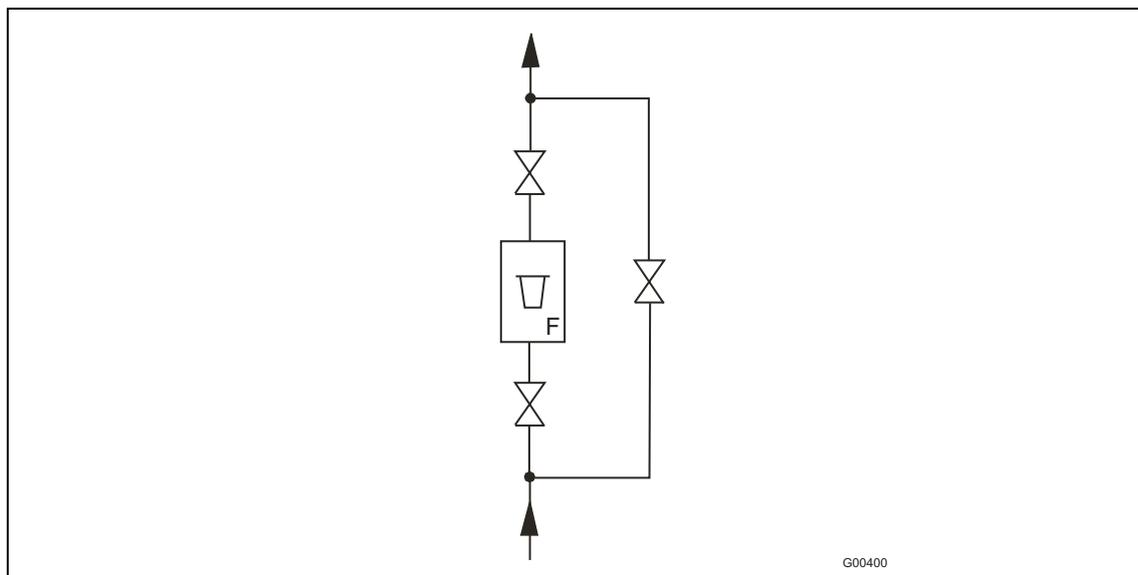


Fig. 1

### 3.2 Installation

#### 3.2.1 General information on installation

The following points must be observed for the installation:

- The flow direction must correspond to the identification if present.
- The maximum torque for all flange connections must be complied with.
- The devices must be installed without mechanical tension (torsion, bending).
- Install flange units with coplanar counter flanges and use only appropriate gaskets.
- Use only gaskets made from a compatible material for the fluid and fluid temperatures.
- Gaskets must not extend into the flow area since possible turbulence could influence the device accuracy.
- The pipeline may not exert any unallowable forces or torques on the device.
- Do not remove the plugs in the cable connectors until you are ready to install the electrical cable.
- Make sure the gaskets for the housing cover are seated properly. Carefully seal the cover. Tighten the cover fittings.
- Do not expose the transmitter to direct sunlight. Provide appropriate sun protection as necessary.

3.2.2 Mounting the meter tube

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



**Warning - Potential damage to device!**

Use of graphite with the flange or process connection gaskets is prohibited. In some instances, an electrically conductive coating may form on the inside of the measuring tube. For meters with PTFE liners (FAM545), vacuum shocks in the pipelines should be avoided to prevent damage to the liners. Vacuum shocks can destroy the meter.

1. Remove protective plates, if present, above and below the meter tube. Make sure that small internal parts such as floats or the conical meter pipe do not fall out and become damaged.
2. Position the meter tube coplanar and centered between the pipes.
3. Install gaskets between the surfaces.



**Important**

For best results, make sure the flowmeter primary gaskets fit concentrically with the measuring tube.

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



**Important**

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

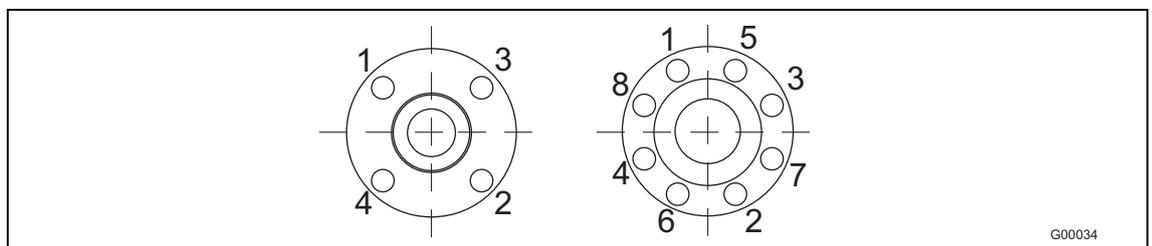


Fig. 2

## 3.3 Operating conditions

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

### Pressure drop

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

### Damping and compression oscillations when metering gases

If a specific critical volume is exceeded between the closest throttling locations up and downstream of the flowmeter, compression oscillations (float bounce) may occur when the operating pressure is low. If the minimum required upstream pressure listed in this specification is not maintained, then the flowmeter must include a gas damping option (see Fig. 3).

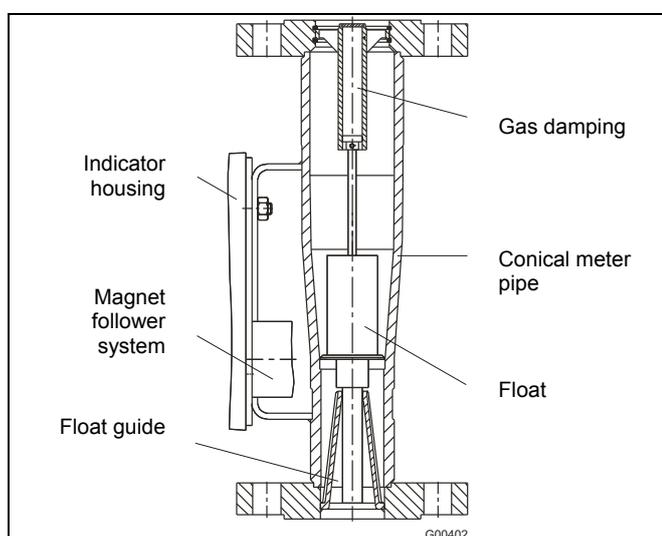


Fig. 3: Flowmeter with gas damping

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

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

### Pressure shocks

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

### Solids in the fluid

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

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

### Temperature diagram

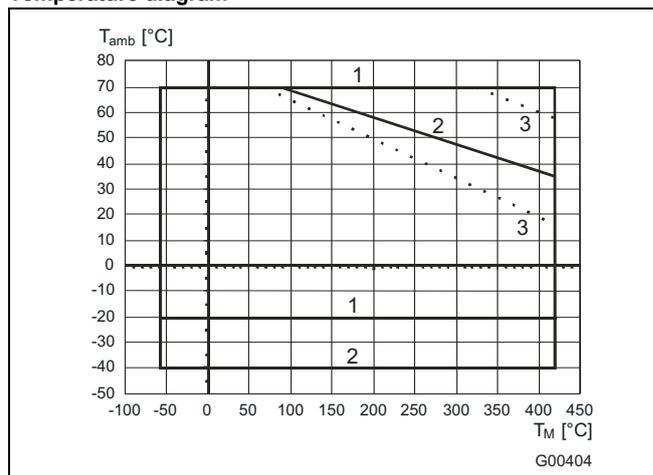


Fig. 4: Max. medium temperature ( $T_M$ ) and ambient temperature ( $T_{amb}$ )

