Operating Instruction
D184B097U02

Vortex Flowmeter / Swirl Flowmeter
FV4000-VT4/VR4 / FS4000-ST4/SR4

HART COMMUNICATION PROTOCOL
PROFIBUS
Fieldbus Foundation

ABB

Vortex Flowmeter / Swirl Flowmeter
FV4000-VT4/VR4 / FS4000-ST4/SR4

Operating Instruction

D184B097U02

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Rev. 08

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

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 Intended use

This device is intended for the following uses:

- To convey fluids, gases (including unstable gases), and steams
- To measure the flow of the operating volume in mass flow or standard units under constant operating conditions (pressure, temperature)
- To measure the flow of saturated steam in mass flow units at varying temperatures/pressures, if the flowmeter sensor is fitted with a temperature sensor (option)

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 “Technical limit values”.
- Use only allowed liquids for measurement; refer to the section “Allowed fluids”.

1.3 Improper use

The following uses of the device are prohibited:

- Operation as a flexible adapter in piping, e. g., to compensate for pipe offsets, pipe vibrations, pipe expansions, etc.
- Use as a climbing aid, e. g., for assembly purposes.
- Use as a support for external loads, e. g., as a support for pipes, etc.
- Material gain, e. g., by painting over the name plate or adding parts by welding / soldering.
- Material loss, e. g., by 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.

1.4 Technical limit values

The meter has been designed for use exclusively within the values stated on the name plate and within the technical limit values specified on the data sheets.

The following technical limit values must be observed:

- The permissible operating pressure (PS) and the permissible temperature of the medium (TS) must not exceed the pressure/temperature values (p/T ratings).
- The maximum operating temperature must not be exceeded.
- The permitted operating temperature must not be exceeded.
- The housing protection type must be observed.

1.5 Approved media

When using media, please note:

- Media (fluids) may only be used if, based on the state of the art or the operating experience of the user, it can be assured that chemical and physical properties of the components coming into contact with the fluids will not be adversely affected during the operating period.
- Specifically chloride media can cause not visible corrosion damages to all media wetted components so that fluid can lead. The suitability of these materials for each application by the operator to examine.
- Media (fluids) with unknown properties or abrasive media may only be used if the operator can perform regular and suitable tests to ensure the safe condition of the meter.
- Observe the information on the name plate.

The meter tube, solid bodies (FV4000-VR4, FV4000-VT4 Vortex flowmeters only), inlet and outlet pipes (FS4000-SR4, FS4000-ST4 Swirl flowmeters only), sensor and gasket come into contact with the measured medium.

1.6 Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

1.7 Plates and symbols

1.7.1 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.

1.7.2 Name Plate / Factory Tag

The factory tag or name plate can be found in the following places on the meter housing:

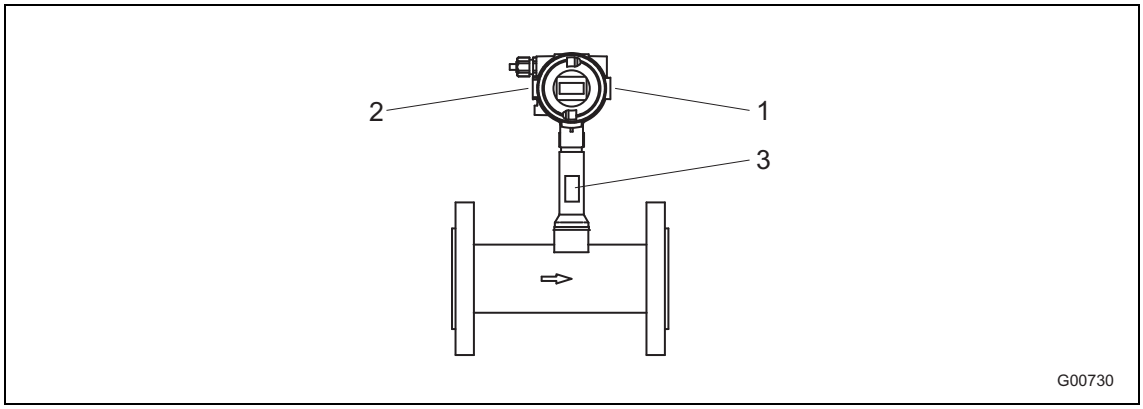


Fig. 1

1 Name plate
2 Name plate, hazardous area
3 Factory tag

1.7.2.1 Identifying the meter design

1. Identifying the model:

   The model number of the meter (see no. 1 in the description of the name plates) can be found on the name plate. The connection diagram appears in the section titled "Electrical connection". Technical data, material load curves, etc., appear sorted by model in the section titled "Technical data".

2. Identifying the transmitter design:

   The transmitter design can be identified from the name plate.

3. Identifying the software version:

   The software version can be displayed when the transmitter is switched on.

1.7.2.2 Name plates

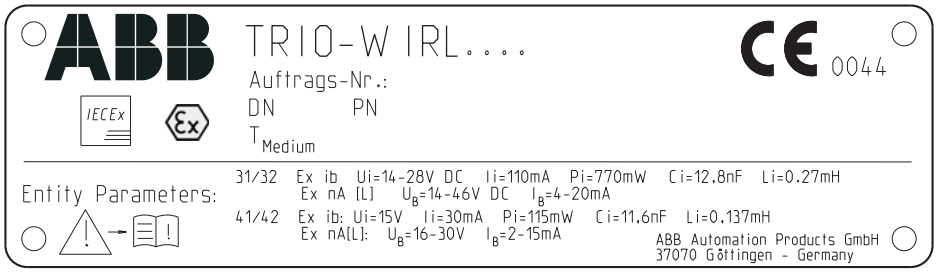


Fig. 2: Name plate

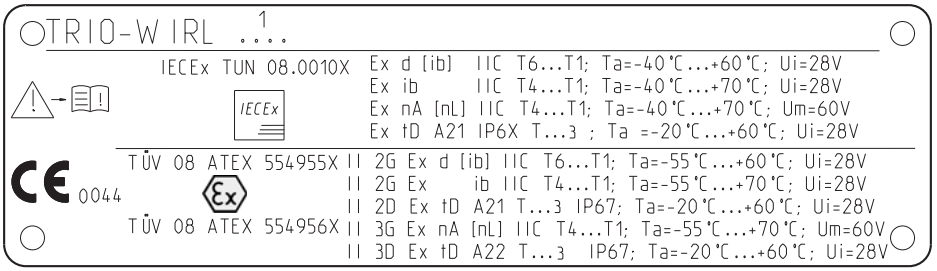


Fig. 3: Name plate, hazardous area

1.7.2.3 Factory Tag

The factory tag is located on the flowmeter sensor housing. If the pressure equipment is subject to the PED (see section 3 para. 3 PED 97/23/EC), two labels are required:

Pressure equipment subject to PED

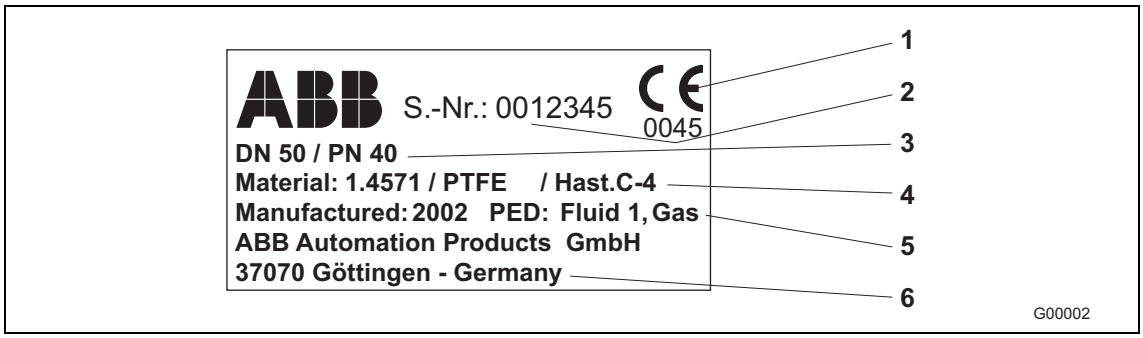


Fig. 4

1 CE mark (with number of labeled location) to confirm the device meets the requirements of pressure equipment directive 97/23/EC.
2 Serial number for identification of the pressure equipment by the manufacturer.
3 Nominal size and nominal pressure rating of pressure equipment.
4 Flange material, liner material and electrode material (wetted parts).
5 Year of manufacture and specification of fluid group as per the **p**ressure **e**quipment **d**irective (PED). Fluid group 1 = hazardous liquids, gaseous.
6 Manufacturer of the pressure equipment.

Pressure equipment outside the applicable range of the PED

Fig. 5

The factory tag contains most of the specifications included on the plate described above with the following differences:

- There is no CE mark because the pressure equipment, as per section 3 para. 3 of the PED, is outside the applicable range of the pressure equipment directive 97/23/EC.
- The reason for the exception is specified in section 3 para. 3 of the PED. The pressure equipment is categorized as SEP (= sound engineering practice).

Important

If the factory tag is not present, the device is not in compliance with directive 97/23/EC. The exception applies for water, power and connected equipment accessories in accordance with guideline 1/16 of sec. 1 para. 3.2 of the pressure equipment directive.

1.8 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.

1.9 Returning devices

Use the original packaging or a suitably secure packaging for returning the device for repair or for recalibration. Include the properly filled out return form (see attachment) with the device.

According to EC guidelines for hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for its shipping:

All delivered devices to ABB Automation Products GmbH must be free from any hazardous materials (acids, alkali, solvents, etc.).

Rinse out and neutralize hazardous materials from all hollow spaces such as between meter tube and housing. These activities must be confirmed in writing using the return form.

1.10 Disposal

ABB Automation Products GmbH actively promotes environmental awareness and has an operational management system that meets the requirements of DIN EN ISO 9001:2000, EN ISO 14001:2004, and OHSAS 18001. Our products and solutions are intended to have minimum impact on the environment and persons during manufacturing, storage, transport, use, and disposal.

This includes the environmentally friendly use of natural resources. ABB conducts an open dialog with the public through its publications.

This product/solution is manufactured from materials that can be reused by specialist recycling companies.

1.10.1 Information on WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product/solution is not subject to the WEEE directive 2002/96/EC and relevant national laws (e. g., ElektroG in Germany).

The product/solution must be disposed of at a specialized recycling facility. Do not use municipal garbage collection points. According to the WEEE Directive 2002/96/EC, only products used in private applications may be disposed of at municipal garbage facilities. Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials.

If it is not possible to dispose of old equipment properly, ABB Service can accept and dispose of returns for a fee.

1.10.2 RoHS directive 2002/95/EC

With the Electrical and Electronic Equipment Act (ElektroG) in Germany, the European directives 2002/96/EC (WEEE) and 2002/95/EC (RoHs) are translated to national law. ElektroG defines the products that are subject to regulated collection and disposal or reuse in the event of disposal or at the end of their service life. ElektroG also prohibits the marketing of electrical and electronic equipment that contains a specific amount of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) (also known as hazardous substances with restricted uses).

The products provided to you by ABB Automation Products GmbH do not fall within the current scope of the directive on waste from electrical and electronic equipment according to ElektroG. If the necessary components are available on the market, these substances will no longer be used in new product development.

1.11 Transport safety information

Please consider the following when transporting the device (in particular if your device weighs more than 50 kg):

- The fact that the center of gravity might not be in the center of the unit
- Any available attachment points
- Transportation safety equipment (e. g. gaskets for openings)

1.12 Installation safety information

Observe the following instructions:

- The flow direction must correspond to the direction indicated on the meter, if labeled.
- The maximum torque must not be exceeded for all flange connections.
- The meters must be installed without mechanical tension (torsion, bending).
- Wafer units must be installed with coplanar counter flanges.
- Equipment must only be installed for the intended operating conditions and with suitable gaskets.
- Flange bolts and nuts must be secured to provide protection against pipeline vibrations.
- The required length of straight pipeline must be provided upstream and downstream of the meter.
- The pipeline must be supported upstream and downstream of the meter.

1.13 Safety information for electrical installation

Electrical connections may only be established by authorized specialist personnel in accordance with the electrical circuit diagrams.

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

Ground the measurement system according to requirements.

Important

The transmitter meets the EMC requirements set out in EN 61326 / NAMUR NE21. There is no EMC protection or protection against accidental contact when the housing cover is open.

Please observe the specific information about meters for hazardous areas in the section titled "Technical data for hazardous areas".

1.14 Safety information for operation

Operation with abrasive fluids and/or cavitation can damage pressurized components.

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

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

Due to wear on the flange gasket, a pressurized medium may escape

Important

- As a general rule, when operating the meter, the detailed information in these operating instructions on the subjects of "electrical safety" and "electromagnetic compatibility" must be observed.
- For operation in potentially explosive areas, observe the relevant information in these operating instructions.