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

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

### Insulation

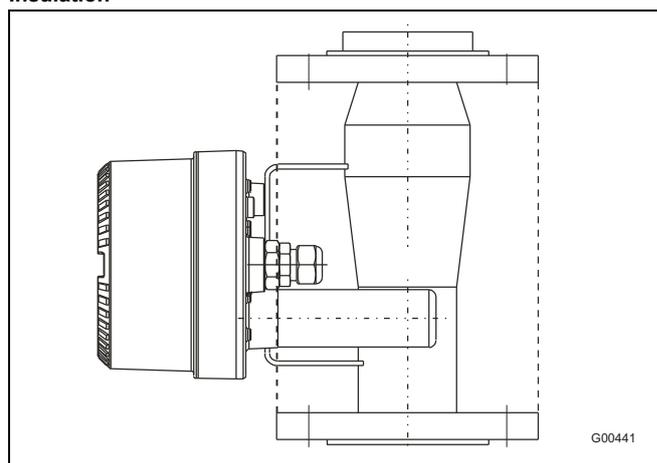


Fig. 5: Maximum insulation = Flange diameter

### 3.4 Electrical connection

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

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

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

#### 3.4.1 Analog display with / without limit signal transmitter

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



Fig. 6

#### Product highlights

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

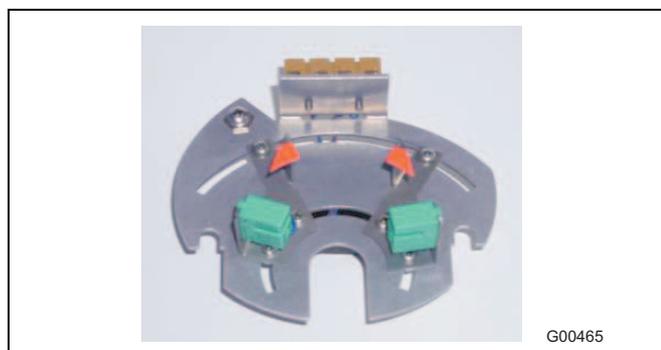


Fig. 7: Alarm module

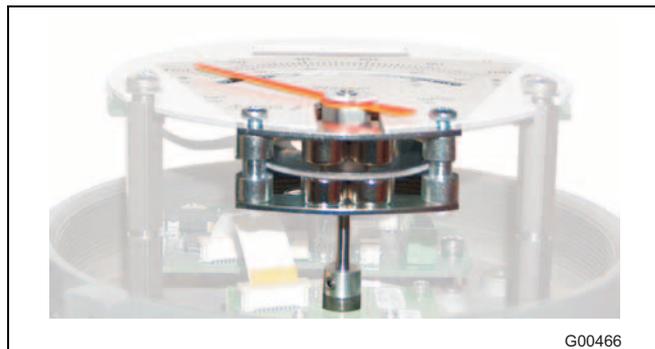


Fig. 8: Standard eddy-current brake

#### Version with limit signal transmitter

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

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

#### An isolated switch amplifier is required for limit signal transmitters:

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

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

#### Terminal connection diagram

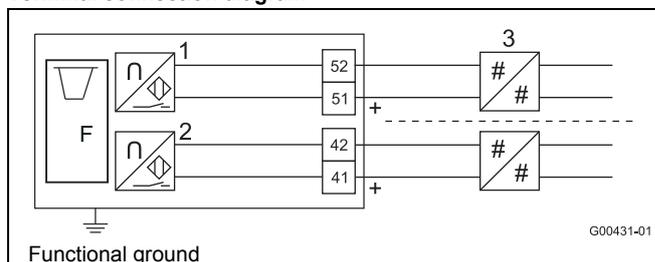


Fig. 9

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

## 3.4.2 Analog indicator with transmitter with / without LCD display

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



Fig. 10

### Product highlights

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

Design with LCD display:

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

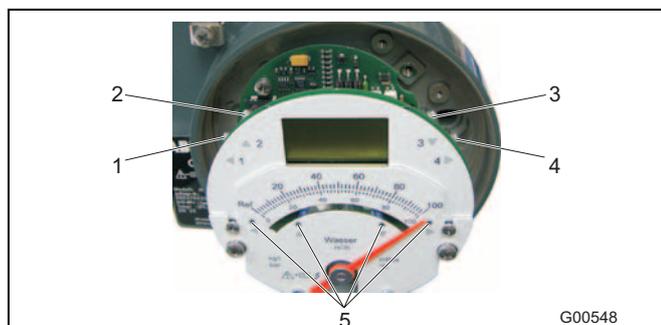


Fig. 11: Display with control buttons and magnet stick markings

- 1 Control button ◀
- 2 Control button ▲
- 3 Control button ▼
- 4 Control button ▶
- 5 Position for magnet stick operation

### Note:

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

### Replacing the electronic unit

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

### LCD display

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

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

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

### Current output terminals 31 / 32

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

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

### Programmable output terminals 41 / 42

The programmable output can be assigned a variety of functions.

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

#### 1. Pulse output

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

#### 2. General Alarm

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

#### 3. Max-Min alarm

Configurable as normally closed or normally open contacts.

#### 4. No function (factory default)

This output has no function.

The following limits apply:

Max. allowable switching current 15 mA

Min. output voltage  $U_S 2 \text{ V DC}$

$U_S =$  Voltage for auxiliary power source

### Damping

Configurable from 1 ... 100 s, corresponds to 5  $\tau$ .