1.15 Safety instructions for operation in hazardous areas

Specific requirements affecting the connection for the supply power and the switching output apply for operation in hazardous areas. Please follow the instructions in the section titled "Technical data for hazardous areas".

1.16 Safety information for maintenance and inspection

Warning - Potential damage to parts!

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.

When the housing is open, EMC protection is limited.

Corrective maintenance work may only be performed by trained personnel.

- Depressurize the device and adjoining lines or containers before removing the device.
- Check whether hazardous materials are used as materials to be measured before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when the device is opened.
- As far as provided in the scope of the operational responsibility, check the following items through a regular inspection:
  - the pressure-carrying walls / lining of the pressure device
  - the measurement-related function
  - the leak tightness
  - the wear (corrosion)

2 Design and function

2.1 Principles of measurement

2.1.1 Vortex flowmeter

The operating principle of the Vortex flowmeter is based on the Karman street. As the fluid flows over and under the solid body, vortices are shed alternately above and below. The shedding of these vortices due to the flow forms a vortex trail (Karman street).

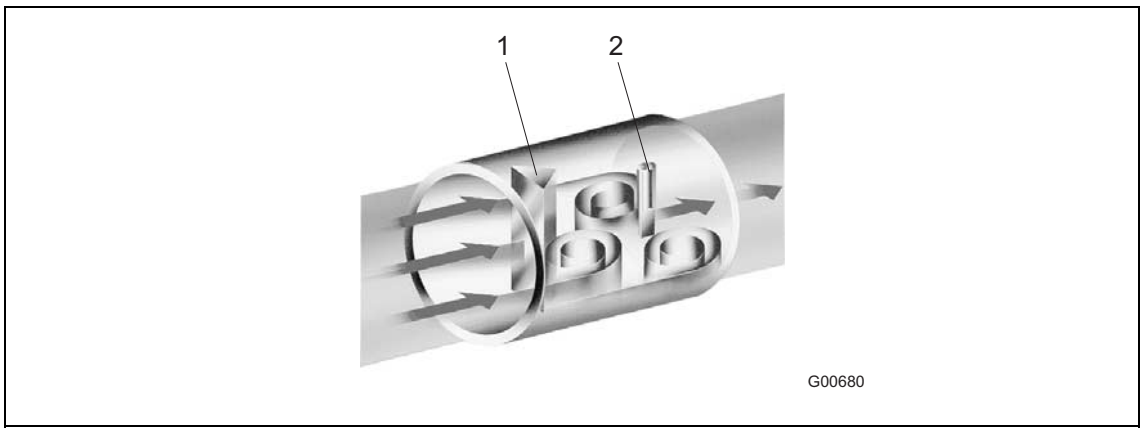


Fig. 6: Principle of measurement, FV4000

1 Solid body 2 Piezo sensor

The frequency *f* of vortex shedding is proportional to the flow velocity *v* and inversely proportional to the width of the solid body *d*:

$$f = St \times \frac{v}{d}$$

St, known as the Strouhal number, is a dimensionless number which has a decisive impact on the quality of vortex flow measurement.

If the solid body is dimensioned appropriately, the Strouhal number *St* will be constant across a very wide range of the Reynolds number *Re* (Fig. 2).

$$Re = \frac{v \times D}{\vartheta}$$

ϑ = Kinematic viscosity

D = Nominal size of meter tube

Consequently, the vortex shedding frequency to be evaluated is dependent solely upon the flow velocity and not at all upon media density and viscosity.

The local changes in pressure induced by vortex shedding are detected by a piezo sensor and converted into electrical pulses corresponding to the vortex frequency.

The frequency signal from the flowmeter sensor, which is proportional to the flow, undergoes downstream processing in the transmitter.

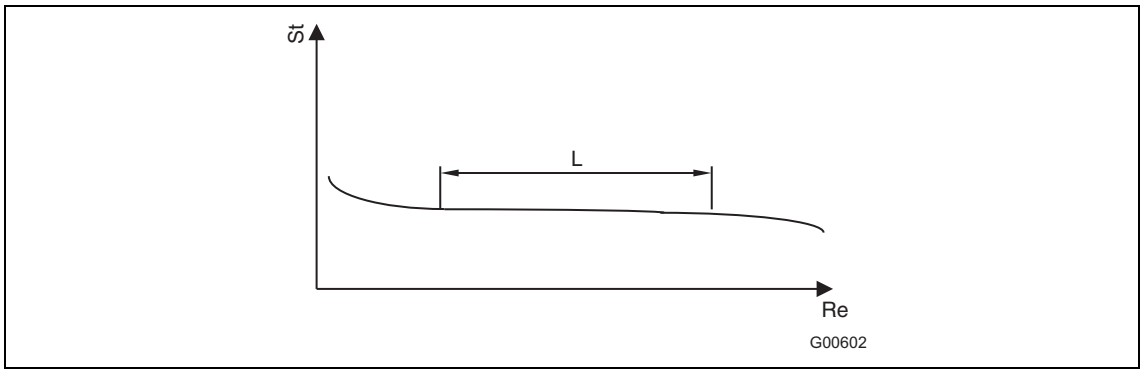


Fig. 7: How the Strouhal number is dependent upon the Reynolds number

St Strouhal number
L Linear flow area
Re Reynolds number

2.1.2 Swirl flowmeter

The inlet pipe converts the axial flow of the incoming media into rotational movement. In the center of this rotation a vortex core is formed which is forced into a secondary spiral-shaped rotation by the backflow.

The frequency of this secondary rotation is proportional to the flow and, if the internal geometry of the meter exhibits an optimum design, will be linear over a wide flow range. This frequency is measured by a piezo sensor. The frequency signal from the flowmeter sensor, which is proportional to the flow, undergoes downstream processing in the transmitter.

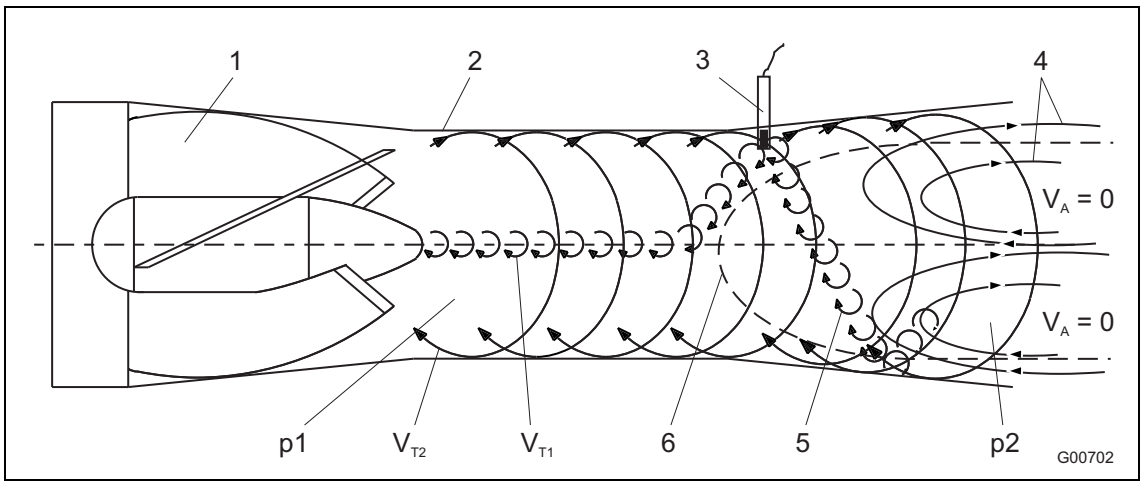


Fig. 8: Principle of measurement of the Swirl flowmeter

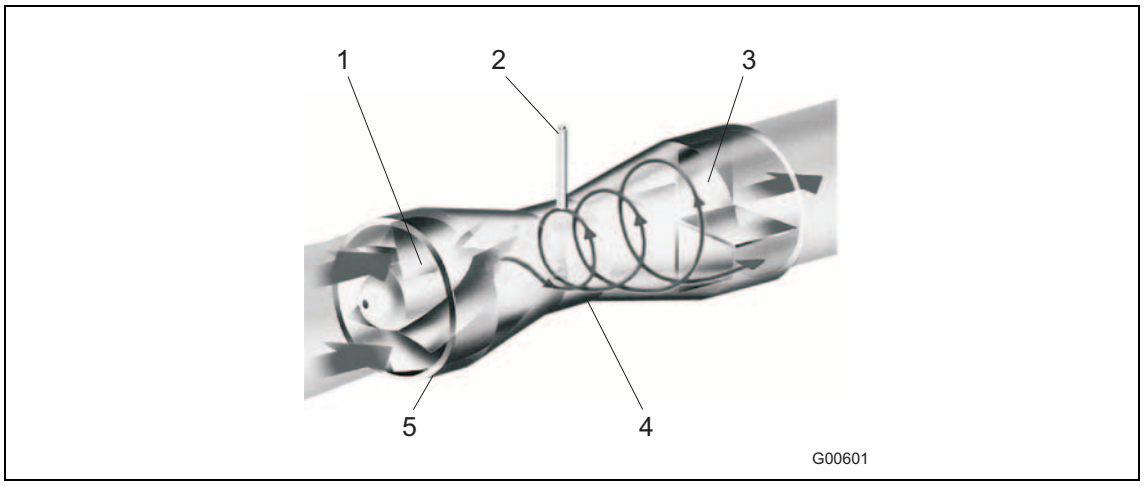


Fig. 9: Principle of measurement of FS4000-ST4/SR4 Swirl flowmeters

1 Inlet pipe
2 Piezo sensor
3 Outlet pipe
4 Stagnation point
5 Housing

2.2 Design

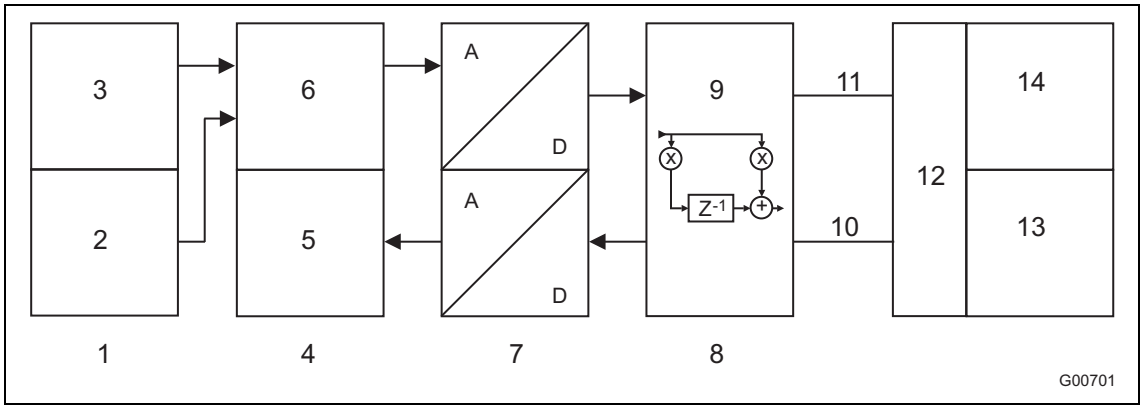


Fig. 10

1 Sensor
2 Vibration sensor
3 Flow sensor
4 Amplifier with automatic gain control
5 Gain control
6 Amplifier
7 A/D-D/A converter
8 DSP
9 FIR [1] filter algorithm and gain control
10 Serial interface
11 Frequency
12 CPU
13 Current output
14 Switching output

1) FIR = Finite Impulse Response

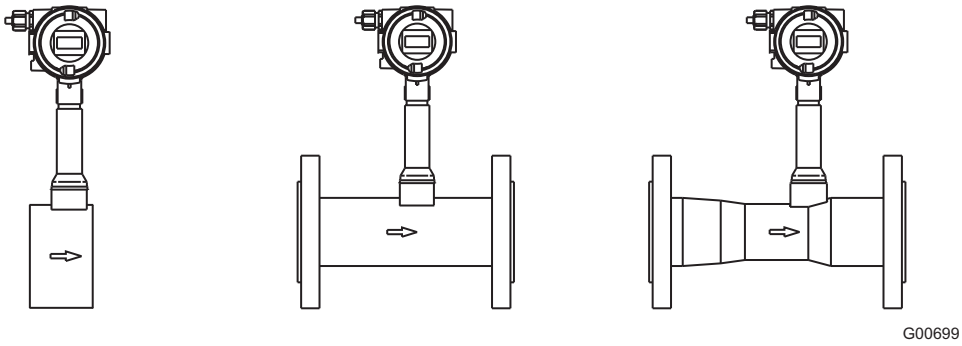
The flow and vibration piezo elements from the sensor deliver signals which are forwarded to the analog-to-digital converter via an amplifier. A gain control mechanism in the DSP controls gain via the D/A converter. Gain control is used to adapt the necessary signal gain dynamically. The filter algorithm in the DSP evaluates the signals, picks up the flow signal and sends this frequency to the CPU for conversion into flow units. This data is then shown on the display and transmitted on the current and switching outputs or via fieldbus communication.