### Low flow cutoff

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

### Function tests

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

### Current output for alarm

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

**Error message on the LCD display**

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

**Data security**

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

**Terminal connection diagram**

**a) Auxiliary power from central power supply**

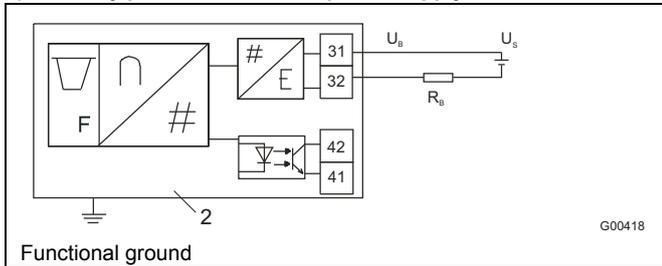


Fig. 12

**b) Auxiliary power from power supply**

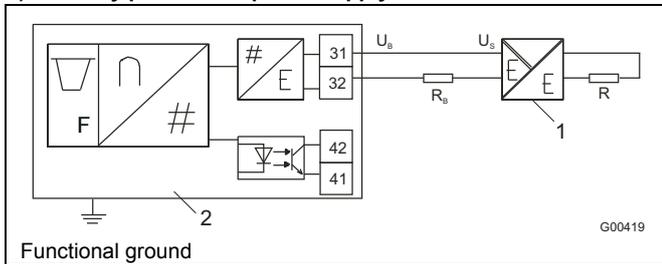


Fig. 13

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

**Auxiliary power (supply voltage)**

Standard: 10 ... 46 V DC

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

Residual ripple: max. 5% or  $\pm 1.5 V_{SS}$

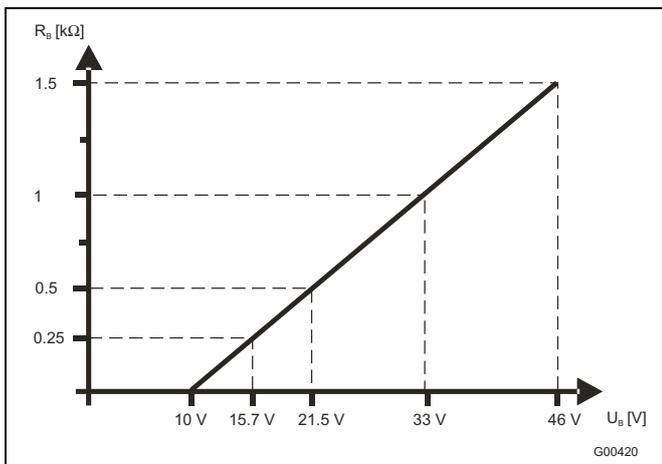


Fig. 14: Current output load diagram

**Current output load**

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

**Cable**

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

To ensure full EMC protection, the cable shield must be connected to the internal ground terminal as shown in Fig. 15:

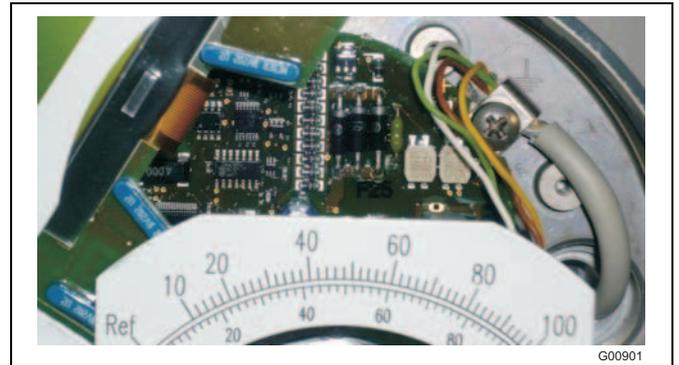


Fig. 15

**Power consumption**

< 1 W

**Temperature influence on current output**

$\leq 8 \mu A/K$

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

**3.4.3 Digital communication**

**Communication HART protocol**

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

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

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

**Transmission method**

FSK modulation at current output of 4 ... 20 mA based on the Bell 202 standard. Max. signal amplitude 1.2 mA<sub>SS</sub>.

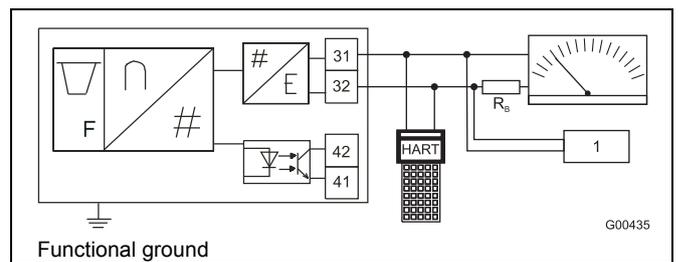


Fig. 16

1 Bell 202 modem

$R_B$  Min. = 250 Ω, max. = 1500 Ω

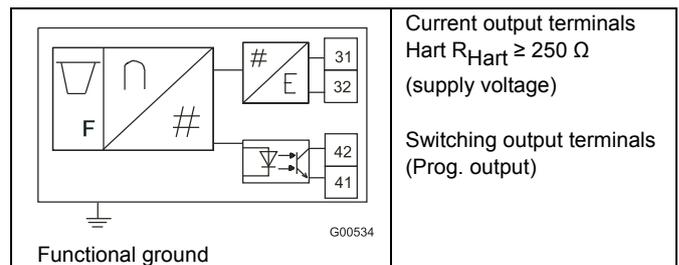


Fig. 17

Current output terminals  
Hart  $R_{Hart} \geq 250 \Omega$   
(supply voltage)

Switching output terminals  
(Prog. output)

## 4 Ex relevant specifications

### 4.1 Basic requirements

Follow the operating instructions to ensure proper installation. The relevant operating instructions for the meter contain all installation and safety instructions. The icon on the name plate indicates the following:



To ensure proper operation, comply with the supplementary safety information in the operating instructions and certificates.

Depending on the application, operators must comply with relevant national installation specifications (e.g., NEC, CEC, ATEX137, IEC60079-14, etc.).

### i

#### Important

- For explosion-proof devices/devices with flameproof enclosures, remove the locking device before opening the housing cover and reattach it after closing the housing!
- The max. ambient temperature for use with combustible dusts (category II 2D) is always  $T_{amb} = +60\text{ °C}$ .
- After switching off the power supply, wait  $t > 2$  minutes before opening the converter housing. Observe the "DELAY BEFORE OPENING > 2 MINUTES" warning message on the housing cover.
- When commissioning the flowmeter, refer to EN50281-1-2 regarding use in areas with combustible dusts.
- For Ex devices in PTFE design, the minimum conductivity of the medium must be  $> 10^{-8}$  S/m.
- When selecting the medium, take into consideration the chemical resistance of the materials for the meter housing, the liner and the gaskets for the process connection.
- If zone 0 is present in the metering tube, the meters may only be installed in an area close by to ensure sufficient ventilation of zone 1.
- Variable area flowmeters used in accordance with maximum electrical values for a category 3 device (zone 2) can also be used without modification as category 2 devices in an explosion-proof/flameproof enclosed zone 1 (see section "5.3.1 Later change of Ex protection classes" in the operating instruction).
- Use only a damp cloth to clean the window in order to avoid electrostatic charging.
- For information about installation conditions for thermal insulation, see chapter "Operating conditions", page 12 .
- Use slow opening valves.
- Comply with installation conditions as per VDI/VDE 3513.
- Avoid gas inclusions when using the meter with fluids.
- Avoid pulsating flow. A float damper is available as an option.
- Avoid gas impurities (see Federal Institute for Geosciences and Natural Resources (BGR) 132-7.3.2.2.2).

## 4.2 Specific requirements FM / cCSAus

### Information about power supply lines

Installations shall comply with the relevant 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.

Installations shall comply with the latest edition of the manufacturer's instruction manual.

### Information about explosion-proof installation

For FAM540-instruments installed in hazardous areas classified as Group A (FM) and B, an ignition block must be provided within a distance of 46 cm (18 inch) from the instrument.

### Intrinsic Safety Control Drawing (SDM-10-A0253)

For intrinsically safety installations, the FAM540 must be installed as illustrated in the Intrinsic Safety Control Drawing (see appendix).

The FAM540 Variable Area Flowmeters power supplies are SELV (Safety Extra Low Voltage) with LPS (Limited Power Source) and double or reinforced insulation from mains with a maximum current available of 8 A, and the external power supply must be connected to limited output NEC Class 2 circuits, as outlined in the National Electric Code® (ANSI / NFPA70).

Tampering and replacement with non-factory components may adversely affect the safe use of the system.

Insertion or withdrawal of removable electric connectors is to be accomplished only when the area is known to be free of flammable vapors.

For ambient temperatures below 5 °C (41 °F) and above 40 °C (104 °F) use field wiring suitable for both minimum and maximum ambient temperatures.

Use copper, copper-clad aluminium or aluminium conductors only.

The recommended tightening torque for field wiring terminals is 0.8 Nm (7 in. lb) or greater, as specified.

A dust tight conduit seal shall be used when installed in Class II & III environments.

Control room equipment connected to intrinsically safe associated apparatus should not use or generate more than 250 V<sub>rms</sub> or VDC.

See ANSI/ISA-RP12.06.01, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations, for guidance on the installation of intrinsically safe apparatus and systems.

**Warning! Risk of explosion!**

Changing equipment accessories can affect suitability for use for Class I, Div 1 and Class I, Div 2. Meters installed as NI rather than XP or IS are only suitable for use in Class I, Div 2, Group A,B,C,D or in non-hazardous locations.

**Warning! Risk of explosion!**

- Substitution of components may impair intrinsic safety.
- Substitution of components may impair suitability for division 1 & 2 and zone 0, 1 & 2.
- Keep cover tight while circuit is alive.
- Do not disconnect equipment unless area is known to be non hazardous.
- Do not open when an explosive gas atmosphere is present.
- Do not open when energized.
- After de-energized, delay 2 minutes before opening.
- For connection only to non-flammable processes..

#### 4.3 Special installation instructions for devices with limit signal transmitter or transmitter

All installation instructions and safety requirements are contained in the respective chapters of the operating instructions.

The meters can be used in a variety of applications:

- As an intrinsically safe meter in zone 1, if connected to an intrinsically safe circuit.
- As a pressure resistant meter in zone 1, if connected to a non-intrinsically safe circuit.
- As an non-incendive meter in zone 2, if connected to a non-intrinsically safe circuit.

### 4.3.1 Cable glands and signal cables

#### Cable glands

The meters are shipped with cable glands or 1/2" NPT threads with dust protection plugs. The different types of cable glands depend on the configuration of the Ex protection and can be selected via the model key.

Approved pressure-resistant cable glands are provided in combination with the ATEX and IECEx Ex d "pressure-resistant design". All other ATEX and IECEx models are shipped with approved plastic glands.

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

- "Ex d" design: 7.2 ... 11.7 mm (0.28 ... 0.46 inch)
- non-"Ex d" design: 5.0 ... 9.0 mm (0.20 ... 0.35 inch)



#### Warning - General hazards!

In conjunction with FM and CSA approval, the meters are shipped with 1/2" NPT threads and dust protection plugs. Approved conduit fittings or cable fittings must be used in compliance with national guidelines (NEC, CEC).

Observe the the special instructions for Ex d cable fittings in section Special installation instructions for explosion protection types flame proof (enclosure) / Explosionproof.

Meters with 1/2" NPT threads and ATEX and IECEx approvals can be ordered and operated without cable glands (with the exception of Ex d meters). The operator is responsible for properly installing threaded conduit connections according to national regulations (e.g., NEC, CEC, ATEX137, IEC60079-14, etc.).

#### 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.

The following applies for cables that are limited to 70 °C (158 °F):

The maximum ambient temperature  $T_{amb} = 60 \text{ °C}$  (140 °F).

The resulting, new maximum temperatures of the medium are determined as follows:

- Calculate a new ambient temperature:  $T_{amb \text{ new}} = T_{amb} + 10 \text{ °C}$  (18 °F).
- Use the new ambient temperature  $T_{amb \text{ new}}$  to determine in the tables the new associated allowable temperatures for the medium.
- Please refer to the tables with the original ambient temperature  $T_{amb}$  to determine the relevant temperature class.

Example:

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

4.3.2 Information about the housing ground

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

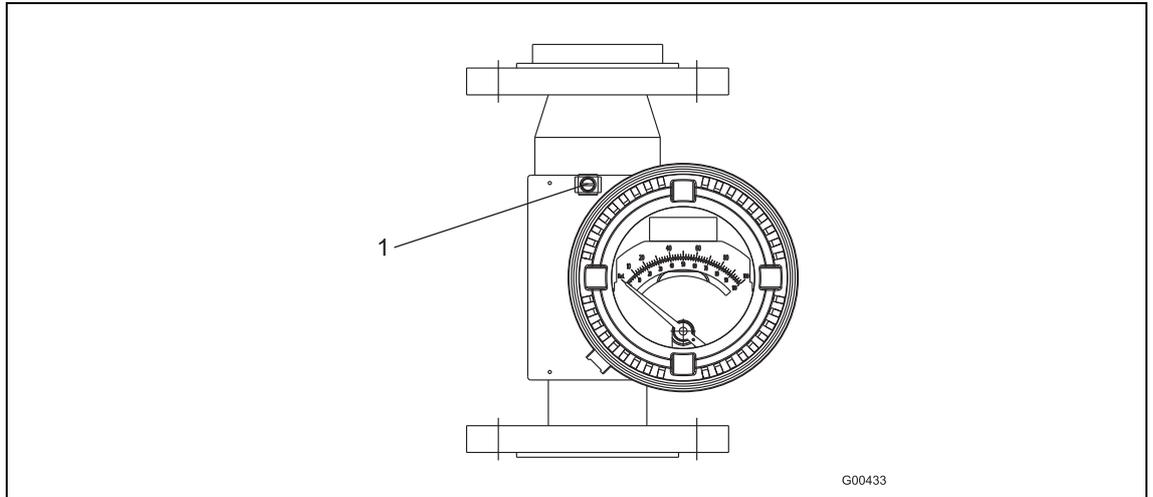


Fig. 18

1 Potential equalization per EN 60079-0



**Important**

The operator must ensure that when connecting the protective conductor (PE) no potential differences exist between protective conductor and potential equalization (PA), even in fault condition.