2.3 Device designs

A general distinction is made between two designs.

2.3.1 Compact design

The transmitter is installed directly on the flowmeter sensor.

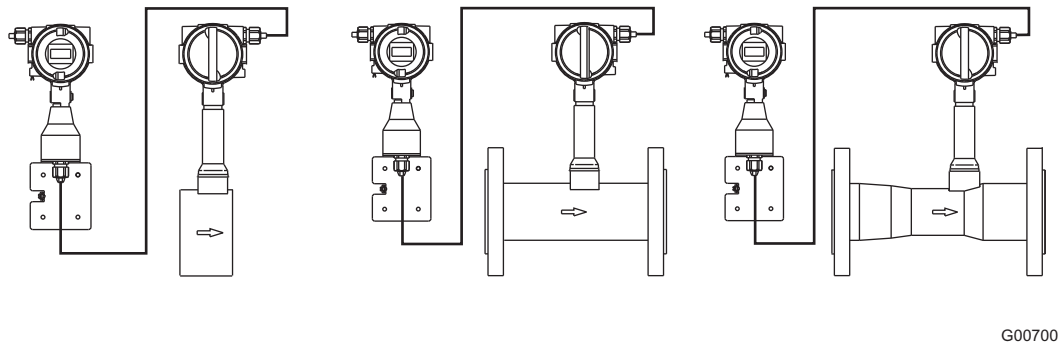


Vortex flowmeter	Vortex flowmeter	Swirl flowmeter
FV4000-VT4	FV4000-VT4	FS4000-ST4
Wafer flange design	Flange design	Flange design

Fig. 11

2.3.2 Remote mount design

The transmitter can be installed up to 10 m (33 ft) away from the flowmeter sensor. The cable is permanently connected to the transmitter. It can be made shorter if required.



Vortex flowmeter	Vortex flowmeter	Swirl flowmeter
FV4000-VR4	FV4000-VR4	FS4000-SR4
Wafer flange design	Flange design	Flange design

Fig. 12

3 Transport

3.1 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.

3.2 Transport of flanged units smaller than DN 350

Warning – Risk of injury due to meter slipping!

The center of gravity of the complete meter may be higher than the lifting straps.

Make sure that the meter cannot rotate or slip unintentionally during transport.

Support the meter laterally.

Warning - Potential damage to parts

A lifting strap must be used to transport flanged units smaller than DN 350. Wrap the straps around both process connections when lifting the meter. Chains should not be used, since these may damage the housing.

3.3 Transport of flanged units larger than DN 300

Caution - Potential damage to parts

Using a forklift to transport the meter can dent the housing.

Flanged units must not be lifted by the center of the housing when using a forklift for transport.

Flanged units must not be lifted by the terminal box or by the center of the housing.

Only the eyebolts fitted to the meter must be used to lift the meter and set it down in the pipeline.

4 Mounting

4.1 General information on installation

The following points must be observed during installation:

- The meter tube must always be completely full.
- The flow direction must correspond to the marking, if there is one.
- The maximum torque for all flange connections must be complied with.
- The meters must be installed without mechanical tension (torsion, bending).
- Wafer design flowmeters with coplanar counter flanges may only be installed with suitable gaskets.
- Only gaskets made from a material which is compatible with the media and its temperature may be used.
- Gaskets must not extend into the flow area since possible turbulence could affect the accuracy of the meters.
- The pipelines must not exert any impermissible forces or torques on the meter.
- Do not remove the plugs in the connectors until you are ready to install the electrical cable.
- Make sure the gaskets for the housing cover are seated properly. Carefully gasket the cover. Tighten the cover fittings.
- Do not expose the transmitter to direct sunlight and provide for appropriate sun protection where necessary.
- When selecting the installation site, make sure that moisture cannot penetrate the terminal housing or transmitter compartment.
- Make sure the signal cable connectors are plugged in and tightened properly to ensure IP 67 protection.

4.2 Installation Requirements

- A Vortex or Swirl flowmeter can be installed at any point in the pipeline system. However, the following installation conditions must be considered:
- Compliant ambient conditions (see data sheet D184S035UXX)
- Compliance with the recommended inflow/outflow sections
- The flow direction must correspond to that indicated by the arrow on the flowmeter sensor.
- Compliance with the required minimum interval for removing the transmitter and replacing the sensor (see data sheet D184S035UXX)
- Avoidance of mechanical vibrations of the pipeline (by fitting supports if necessary)
- The internal diameter of the flowmeter sensor and the pipe must be identical.
- Avoidance of pressure vibrations at zero flow by fitting gates at intervals in long pipeline systems
- Attenuation of alternating (pulsating) flow during piston pump or compressor conveying by using appropriate damping devices. The residual pulse must not exceed 10 %. The frequency of the conveying equipment must not be within the range of the measuring frequency of the flowmeter.
- Valves / gates should normally be arranged in the flow direction downstream of the flowmeter (typically: 3 x DN). If the medium is conveyed through piston/plunger pumps or compressors (pressures for fluids > 10 bar (145 psi)), it may be subject to hydraulic vibration in the pipeline when the valve is closed. If this does occur, the valve absolutely has to be installed in the flow direction upstream of the flowmeter. Suitable damping devices (e. g. air vessels) might need to be fitted.
- When fluids are measured, the sensor must always be filled with media and must not run dry.
- When fluids are measured and during damping there must be no evidence of cavitation.
- The relationship between the temperature of the media and the ambient temperature has to be taken into account (see "Ambient conditions" in the section titled "Technical data").
- At high media temperatures > 150 °C (302 °F) the flowmeter sensor must be installed so that the electronics are pointing to the side or downward.

4.3 Recommended inflow and outflow sections

4.3.1 Vortex flowmeter

In order to maximize operational reliability, the flow profile at the inflow end must not be distorted if at all possible. Provision should be made for an inflow section measuring approx. 15 times the nominal diameter. At elbows, the inflow section should measure at least 25 times the nominal diameter, at round elbows 40 times the nominal diameter and where shutoff valves appear in the inflow section, 50 times the nominal diameter. A value 5 times the size of the nominal diameter is required at the outflow end.

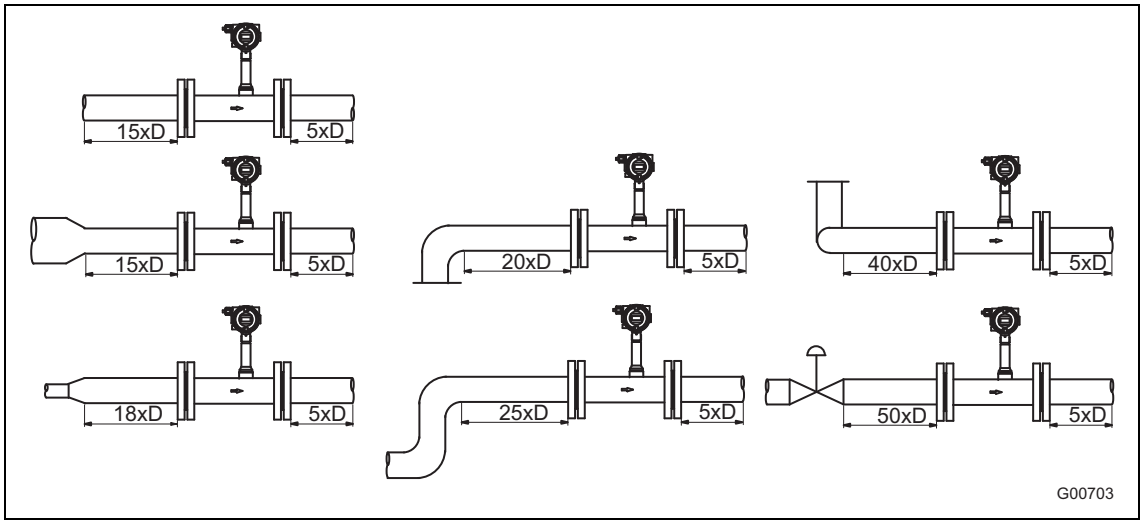


Fig. 13: Recommended inflow and outflow sections

4.3.2 Swirl flowmeter

On account of its operating principle, the Swirl flowmeter functions virtually without inflow and outflow sections. The figure below shows the recommended inflow and outflow sections for various installations. Inflow and outflow sections are not required if the elbow radius of single or double pipe elbows upstream and downstream of the meter is greater than 1.8 x D. Similarly, additional inflow and outflow sections are not required downstream of reductions with flange transition pieces conforming to DIN 28545 (α/2 = 8°).

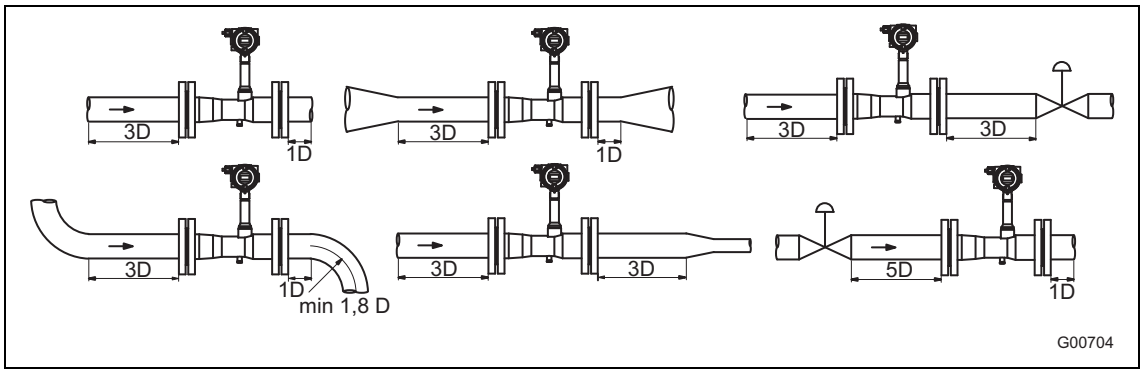


Fig. 14: Recommended inflow and outflow sections

4.4 Installation at high media temperatures > 150°C (302 F)

At high media temperatures > 150°C (302 F) the flowmeter sensor must be installed so that the transmitter is pointing to the side or downward (see the figure below).

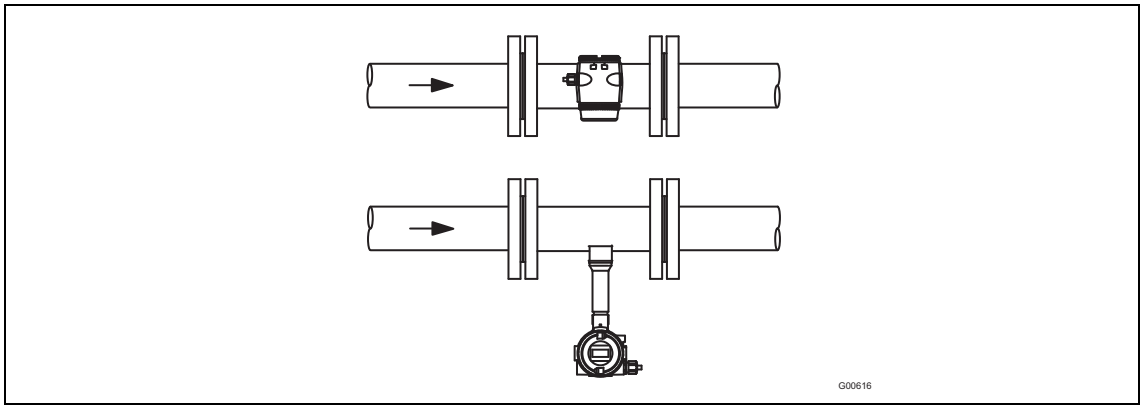


Fig. 15: Installation at high media temperatures > 150°C (302°F)

4.5 Installation for pressure and temperature measurement

As an option, the flowmeter can be fitted with a PT100 for direct temperature measurement. This temperature measurement supports, for example, the monitoring of the media temperature or the direct measurement of saturated steam in mass flow units.

If pressure and temperature are to be compensated externally (e. g. with the "Sensycal"), the measuring points must be installed as illustrated in the figure below.