**4.3.3 Special installation instructions for explosion protection types flame proof (enclosure) / Explosionproof**

**ATEX / IECEx**

The electrical connection for the flowmeter is made via the cable gland on the unit (observe Fig. 19). The connection can also be made via an approved threaded conduit connection with flame arrester (located directly on the meter). First remove the cable gland, but leave the 1/2" NPT adapter on the meter. Comply with requirements in EN 60079-1. There must be a separate examination certificate for the threaded conduit connection. Use of cable and wire entries as well as plugs of simple design is prohibited. Close unused openings in accordance with EN 60079. When using pipeline systems, install the ignition blocks directly on the housing.

**Connection via pressure-resistant cable gland**

The outer diameter of the unshielded connecting cable must be between 7.2 ...11.7 mm (0.28... 0.46 inch). After installing the cable in the fitting, tighten the lock nut using a torque of 32.5 Nm. Use an additional strain relief device in the housing to secure the connecting cable.

**FM / cCSAus**

The electrical connection for the flowmeter can be made via approved threaded conduit connections with a flame arrester (located directly on the meter). First remove the plastic protection cap, but leave the 1/2" NPT adapter on the meter.

**i**

**Important**

There must be a separate examination certificate for the threaded conduit connection. Use of cable and wire entries as well as plugs of simple design is prohibited. The conduit fittings are not included in the meter's scope of supply.

**Electrical connection for protection type Encapsulated device / Explosion-proof**

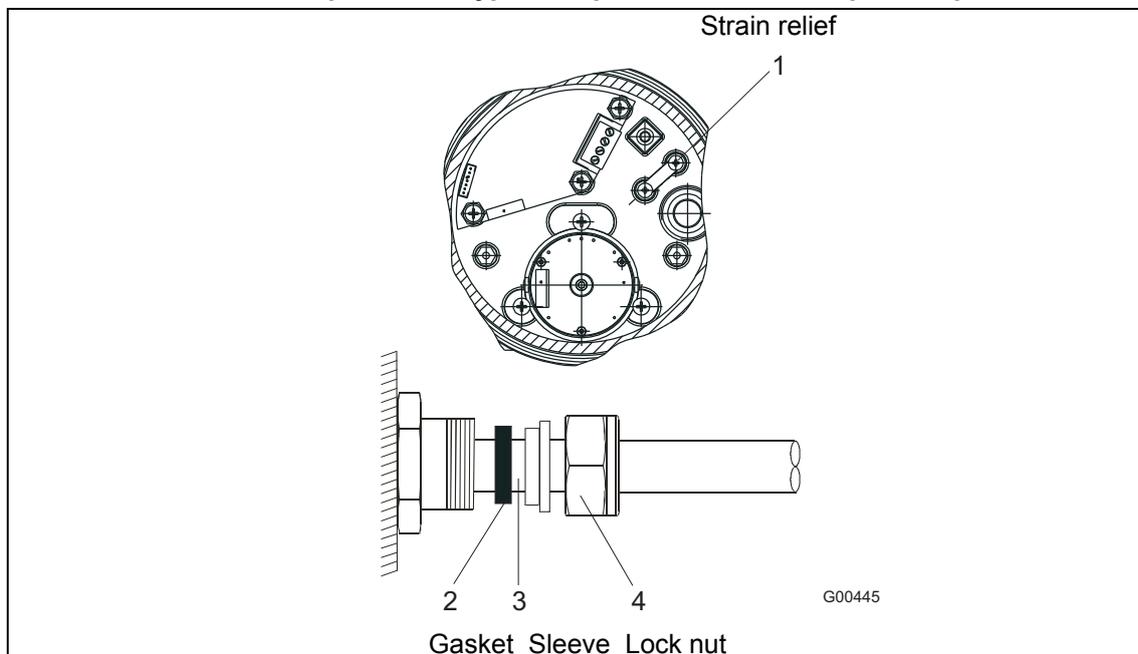


Fig. 19

## 5 Commissioning

### 5.1 General information

#### General information

- When using meter with fluids carefully remove the air to prevent gas bubbles.
- When using meter with gases increase the flow pressure slowly.
- Vary the flow with help of adjustable valves (control valves) to protect the float from pressure shock waves. Otherwise, the flowmeter may be damaged.
- The optional use of gas damping may not be used to compensate for shock waves.

#### Inspection prior to switching on auxiliary power

Prior to commissioning the unit, check the following:

- The wiring is correctly implemented according to the connection diagram, see chapter Electrical connection,
- The flowmeter is grounded properly,
- The ambient conditions meet specifications,
- The auxiliary power must match information on the model plate.

#### Inspection after switching on auxiliary power

After commissioning perform the following step:

- Check and configure the measurement parameters according to operating conditions.

## 5.2 Inspection

Before installing the flowmeter primary, check whether possible damage has occurred due to improper transport. All claims for damages must be submitted to the shipper without delay and before installation. Comply with installation conditions. Meters must be commissioned and operated according to ElexV (Standard on electrical equipment in potentially explosive areas) and EN 60079-14 (Installation of equipment in potentially explosive atmospheres), or relevant national standards. Installation and commissioning as well as maintenance or service in the Ex area may be performed by properly trained personnel only. The commissioning activities described here are performed after installing and electrically connecting the flowmeter. The auxiliary power is switched off. When operating the meter with combustible dusts, comply with EN 50281-1.



### Warning - General hazards!

Comply with the following instructions when opening the housing:

- Make sure there is no explosion hazard.
- A fire permit is required.
- Power to all connecting cables must be switched off.
- When the housing is open, EMC protection is suspended.

The surface temperature of the flowmeter may exceed 70 °C (158 °F) depending on the fluid temperature.

## 5.3 Information for safe operation – ATEX / IECEx



### Important

Commissioning and operation must be performed in accordance with ATEX 137 or BetrSichV (EN60079-14). Only properly trained personnel are authorized to carry out commissioning in Ex areas.