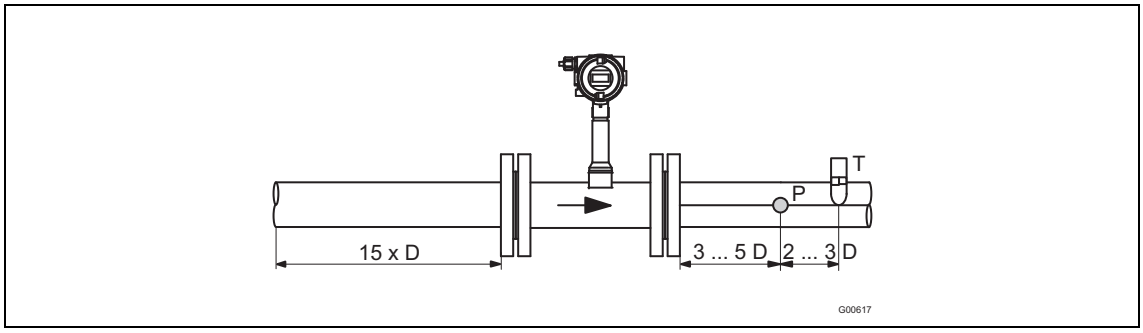


Fig. 16: Arrangement of temperature and pressure measuring points

4.6 Installation of final controlling equipment

4.6.1 Vortex flowmeter

Final controlling equipment must be arranged at the outflow end spaced at a minimum 5 x DN.

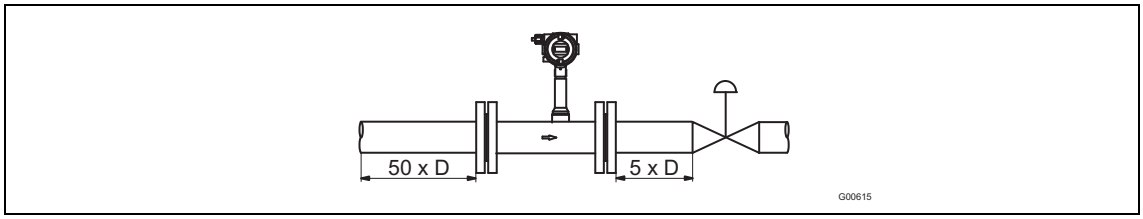


Fig. 17: Installation of final controlling equipment

4.6.2 Vortex and Swirl flowmeters

If the medium is conveyed through piston/plunger pumps or compressors (pressures for fluids > 10 bar (145 psi)), it may be subject to hydraulic vibration in the pipeline when the valve is closed. If this does occur, the valve absolutely has to be installed in the flow direction upstream of the flowmeter. Suitable dampers (e. g. air vessels in the case of pumping using a compressor) might need to be used.

4.7 Mounting the meter tube

The flowmeter sensor can be installed at any location in a pipeline subject to compliance with the installation conditions.

1. Position the flowmeter sensor coplanar and centered between the pipes.
2. Install gaskets between the surfaces of the flowmeter sensor and the counter flange.

Important

The flowmeter sensor gaskets and the flowmeter sensor must be centered. This will ensure accurate measurement results. Do not allow the gaskets to extend into the pipeline. Otherwise the flow profile will be distorted.

3. Use the appropriate screws for the holes.
4. Slightly grease the threaded nuts.
5. Tighten the nuts in a crosswise manner as shown in the figure. Observe the selected tightening torque!

Important

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

First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque. Do not exceed the maximum selected torque.

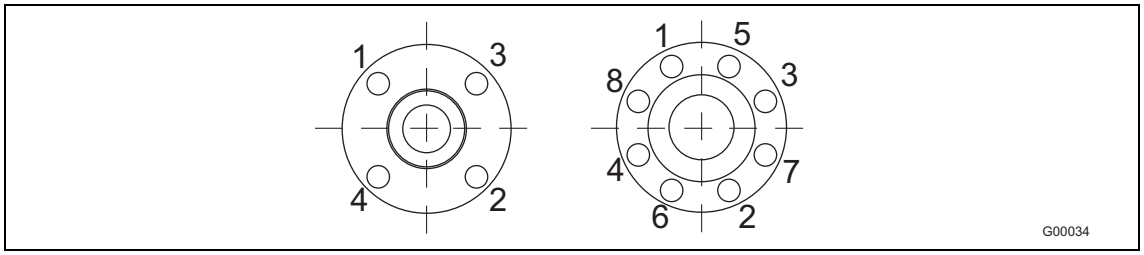


Fig. 18

Important

Tighten flange screws and nuts to prevent them coming loose. This is recommended in the case of pipeline vibration. Supports/damping devices should always be installed to prevent pipeline vibration.

4.8 Centering the wafer design

Wafer units (FV4000-VT4/VR4 only) are centered via the outer diameter of the sensor body with the corresponding bolts. Depending on the nominal pressure rating, sleeves for the bolts, a centering ring (up to DN 80) or segments can be ordered as additional accessories (see Fig. 20).

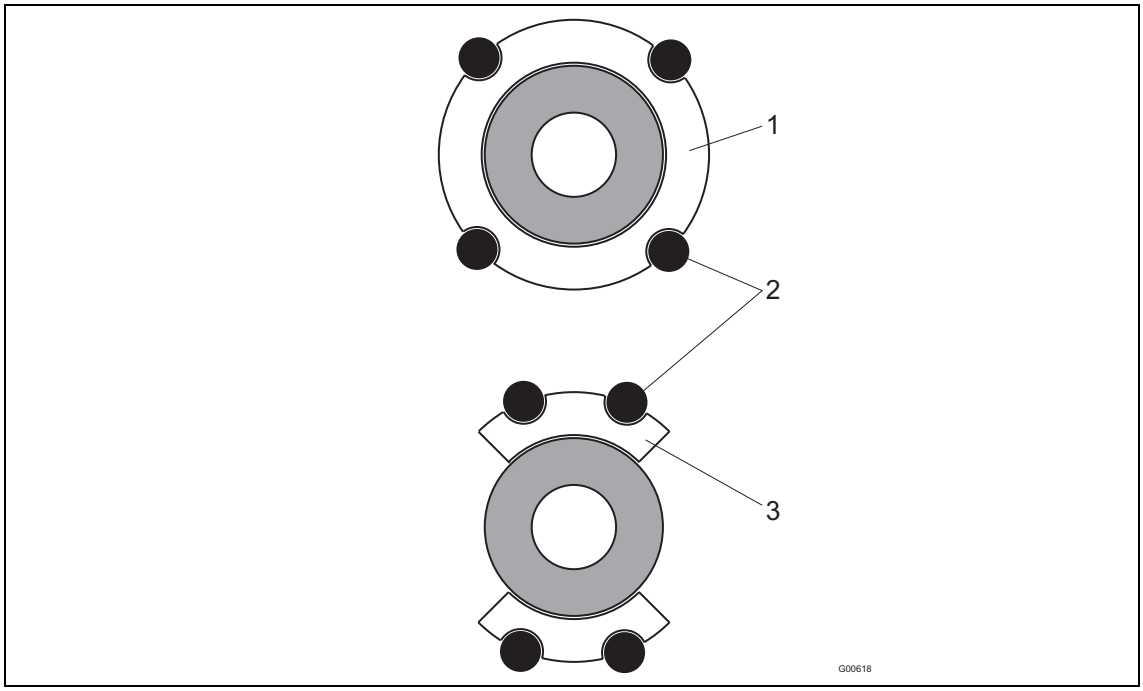


Fig. 19: Centering the wafer unit with ring or segment

1 Centering
2 Bolts
3 Centering segment

4.9 Flowmeter insulation

The pipeline may be insulated up to a maximum of 100 mm (3.94 inch) upper edge.

Use of trace heating

Trace heating may be used under the following conditions:

- If it is fixed directly on or around the pipeline
- If, in the case of existing pipeline insulation, it is installed inside the insulation (the maximum height of 100 mm (3.94 inch) must not be exceeded)
- If the maximum temperature the trace heating is able to produce is less than or equal to the maximum temperature of the fluid.

The requirements to be met by integrators set out in EN 60079-14 must be complied with!

Please note that the use of trace heaters will not impair EMC protection or generate additional vibrations.

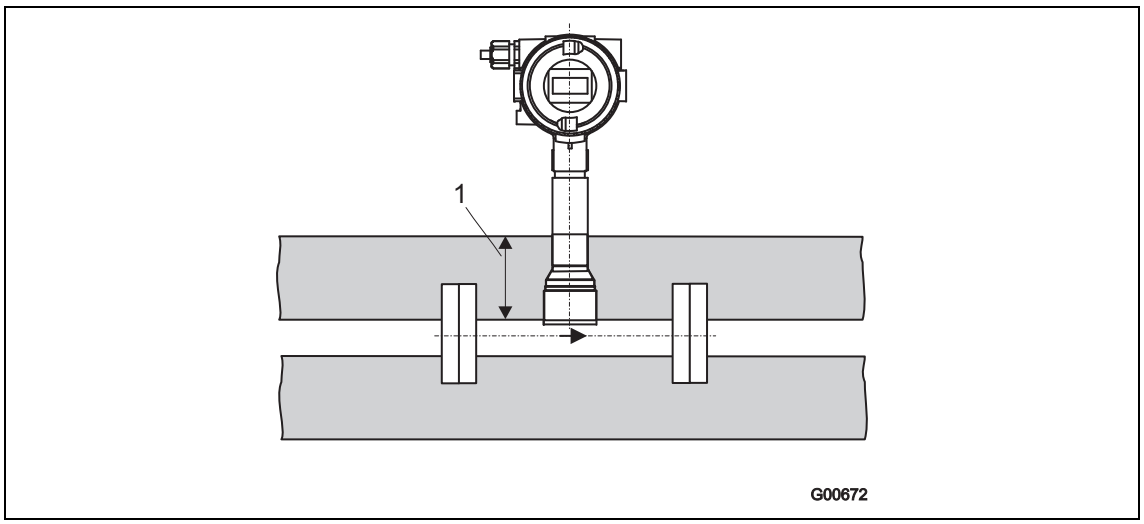


Fig. 20: Flowmeter insulation

1 Maximum 100 mm (3.94 inch)

4.10 Transmitter orientation

During installation, the transmitter hosing can be turned to a position appropriate for reading requirements. A simple mechanical stop in the transmitter housing prevents rotation in excess of 330°. This stop protects the cable running from the flowmeter sensor.

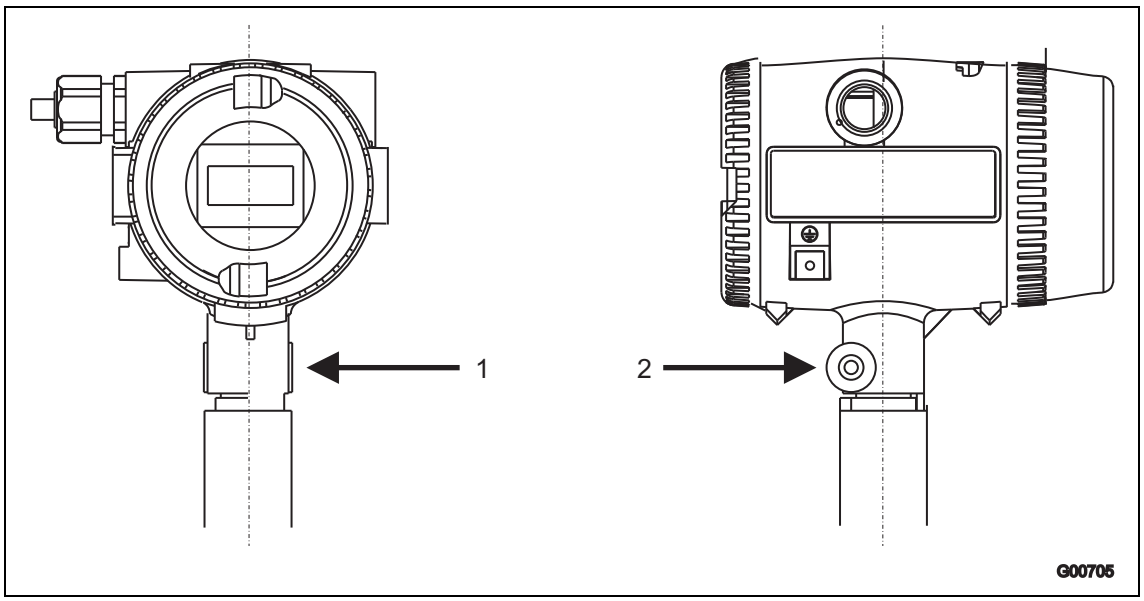


Fig. 21: Rotating the transmitter housing
1 Bolt 2 Stop screw

1. Unscrew the stop screw on the transmitter housing with a 4 mm Allen key.
2. Push the bolts out.
3. Turn the transmitter housing in the required direction.

Warning - Potential damage to parts

The transmitter housing must not be lifted up, since this could tear away the cable coming out of the housing.

4. Put the bolts back in.
5. Fasten the stop screw.

4.11 Rotating the display

The display can be rotated in 90° increments to make its content more legible.

Warning - Potential damage to parts

Disconnect the flowmeter from the power supply. Ensure compliance with the waiting times before opening the flowmeter as specified on the flowmeter plate (see "Technical data for hazardous areas"). Installation engineers must have statically discharged themselves before touching electronic components.

EMC protection is no longer assured when the flowmeter cover is open.

When the cover is open, the inside of the meter must be protected against the ingress of dust and moisture.

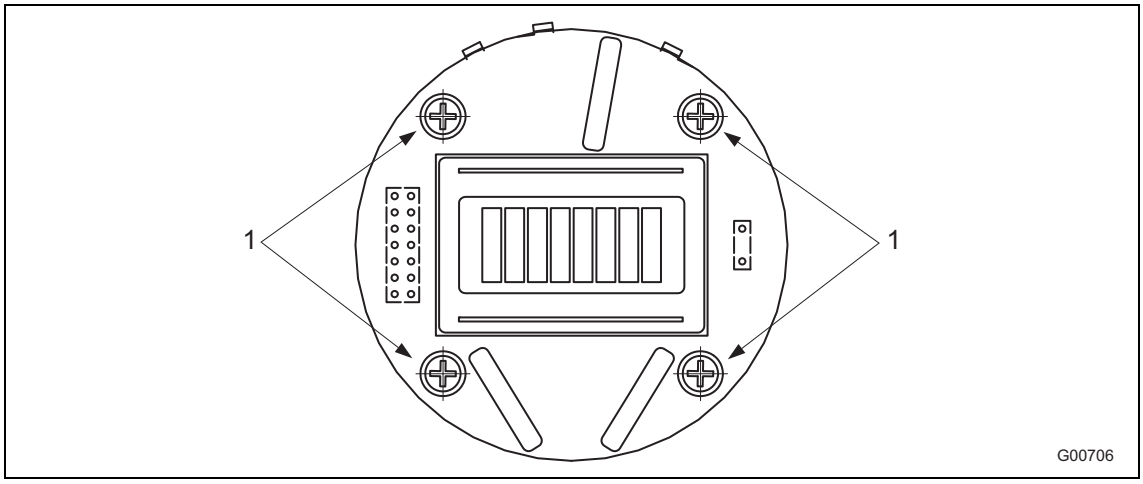


Fig. 22: Rotating the display
1 Phillips head screws

1. Unscrew the front housing cover. The lock on the cover needs to be undone first on meters for hazardous areas.

Important

After switching off the supply power, wait t > 2 minutes before opening the flameproof housing.

2. Remove the white clip-on cover.
3. Unscrew the 4 Phillips head screws (1) from the corners of the display.
4. Turn the display to the required position. Take care not to over-rotate the connecting cable!
5. Then screw the display panel back in place.
6. Fasten the white cover.
7. Finally, tighten the housing cover hand-tight. The lock on the cover needs to be re-attached on meters for hazardous areas.

4.12 Flowmeter sizes, flow range

4.12.1 Flow ranges, FV4000 vortex flowmeter

4.12.1.1 Fluid flowrates

DN		DIN pipe				ANSI pipe						
		$Q_V$min 1) (m^3/h)		$Q_V$maxDN (m^3/h)	Frequency (Hz) at $Q_V$max	$Q_V$min 1) (m^3/h)		$Q_V$maxDN (m^3/h)	$Q_V$min 1) (US gal/min)		$Q_V$max DN (US gal /min)	Frequency (Hz) at $Q_V$max
		std.	HT			std.	HT		std.	HT		
15	1/2“	0.5	-	6	370	0.5	-	5.5	2.20	-	24.22	450
25	1“	1.6	3.6	18	240	1.6	3.6	18	7.04	15.85	79.25	400
40	1 1/2“	2.4	9.6	48	190	2.5	9.6	48	11.01	42.27	211.34	270
50	2“	3	14	70	140	3	13	66	13.21	57.24	290.59	176
80	3“	10	34	170	102	10	32	160	44.03	140.89	704.46	128
100	4“	10	54	270	72	12	43	216	52.83	189.32	951.02	75
150	6“	30	126	630	50	33	106	530	145.29	466.70	2333.52	50
200	8“	70	220	1100	45	70	187	935	308.20	823.34	4116.68	40
250	10“	70	340	1700	29	82	289	1445	361.04	1272.43	6362.14	36
300	12“	135	480	2400	26	135	408	2040	594.39	1796.37	8981.85	23

1) Std. 280 °C (536 °F) version/HT = High temperature version (fmax = 400 °C (752 °F))

The flowrates apply for fluids at 20 °C (68 °F). 1.013 mbar (14.69 psi). ρ = 998 kg/m^3 (62.30 lb/ft^3).

4.12.1.2 Gas/Steam flowrates

DN		DIN pipe				ANSI pipe						
		$Q_V$min 1) (m^3/h)		$Q_V$maxDN (m^3/h)	Frequency (Hz) at $Q_V$max	$Q_V$min 1) (m^3/h)		$Q_V$maxDN (m^3/h)	$Q_V$min 1) (ft^3/min)		$Q_V$maxDN (ft^3/min)	Frequency (Hz) at $Q_V$max
		std.	HT			std.	HT		std.	HT		
15	1/2“	4	-	24	1520	5	-	22	2.94	-	12.95	1980
25	1“	15	30	150	2040	12	16	82	7.06	9.42	48.26	1850
40	1 1/2“	30	78	390	1550	21	68	340	12.36	40.03	200.12	1370
50	2“	40	100	500	1030	43	90	450	25.31	52.97	264.86	1180
80	3“	100	240	1200	700	78	190	950	45.91	111.83	559.15	780
100	4“	150	380	1900	500	120	360	1800	70.63	211.89	1059.44	635
150	6“	300	900	4500	360	260	810	4050	153.03	476.75	2383.74	405
200	8“	430	1600	8000	285	420	1360	6800	247.20	800.47	4002.33	240
250	10“	810	2800	14000	260	820	2400	12000	482.63	1412.59	7062.93	225
300	12“	1410	4000	20000	217	1300	3400	17000	765.15	2001.16	10005.82	195

1) Std. 280 °C (536 °F) version/HT = High temperature version (fmax = 400 °C (752 °F))

The flowrates apply for gas at ρ = 1.2 kg/m^3 (0.075 lb/ft^3).

4.12.2 Flow ranges, swirl flowmeter FS4000

4.12.2.1 Fluid flowrates

DN		$Q_V$min (m^3/h)	$Q_V$minDN (m^3/h)	$Q_V$min (US gal/min))	$Q_V$minDN (US gal/min)	Frequency (Hz) at $Q_V$maxDN	Re min
15	1/2“	0.1	1.6	0.44	70.45	185	2100
20	3/4“	0.2	2	0.88	8.81	100	3500
25	1“	0.4	6	1.76	26.42	135	5200
32	1 1/4“	0.8	10	3.52	44.03	107	7600
40	1 1/2“	1.6	16	7.05	70.44	110	13500
50	2“	2.5	25	11.01	110.07	90	17300
80	3“	3.5	100	15.41	440.29	78	15000
100	4“	5	150	22.01	660.43	77	17500
150	6“	18	370	79.25	1629.06	50	43000
200	8“	25	500	110.07	2201.43	30	44000
300	12“	100	1000	440.29	4402.87	16	115000
400	16“	180	1800	792.52	7925.16	13	160000

.The flowrates apply for fluids at 20 °C (68 °F), 1013 mbar (14.69 psi), ν = 1 cSt, ρ = 998 kg/m^3 (62.30 lb/ft^3)

4.12.2.2 Gas/Steam flowrates

DN		$Q_V$min (m^3/h)	$Q_V$maxDN (m^3/h)	$Q_V$min (ft^3/min)	$Q_V$maxDN (ft^3/min)	Frequency (Hz) at $Q_V$maxDN
15	1/2“	2.5	16	1.47	9.42	1900
20	3/4“	5	25	2.94	14.71	1200
25	1“	5	50	2.94	29.43	1200
32	1 1/4“	8	130	4.71	76.52	1300
40	1 1/2“	12	200	7.06	117.72	1400
50	2“	18	350	10.59	206.0	1200
80	3“	60	850	35.31	500.29	690
100	4“	65	1500	38.26	882.87	700
150	6“	150	3600	88.29	2118.88	470
200	8“	200	4900	117.72	2884.03	320
300	12“	530	10000	311.95	5885.78	160
400	16“	1050	20000	618.01	11771.56	150

The flowrates apply for gas/steam at ρ = 1.2 kg/m^3 (0.075 lb/ft^3).

5 Electrical connection

Warning - General risks

Observe the applicable regulations governing electrical installation. Connections must only be established in a dead-voltage state. Since the transmitter has no switch-off elements, overvoltage protection devices, lightning protection, and voltage separation capacity must be provided at the plant (overvoltage / lightning protection is optional).

Check that the existing operating voltage corresponds to the voltage indicated on the name plate.

The same lines are used for both the power supply and output signal.

Important

Please ensure compliance with applicable requirements when making electrical connections for meters approved for use in the USA and Canada!

USA:

Meters approved for use in the USA must be connected in compliance with the National Electrical Code (NEC).

Canada:

Meters approved for use in Canada must be connected in compliance with the Canadian Electrical Code (CEC).

5.1 Cable connection area

5.1.1 HART design

The transformer has a 2-wire design. This means that the supply voltage and the measuring signal (4 ... 20 mA) are routed on the same wire. An additional switching output is also available.

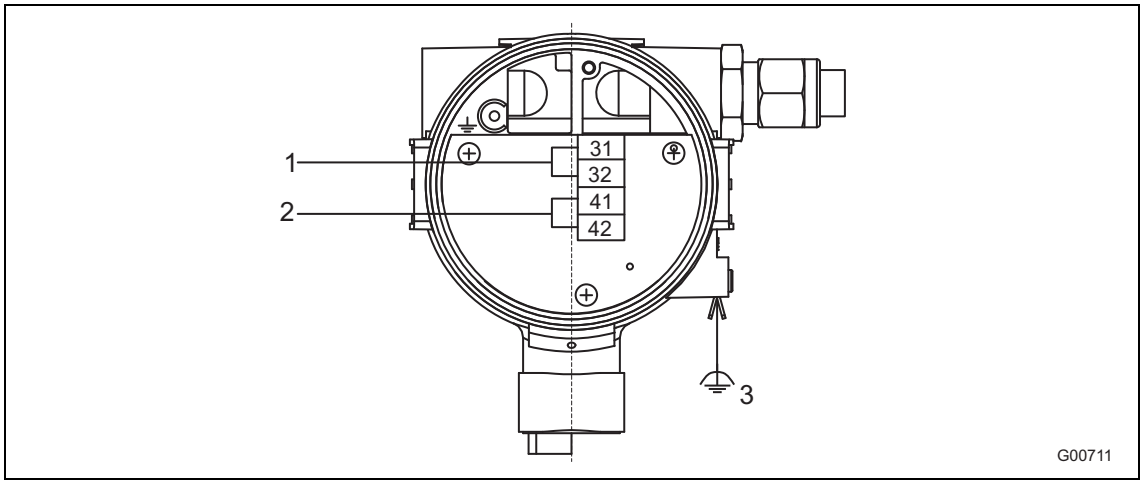


Fig. 23: Cable connection area

1 Current output terminals
2 Switching output terminals
3 Functional ground

Pin configuration

Connection	Description
31	Supply power
32	Supply power
41	Switching output +
42	Switching output -
⏚	Functional ground

Supply power (terminals 31 / 32)

Standard	14 ... 46 V DC
Hazardous area design	See “Technical data for hazardous areas” section.
Residual ripple	Maximum 5 % or. ± 1.5 Vpp
Power consumption	< 1 W

Connection examples

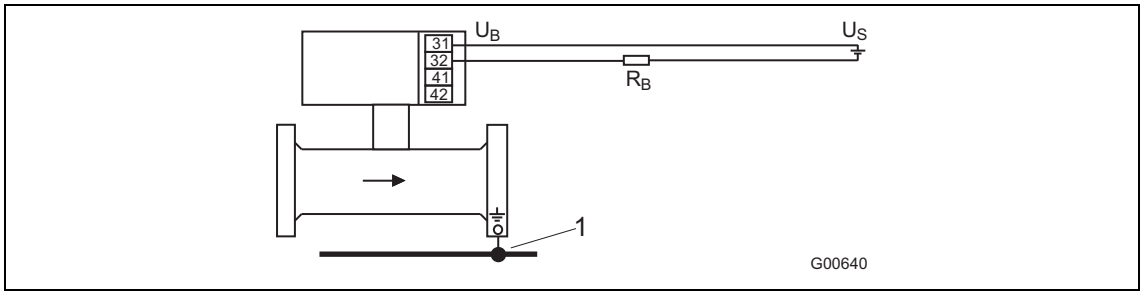


Fig. 24: Supply power from central voltage supply
1 Functional ground

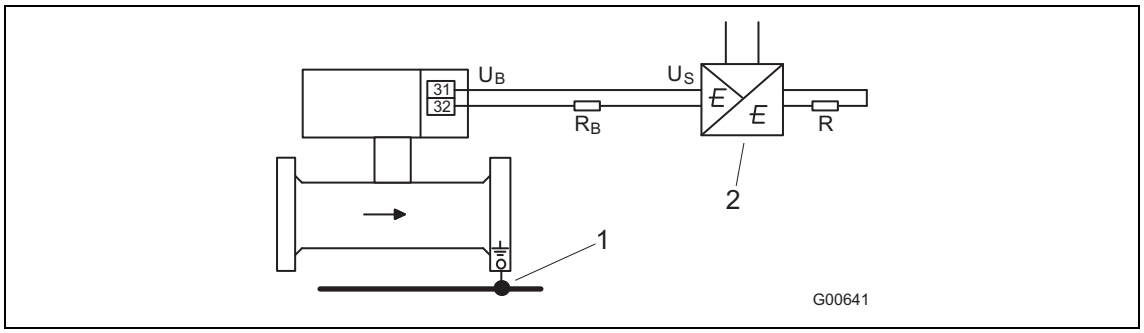


Fig. 25: Supply power (DC or AC) from power supply unit
1 Functional ground
2 Power supply unit