## 5.4 Setting the limit signal transmitter

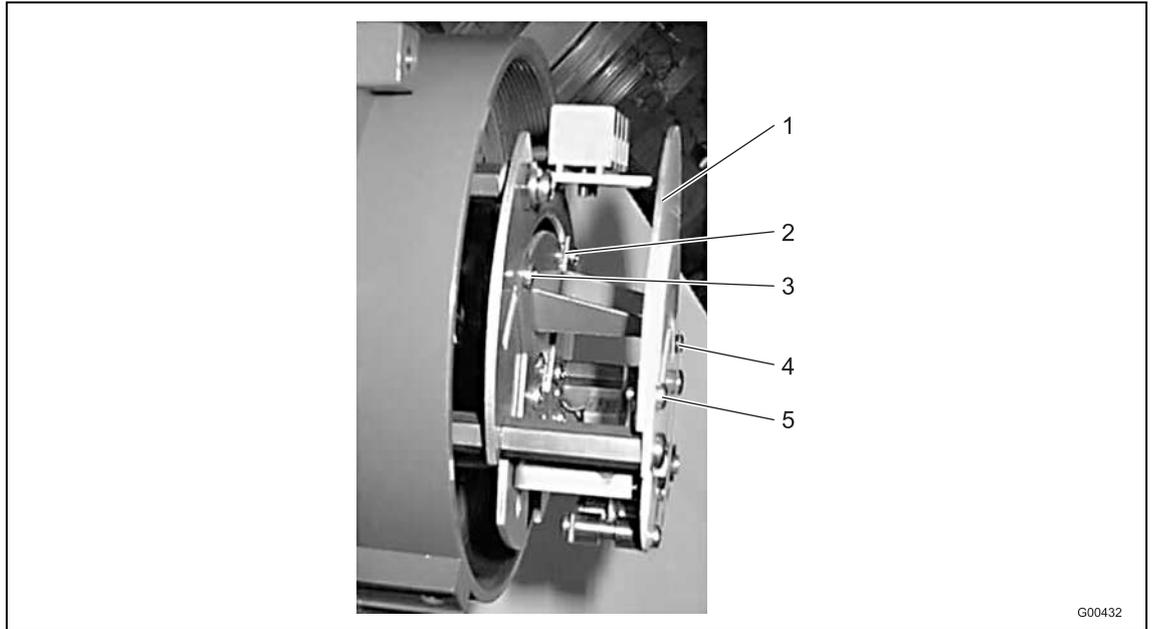


Fig. 20

1. Screw off housing cover.
2. Loosen screws (1) and remove cover plate (2).
3. Loosen screws (3 + 4).
4. Move the limit signal transmitter (5) into the desired position.
5. Tighten screws (3 + 4).
6. Replace cover plate (2) and tighten screws (1).
7. Screw on housing cover.

**Important**

For explosion-proof devices, remove the safety locking device when opening the cover and reattach it after closing the housing.

**5.5 Configuring the programmable output**

The contact output of the transmitter is configured by default as a NAMUR contact:  
 The contact can be changed, if necessary.

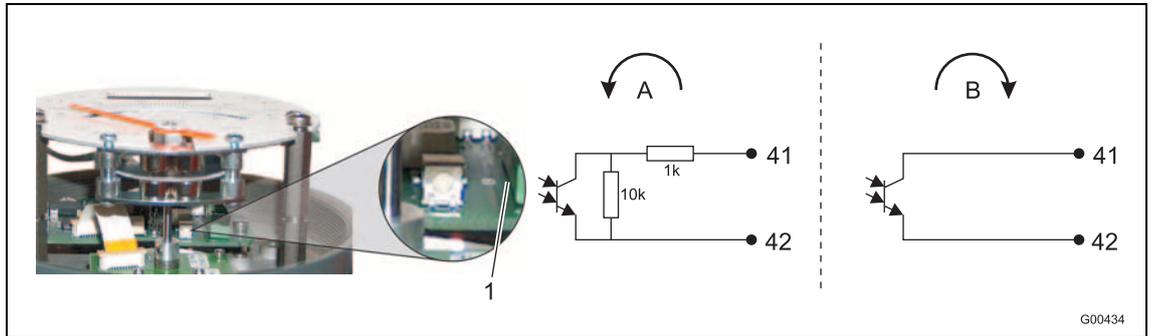


Fig. 21

- 1 Contact for switching the output configuration
- A Switch on left stop: NAMUR contact
- B Switch on right stop: Optocoupler function



**Important**

For explosionproof devices, remove the safety locking device when opening the cover and reattach it after closing the housing.

## 6 Parameterization



### Important

For information about menu navigation for the device, refer to the the “Parameterization” section of the operating instructions.

Information can be entered in several languages using the four keys on the transmitter. The magnet stick can also be used to configure the meter with the housing cover closed.

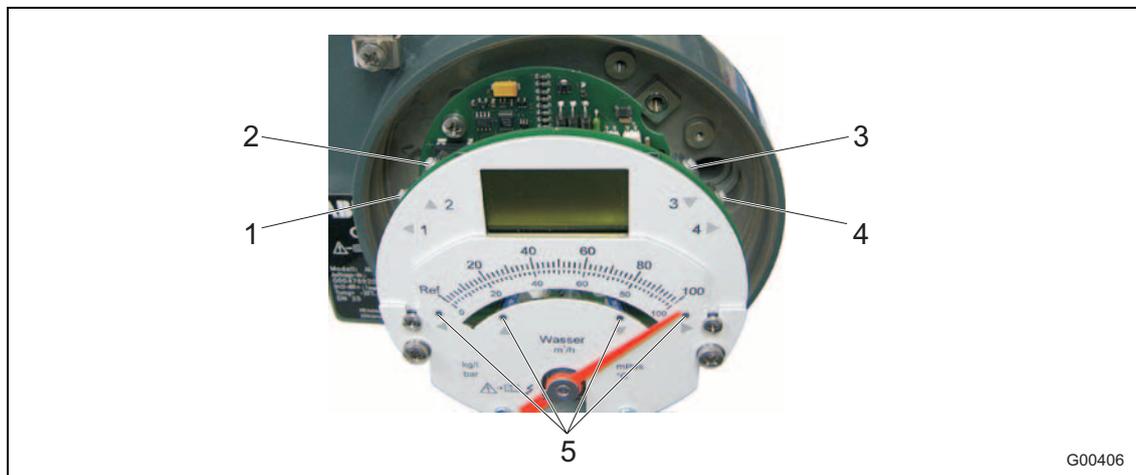


Fig. 22: Display with control buttons and magnet stick markings

The ◀ (1), ▶ (4), ▲ (2) and ▼ (3) buttons are available for the menu-controlled configuration. The positions for magnet stick operation (5) are marked on the scale plate. The same arrangement also applies here.