5.1.2 Fieldbus design

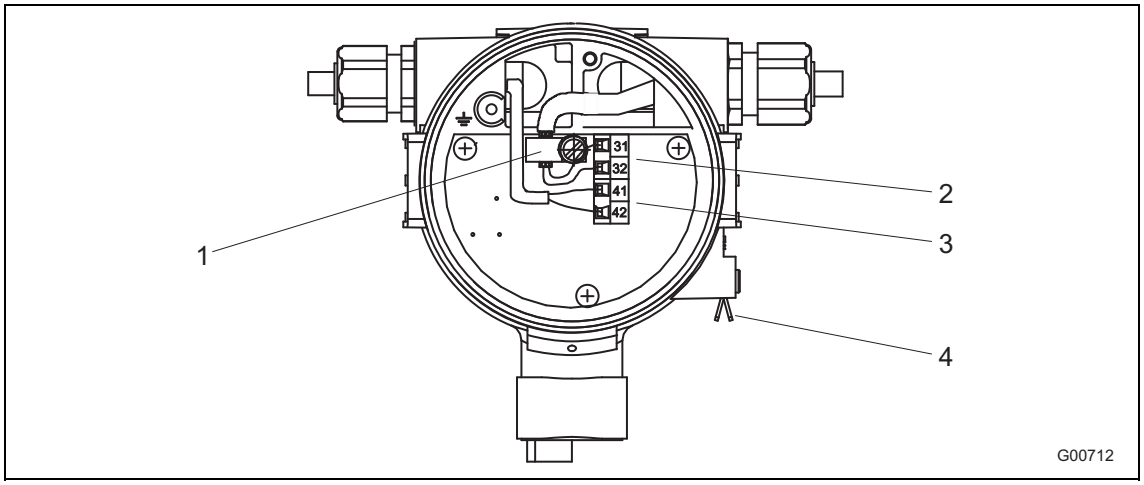


Fig. 26: Cable connection area

1 Terminal for bus cable shield
2. "Bus" terminals
3. "Switching output" terminals
4. Functional ground

Pin configuration

Connection	Description	
	PROFIBUS PA	FOUNDATION Fieldbus
31	PA+ 1)	FF+ 2)
32	PA- 1)	FF- 2)
41 (C9)	Switching output +	
42 (E9)	Switching output -	
⏚	Terminal for cable shield, functional ground	

1) Connection for PROFIBUS PA to IEC 1158-2
2) Connection for FOUNDATION Fieldbus (H1)

5.2 Cable connection

5.2.1 Standard design, HART

1. A suitable voltage supply cable must be used for the electrical connection of the transmitter (see the section titled "Technical data").
2. Unscrew the cover from the cable connection area at the rear of the transmitter.

Important

After switching off the supply power, wait t > 2 minutes before opening the flameproof housing. (Hazardous area protection only!)

3. Insert the supply voltage cable into the cable connection area through the cable gland and fasten to the cable grip to prevent accidental disconnection.
4. Tighten the cable gland.

Warning - Potential damage to parts

If the supply voltage cable is not fastened with the cable grip, there is a risk of it being pulled completely out of the transmitter housing should the strain fall below the required level, thereby interrupting the electrical connection.

The sheathing of the supply voltage cable must not be damaged. Otherwise, protection class IP 67 for the flowmeter cannot be ensured.

5. Remove the insulation from the cable sheath and the wires and connect these to the corresponding terminals (see the section titled "Cable connection area").
6. Screw on the cover for the cable connection area fully and fasten hand-tight. Make sure the gaskets for the cover are seated properly.

5.2.2 Connection via flameproof cable gland (Ex d design)

The electrical connection for the flowmeter is made via the cable gland on the unit. Alternatively, the flowmeter can be connected using an approved flame-resistant conduit gland located directly on the unit. If this option is selected, the cable gland has to be removed first.

Important

The requirements set out in EN 500181 Section 13.1 and 13.2 must be complied with.

The requirements to be met by integrators set out in EN 60079-14 must be complied with when selecting conduit glands.

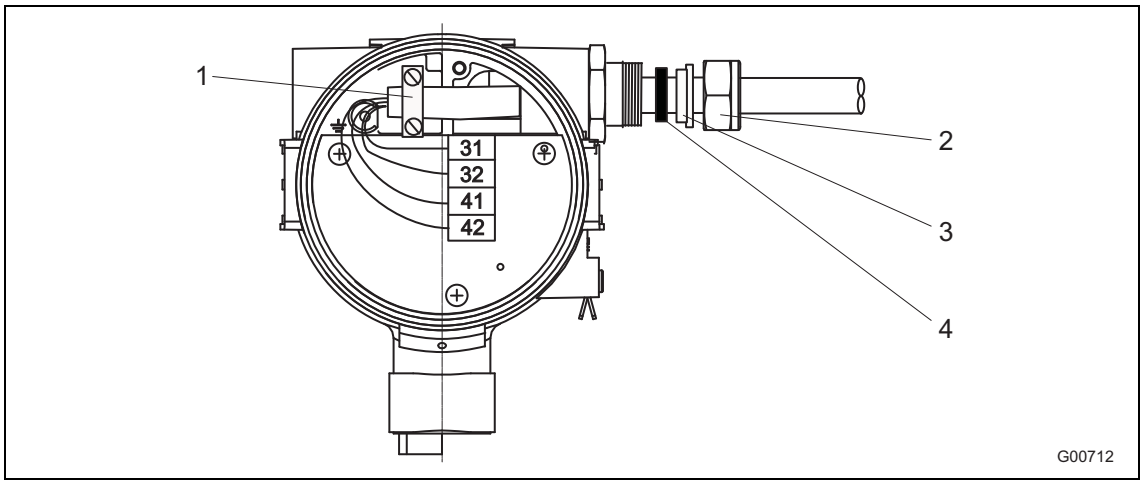


Fig. 27: Electrical connection of the flameproof design with open cable gland

1 Cable grip
2 Lock nut
3 Sleeve
4 Gaskets

Important

After switching off the supply power, wait t > 2 minutes before opening the flameproof housing.

1. Unscrew the cover from the cable connection area at the rear of the transmitter.
2. Remove the cable gland.
3. Install the conduit gland.
4. Route the connecting cable through.

Important

The outer diameter of the unshielded connecting cable must be between 8.0 mm (0.31 inch) and 11.7 mm (0.46 inch)

5. Tighten the lock nut on the gland to a torque of 32.5 Nm (23.97 lbf-ft).
6. Fasten the connecting cable inside the housing with the additional cable grip.
7. Connect the bare wires to the corresponding terminals (see the section titled "Cable connection area").
8. Screw on the cover for the cable connection area fully and fasten hand-tight. Make sure the gaskets for the cover are seated properly.

5.2.2.1 Voltage supply, 4 ... 20 mA / HART

Electrical variable	Value
Supply voltage	$U_B \geq 14$ V DC
Supply voltage	$U_S = 14 ... 46$ V DC
Maximum permissible load for the power supply unit (e. g. display, load)	R_B
Maximum permissible load for the output circuit (determined by the power supply unit)	R

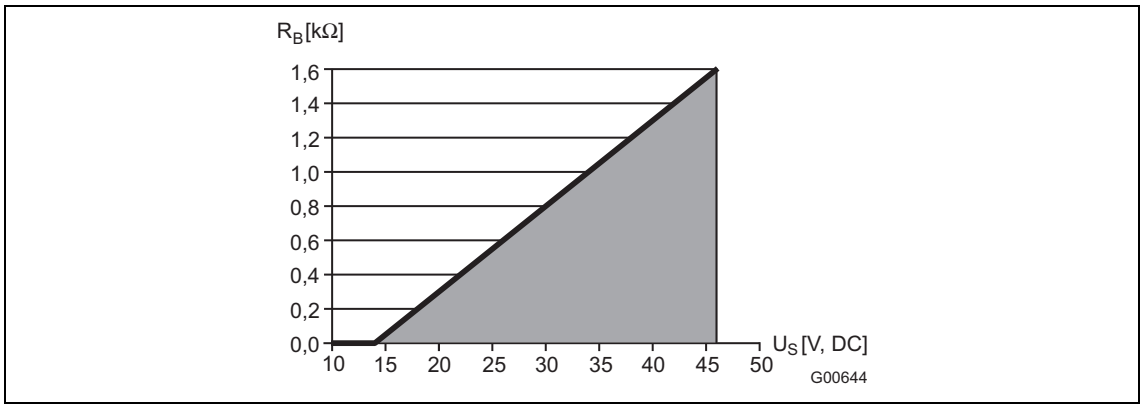


Fig. 28: Load diagram for current output, load via supply power

In HART communication, the smallest load is 250 Ω. The load R_E is calculated on the basis of the available supply voltage U_S and the selected signal current as follows:

$$R_E = \frac{U_S}{I_B}$$

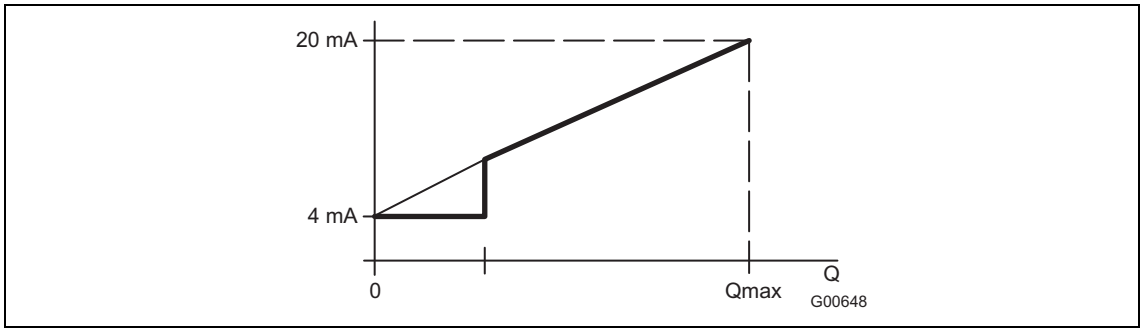


Fig. 29: Current output

1 Low flow

The measurement value output at the current output is as shown in the figure: Above the low flow, the current is a straight line that would have 4 mA in Q = 0 and 20 mA in Q = Qmax operating mode. Due to low flow cutoff, the flow is set to 0 below x % Qmax or the low flow (in other words, the current is 4 mA).

5.2.3 Standard design, PROFIBUS PA / FOUNDATION Fieldbus

1. A suitable bus cable must be used for the electrical connection of the transmitter (see the section titled "Technical data").

   A shielded, twisted cable is recommended (in accordance to IEC 61158-2, types A or B are preferred).

Important

The permissible cable length in the segment, including all spur lines, is restricted to a maximum of 1900 m (6324 ft). It is determined by the cable type and the type of explosion protection (hazardous area protection). For hazardous protection, no special measures need to be taken up to 1000 m (3281 ft) in accordance with the FISCO model. However, special measures are required with regard to explosion protection for longer cable lengths.

2. Unscrew the cover from the cable connection area at the rear of the transmitter.

Important

After switching off the supply power, wait t > 2 minutes before opening the flameproof housing.

3. Remove the insulation from the cable sheath, the shield and the wires as specified (see the section titled "Cable connection area").
4. Insert the bus cable into the cable connection area through the cable gland and fasten to the cable grip level with the shield to prevent accidental disconnection.
5. Tighten the cable gland.

Warning - Potential damage to parts

If the bus cable is not fastened to the cable grip, the shield will not have a functional ground. Furthermore, there is a risk of the cable being pulled completely out of the transmitter housing should the strain fall below the required level, thereby interrupting the electrical connection.

The sheath of the bus cable must not be damaged. Otherwise, protection class IP 67 for the flowmeter cannot be ensured.

6. Connect the bare wires to the corresponding terminals (see the section titled "Cable connection area").
7. Screw on the cover for the cable connection area fully and fasten hand-tight. Make sure the gaskets for the cover are seated properly.

5.2.3.1 Bus connector

The fieldbus transmitter is suitable for connection to the ABB multibarrier, the segment coupler (PROFIBUS PA design only) and special power supply units or a linking device (FOUNDATION Fieldbus design only). As well as the bus connection (terminals 31 / 32) there is also a freely configurable switching output (terminals 41 / 42) available.

Electrical variable	Value
Supply voltage	U = 14 ... 32 V DC
Current (normal operation)	I = 10 mA
Current (in the event of an error / FDE)	I = 13 mA

VT4A / ST4A models

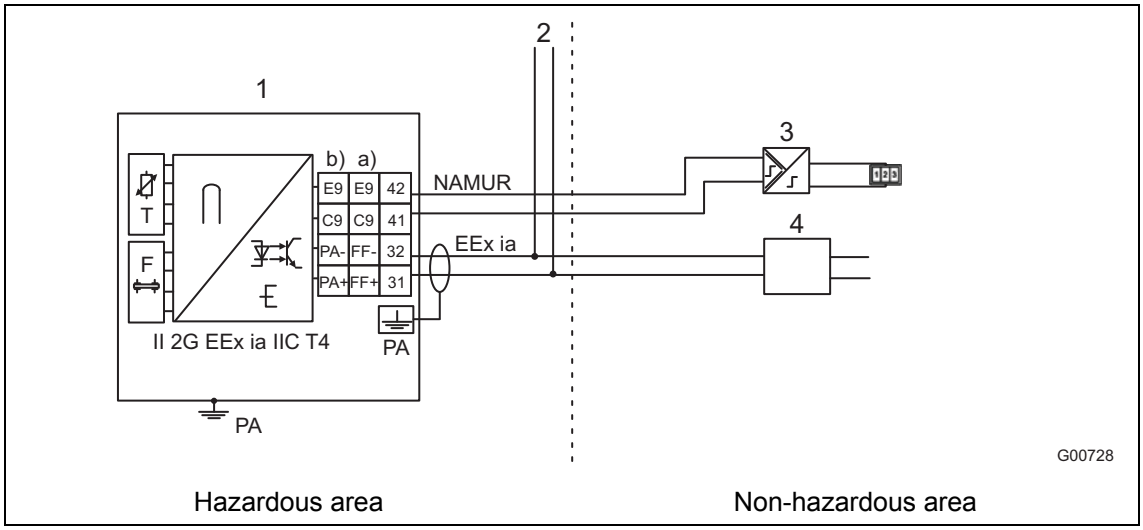


Fig. 30: FV4000-VT4A / FS4000-ST4A connection diagram

1 Flowmeter sensor and transmitter
2 Other bus nodes
3 Switching amplifier (NAMUR DIN 19234)
4 PROFIBUS PA:
Intrinsically safe segment coupler
FOUNDATION Fieldbus:
Intrinsically safe supply isolator,
zener barrier/power supply unit

5.2.4 Separate design

1. Use the cable connected to the flowmeter sensor to make the electrical connection between the flowmeter sensor and the transmitter.
2. Unscrew the cover from the cable connection area at the rear of the transmitter.

Important

After switching off the supply power, wait t > 2 minutes before opening the flameproof housing.

3. Remove the insulation from the cable sheath, the shield and the wires as specified (see the section titled "Cable connection area").
4. Insert the bus cable into the cable connection area through the cable gland and fasten to the cable grip on level with the shield to prevent accidental disconnection.
5. Tighten the cable gland.

Warning - Potential damage to parts

If the bus cable is not fastened to the cable grip, the shield will not have a functional ground. Furthermore, there is a risk of the cable being pulled completely out of the transmitter housing should the strain fall below the required level, thereby interrupting the electrical connection.

The sheath of the bus cable must not be damaged. Otherwise, protection class IP 67 for the flowmeter cannot be ensured.

6. Connect the bare wires to the corresponding terminals (see the section titled "Cable connection area").
7. Screw on the cover for the cable connection area fully and fasten hand-tight. Make sure the gaskets for the cover are seated properly.

5.2.4.1 Laying the signal cable (remote mount design only)

Remote mount design FV4000-VR4 Vortex and FS4000-SR4 Swirl flowmeters are based on the FV4000-VT4 / FS4000-ST4 compact meters with all options. The transmitter is installed separately from the flowmeter sensor, if this is positioned in a location which is difficult to access. This design can also be advantageous if the measuring point is located in extreme ambient conditions. The distance between the flowmeter sensor and the transmitter must not exceed 10 m (33 ft). A special cable connects the flowmeter sensor to the transmitter. The cable is permanently connected to the transmitter.

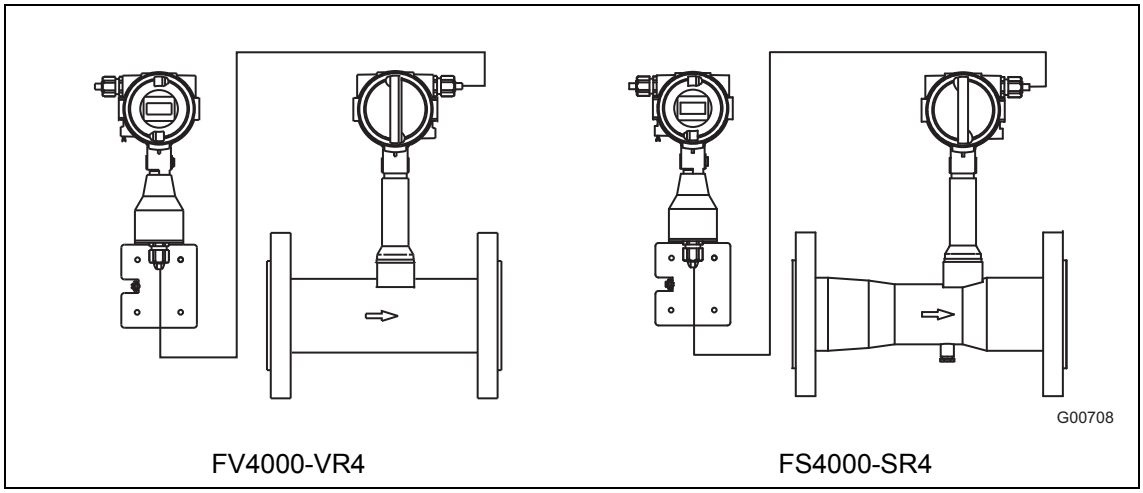


Fig. 31: Vortex / Swirl flowmeters

Important

Please observe the following when laying the signal cable:

- The signal cable carries a voltage signal of only a few millivolts and must, therefore, be routed along the shortest distance possible. The maximum permissible signal cable length is 10 m.
- All leads must be shielded and connected to operational ground. For this purpose, the cable shield must be connected underneath the cable clamp.
- Avoid routing the signal cable in the vicinity of electrical equipment or switching elements that can create stray fields, switching pulses and induction. If this is not possible, run the signal cable through a metal pipe and connect this to operational ground.
- Make sure during installation that the cable is provided with a water trap. For vertical installation, align the cable glands pointing downward.

Once installation is complete, cut the connecting cable to length as far as the flowmeter sensor. Since the transmission signal is not amplified between the sensor and the transmitter, the connections need to be routed carefully and the wires laid in the terminal box so that they are not affected by vibration.

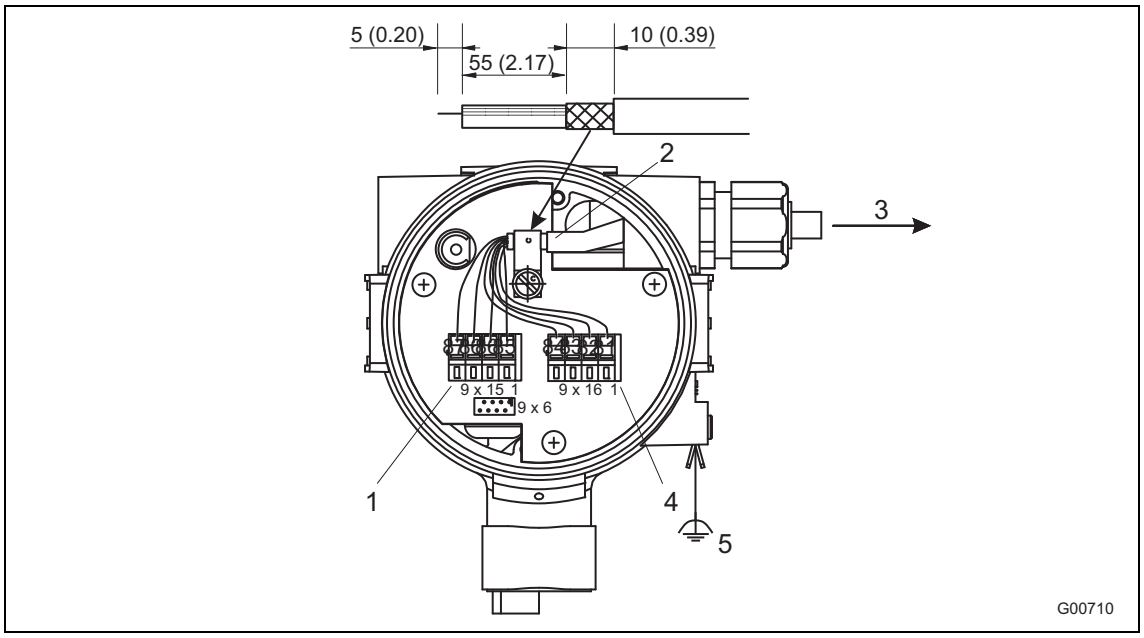


Fig. 32: Flowmeter sensor cable connection area (dimensions in mm (inch))

1 Flowmeter sensor cable connection area
2 Close-up of signal cable fastening
3 To transmitter
4 Terminals for Pt100
5 Functional ground

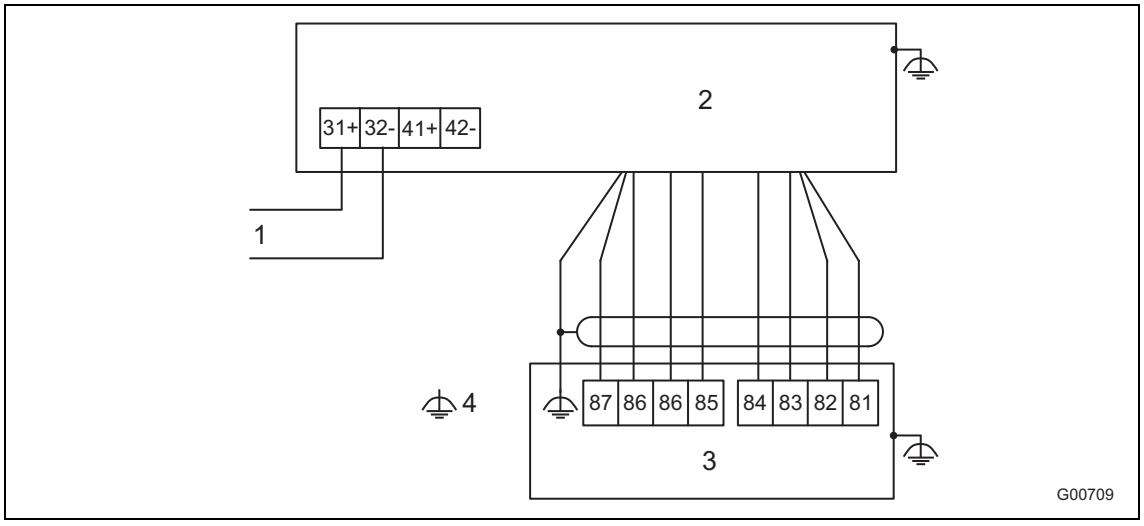


Fig. 33: Connection between transmitter and flowmeter sensor

1 Voltage supply connection
2 Converter
3 Flowmeter sensor
4 Functional ground

Wire colors, signal cable

Wire color	White	Brown	Green	Yellow	Gray	Pink	Blue	Red
Connection	87	86	86	85	84	83	82	81

5.3 M12 plug-in connector, PROFIBUS PA

As an option, the electrical connection can also be made using an M12 plug-in connector (see the section titled "Ordering information"). The device can be shipped completely prewired. The M12 plug-in connector is installed in the terminal box instead of the cable gland.

Important

Matching sockets (type EPG300) can be found in data sheet 10/63–6.44 xx, along with other accessories.