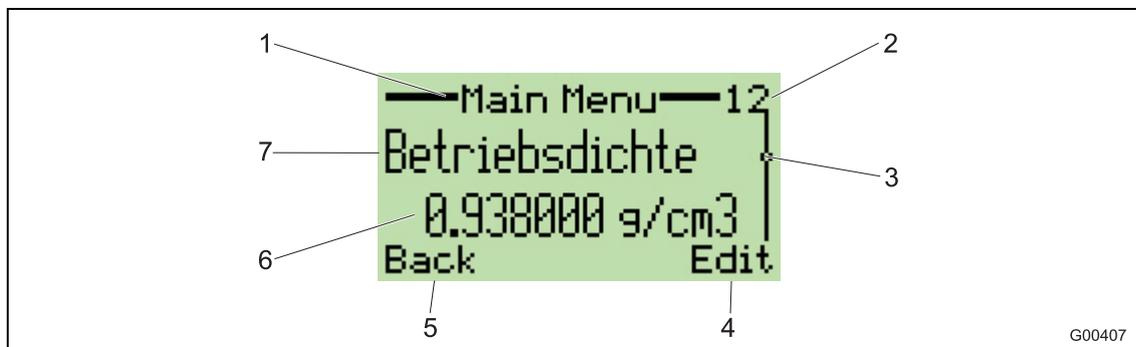


Fig. 23: Display view (example)

- |                           |                     |
|---------------------------|---------------------|
| 1 Name of menu or submenu | 5 Function of ◀ key |
| 2 Number or line of menu  | 6 Parameter value   |
| 3 Scroll bar              | 7 Parameter name    |
| 4 Function of ▶ key       |                     |

The menu/submenu name is displayed above in the LCD display. The number/line of the currently selected menu item is displayed in the upper right of the LCD display.

A scroll bar is located on the right edge of the LCD display which shows the relative position of the currently selected menu item within the menu.

The functions of the ◀ and ▶ keys depend on the menu and are indicated by the symbols in the lower corners of the display.

The ▲ and ▼ keys are used to scroll forwards and backwards in the menu and change numerical values.

After 20 seconds without any operation, the display returns to the current flow value. Pressing the ▶ key calls up the menu item previously selected.

## 6.1 User levels

The unit has 4 user levels (Menu "Prog. Level"):

### 1. Level: Standard

The standard menu is used for the quick parametrization of the unit. All of the customer-specific menu settings that are required for the use of the unit can be configured here.

### 2. Level: Specialist

Unlike in the standard menu, all of the customer-relevant menu parameters are displayed.

### 3. Level: Service

The service menu is exclusively reserved for the after-sales-service of ABB Automation Products. It includes the default settings of the unit. It can only be accessed through the service code. Changes may cause the device to display incorrect information.

### 4. Level: Locked

The menus of the standard level are visible, but they cannot be edited. After an interruption of the power supply, this user level is active.

### 6.1.1 Changing the user level

Before changing parameters, select the proper user level.

1. Press the ▶ key to jump to the Main Menu.
2. Use the ▲ or ▼ key to select the Prog. Level.
3. Press the ▶ key to jump to the Prog. Level.
4. Use the ▲ and ▼ keys to select the desired user level and press ▶ (OK) to confirm.

You can now parametrize the meter according to the selected user level.

## 7 Appendix

### 7.1 Additional documents

- Data Sheet (DS/FAM540)
- Operating Instruction (OI/FAM540)
- Interface description for devices with HART communication (D184B080U05)

### 7.2 Approvals and certifications

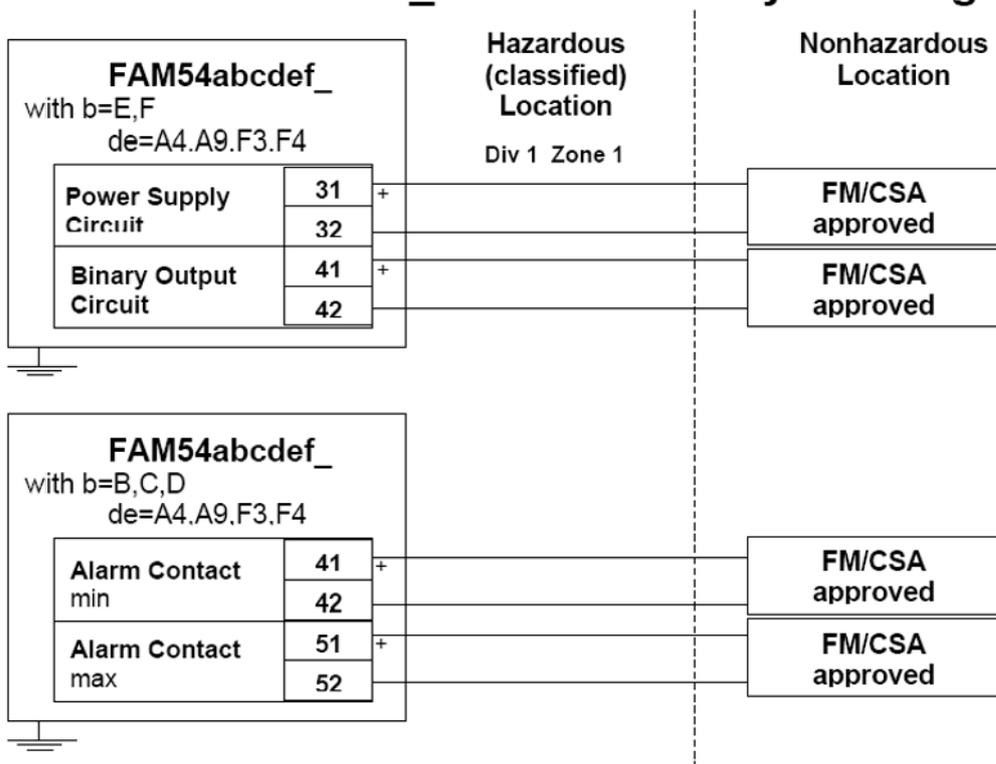


#### **Important**

All documentation, declarations of conformity, and certificates are available in ABB's download area.

[www.abb.com/flow](http://www.abb.com/flow)

## FAM54abcdef\_: Intrinsic Safety Drawing



**CAUTION:**

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

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

**LA SUBSTITUTION DE COMPOSANTES PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE**



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" and 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**



## EG-Konformitätserklärung EC-Certificate of Compliance



Hiermit bestätigen wir die Übereinstimmung der  
*Herewith we confirm that our*

### Schwebekörper Durchflußmesser *Variable Area Flowmeter*

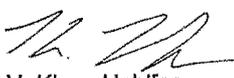
### Modell Serie FAM54-..... *Model Series FAM54-.....*

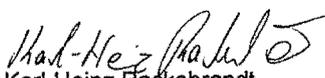
mit den grundlegenden Sicherheits- und Gesundheitsanforderungen gem. der Richtlinie 94/9/EG des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.  
*are in compliance with the Essential Health and Safety Requirements with refer to the council directives 94/9/EC of the European Community. The safety and installation requirements of the product documentation must be observed.*

Die Schwebekörper Durchflussmesser dienen zur Messung des Durchflusses von Gasen, Dämpfen und Flüssigkeiten.  
*The Variable Area Flowmeters are utilized to meter the flowrate of gases, steam or liquids.*

EG-Baumusterprüfbescheinigung: <i>EC-Type Examination Certificate:</i>	KEMA 07 ATEX 0104 X		
Benannte Stelle: <i>Notified Body:</i>	KEMA Quality B.V., Kennnummer 0034		
Geräte-Kennzeichnung: <i>Apparatus code:</i>	II 1/2G Ex c ia IIC T6 ... T1 und/oder Ex c d IIC T6 ... T1 und/oder c T6 ... T1 und/oder II 1/3G Ex c nA [nL] IIC T6 ... T1 oder Ex c nA II T6 ... T1 und II 2D c T85°C ... Tmedium oder Ex tD A21 IP6X T85°C ... Tmedium		
Sicherheitstechnische Daten: <i>Safety values:</i>	siehe EG-Baumusterprüfbescheinigung <i>refer to EC-Type Examination Certificate</i>		
Angewandte Normen: <i>Standards:</i>	EN 60079-0: 2006 EN 60079-15: 2005 EN 13463-1: 2001	EN 60079-1: 2004 EN 61241-0: 2006 EN 13463-5: 2003	EN 60079-11: 2007 EN 61241-1: 2004

Göttingen, 20. September 2007

  
i.V. Klaus Hablbas  
(Site Manager)

  
i.A. Karl-Heinz Rackebrandt  
(R&D Manager Sensors)

BZ-13-8017, Rev.01, 198

## ABB Automation Products GmbH

Postanschrift:  
Dransfelder Str. 2  
D-37079 Göttingen

Besuchsanschrift:  
Dransfelder Str. 2  
D-37079 Göttingen  
Telefon +49 551 905 0  
Telefax+49 551 905 777  
Internet: <http://www.abb.com/de>

Sitz der Gesellschaft:  
Ladenburg  
Registriergericht:  
Amtsgericht Mannheim  
Handelsregister:  
HRB 700229  
USt-IdNr.: DE 115 300 097

Vorsitz des Aufsichtsrates:  
Heinz-Peter Paffenholz  
Geschäftsführung:  
Christian Wendler

Bankverbindung:  
Commerzbank AG Frankfurt  
Konto: 589 635 200  
BLZ: 500 400 00



**EG-Konformitätserklärung**  
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Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

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 Dransfelder Straße 2, 37079 Göttingen - Germany

Gerät:  
 Device: Metallkonus-Schwebekörper-Durchflussmesser  
 Metal Cone Variable Area Flowmeter

Modelle.:  
 Models.: FAM54X  
 FAM54X

Richtlinie:  
 Directive: 2004/108/EG \* (EMV)  
 EMC directive 2004/108/EC \* (EMC)

Europäische Norm:  
 European Standard: EN 61326-1, 10/2006 \* EN 61326-2-3, 05/2007 \*  
 EN 61326-1, 10/2006 \* EN 61326-2-3, 05/2007 \*

\* einschließlich Nachträge / including alterations

Göttingen, 03. Juli 2009

i.V. Dr. Günter Kuhlmann  
 (R&D Manager)

i.A. Dirk Steckel  
 (R&D Electrical Safety)

**ABB Automation Products GmbH**

BZ-13-5030, Rev.02, 12936

Postanschrift:  
 Dransfelder Str. 2  
 D-37079 Göttingen

Besuchanschrift:  
 Dransfelder Str. 2  
 D-37079 Göttingen  
 Telefon +49 551 905 0  
 Telefax+49 551 905 777  
 Internet: <http://www.abb.com/de>

Sitz der Gesellschaft:  
 Ladenburg  
 Registergericht:  
 Amtsgericht Mannheim  
 Handelsregister:  
 HRB 700229  
 USt-IdNr.: DE 115 300 097

Vorsitz des Aufsichtsrates:  
 Hans-Georg Krabbe  
 Geschäftsführung:  
 Christian Wendler

Bankverbindung:  
 Commerzbank AG Frankfurt  
 Konto: 589 635 200  
 BLZ: 500 400 00



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*Herewith we confirm that the listed instrument is in compliance with the council directives of the European Community and are marked with the CE marking. The safety and installation requirements of the product documentation must be observed.*

Hersteller: <i>manufacturer:</i>	ABB Automation Products GmbH, 37070 Göttingen - Germany
Modell: <i>model:</i>	FAM54__ FAM54__
Richtlinie: <i>directive:</i>	Druckgeräterichtlinie 97/23/EG <i>pressure equipment directive 97/23/EC</i>
Einstufung: <i>classification:</i>	Ausrüstungsteile von Rohrleitungen <i>pipng accessories</i>
Normengrundlage: <i>technical standard:</i>	AD 2000
Konformitätsbewertungsverfahren: <i>conformity assessment procedure:</i>	B1 (EG-Entwurfsprüfung) + D (Qualitätssicherung Produktion) <i>B1 (EC design-examination) + D (production quality assurance)</i>
EG-Entwurfsprüfbescheinigungen: <i>EC design-examination certificates:</i>	Nr. 07 202 0124 Z 0052/2/0005 Nr. 07 202 0124 Z 0678/2/0001 Nr. 07 202 STK1 Z 0905/8/D/01
benannte Stelle: <i>notified body:</i>	TÜV NORD Systems GmbH & Co.KG Große Bahnstraße 31 22525 Hamburg - Germany
Kennnummer: <i>identification no.</i>	0045

Göttingen, den 06.10.2008

ppa.

(Dr. D. Binz, R&D Manager)

i.A.

(K.-H. Rackebrandt, R&D Manager Sensors)

BZ-25-0005 Rev.04



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**ABB Limited**

Oldends Lane, Stonehouse  
Gloucestershire, GL10 3TA  
UK

Tel: +44 (0)1453 826661

Fax: +44 (0)1453 829671

**ABB Inc.**

125 E. County Line  
Road  
Warminster, PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

**ABB Automation Products GmbH**

Dransfelder Str. 2  
37079 Goettingen  
Germany

Tel: +49 551 905-534

Fax: +49 551 905-555

CCC-support.deapr@de.abb.com