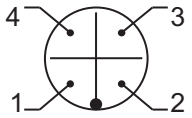
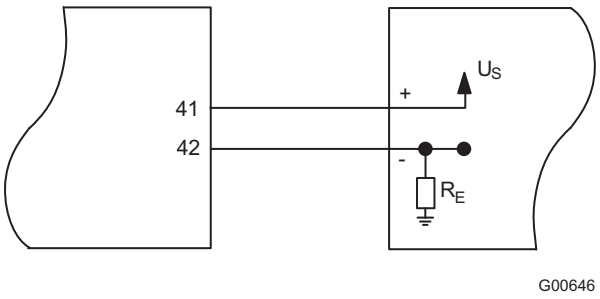


Fig. 34: Assignment for connection using optional M12 plug-in connector (view from the front looking at pin insert and pins)

Pin	Assignment
1	PA+ (31)
2	NC
3	PA- (32)
4	Shield

5.4 Switching output

The function of the switching output can be selected in the software. It can be assigned as a pulse output, a min./max. alarm (temperature or flow) or a system alarm. It can be configured as a NAMUR contact (to DIN 19234) or as a passive optocoupler.



Switching output

Input from, e.g., PLC, etc. with U_S = 16 ... 30 V

Fig. 35: Electrical connection

Function	Technical data
Pulse output	f_{max} = 100 Hz, 1 ... 256 ms
NAMUR contact	Closed: 1 KΩ, open: > 10 KΩ
Passive optocoupler	$0 \le U_{CEL} \le 2$ V, 16 V $\le U_{CEH} \le 30$ V $0 \le I_{CEH} \le 0.2$ mA, 2 mA $\le I_{CEL} \le 15$ mA

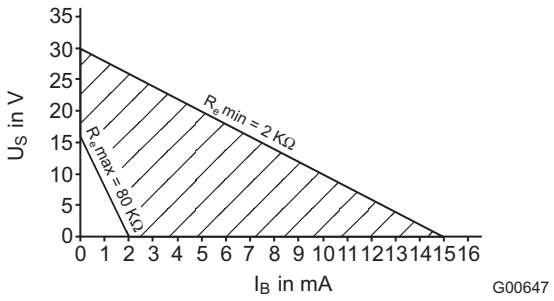
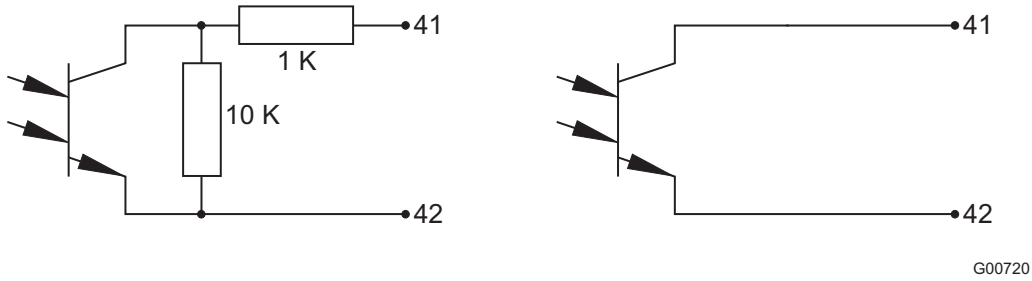


Fig. 36: Load resistance of the switching output as a function of current and voltage

5.5 Configuration of the switching output

The switching output can be configure as both a NAMUR contact and an optocoupler.



Rotary switch counterclockwise: NAMUR contact

Rotary switch clockwise: optocoupler

Fig. 37: Switching output circuit diagram

The switching output of the transmitter is factory-configured on the basis of the order code. The following table lists contact types and their matching order codes and Ex approval.

Order code	Ex approval	Contact type
VT40, VR40, ST40, SR40	None	optocoupler
VT41,VR41, ST41, SR41	Ex ib / Ex nA [nL]	NAMUR contact
VT42, VR42, ST42, SR42	Ex d / Ex ib / Ex nA [nL]	Optocoupler
VT43, VR43, ST43, SR43	$_{C}FM_{US}$	Optocoupler
VT4A, VR4A, ST4A, VR4A	II 2G EEx ia IIC T4	NAMUR contact

If necessary, the switching output can be modified subsequently should prevailing site conditions change.

1. Disconnect the flowmeter from the line supply.
2. Unscrew the front housing cover. The lock on the cover needs to be undone first on meters for hazardous areas.

Important

Observe the waiting times for meters for hazardous areas (see the section titled "Technical data for hazardous areas").

3. Remove the transmitter from the housing. To do this, unscrew the three Phillips head screws and carefully take the transmitter out of the housing.

4. Set the configuration switch as illustrated below.

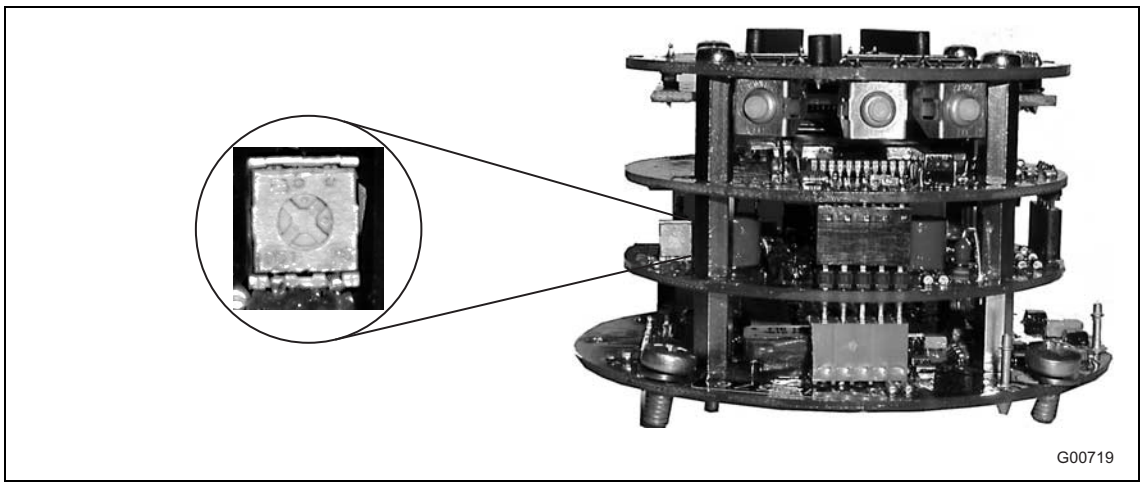


Fig. 38: Position and function of the configuration switch

5. Carefully put the transmitter back into the housing.. Make sure it is centered correctly.

Warning - Potential damage to parts

If the transmitter is not placed into the housing correctly, the electrical plug-in connectors at the rear can twist or break off.

Position the transmitter so that the three screw holes on the base plate are located exactly in front of the threaded bolts.

6. Then tighten the three screws again.
7. Finally, tighten the housing cover hand-tight. The lock on the cover needs to be re-attached on meters for hazardous areas.

5.6 Functional ground/Equipotential bonding

Functional ground/equipotential bonding is implemented externally using the designated terminal on the transmitter housing.

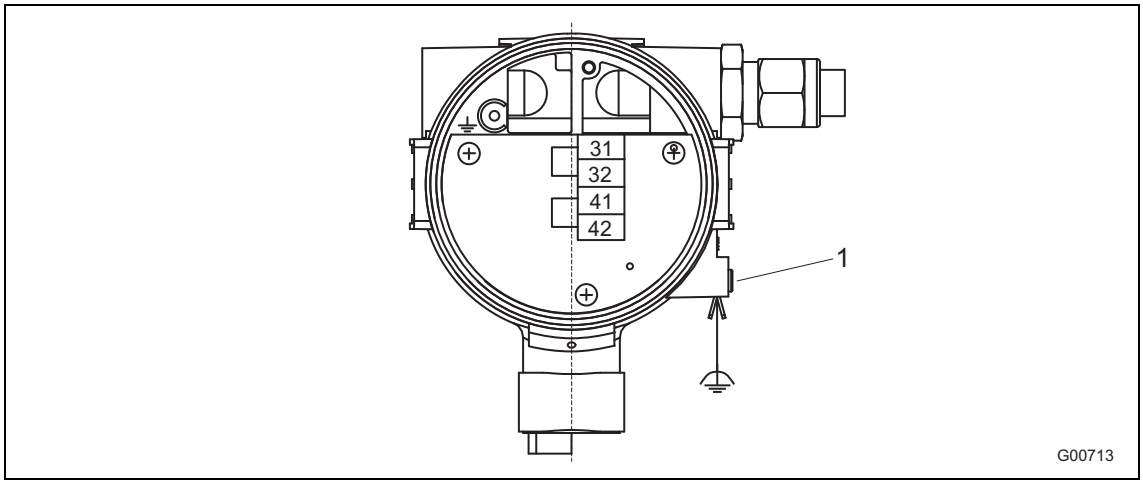


Fig. 39

1 Functional ground/equipotential bonding terminal

Functional ground connection

1. Unscrew the screw-type terminal on the transmitter housing.
2. Insert the fork-type cable lug for functional ground into the terminal between the two metal tabs.
3. Tighten the screw-type terminal.

6 Commissioning

6.1 Preliminary checks prior to start-up

The following points must be checked before commissioning:

- The supply power must be switched off.
- The supply power must match information on the name plate.
- The pin assignment must correspond to the connection diagram.
- The unit must be grounded.
- The temperature limits must be observed.

6.2 Commissioning the unit

Important

Please ensure compliance with the specific instructions for installing explosion-proof equipment. They can be found on page 104 of the section titled "General data for hazardous areas".

6.2.1 Switching on the supply power

After switching on the supply power, the display (if in use) shows the current flow after a few seconds.

6.2.2 Device configuration

The device can be factory calibrated to customer specifications upon request. If no customer information is available, the device is delivered with factory settings (see Standard display format on page 68).

6.3 Information on voltage/current consumption

The switch-on response meets the requirements set out in draft DIN IEC 65C/155/CDV, June 1996. The mean current consumption of the device is 10 mA. In the event of an error, the FDE (fault disconnection electronic) function integrated into the device ensures that the current consumption can rise to a maximum of 13 mA. The upper limit of the voltage is electronically limited. The supply voltage for the standard design (model V_40 / S_40)) is 9 ... 32 V DC. The intrinsically safe design (model V_4A / S_4A) has a supply voltage range of 9 ... 24 V DC.

6.4 Setting the bus address (PROFIBUS PA)

If no bus address information is supplied by the customer, the unit will be shipped with an address setting of "126" (addressing via the bus). The address has to be set to within the valid range (0, 2 ... 125) during installation and start-up.

Important

The set address may only appear once in the segment.

The address can be set either locally on the unit (via the miniature switch 8 on the digital board), using system tools, or via a PROFIBUS DP master class 2 such as SMART VISION.

Switch 8 is factory-set to "Off"; in other words, addressing is via the fieldbus.

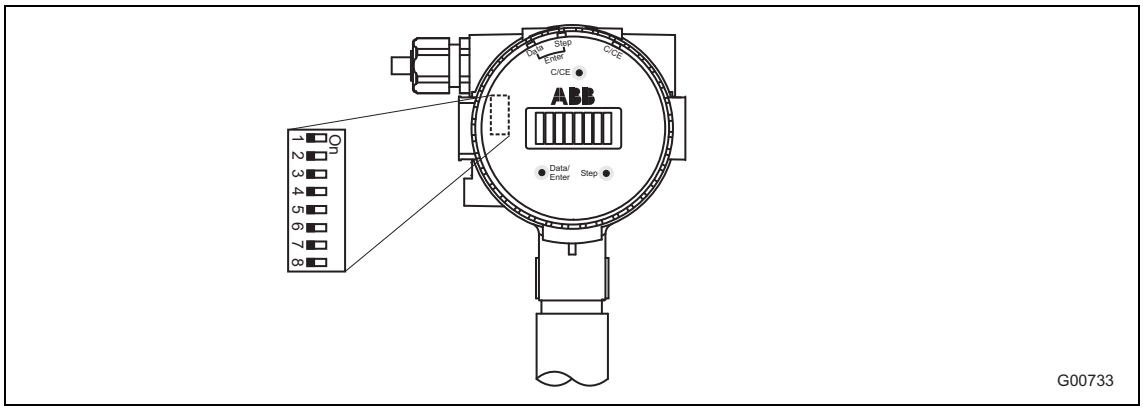


Fig. 40: Position of the miniature switch

Setting the bus address

1 Unscrew the front cover from the transmitter housing.

2. Set the bus address using the following table.

Switch	1	2	3	4	5	6	7	8
Setting	Device address							Address mode
Off	0	0	0	0	0	0	0	Bus
On	1	2	4	8	16	32	64	Local

3. Screw the cover back into place.

Definition of the address mode

Setting of switch 8	Address mode
Off (bus)	Addressing is via the bus.
On (local)	Addressing is via miniature switches 1 to 7.

Important

In the case of local addressing, address settings are not applied until the device is switched on.

Example

Setting of bus address 81:

Switch	1	2	3	4	5	6	7	8
Setting	On	Off	Off	Off	On	Off	On	On

The bus address is set by adding together the corresponding address values of switches 1 to 7. To set bus address 81, switches 1, 5, and 7 have to be set to "On", since the corresponding address values 1, 16, and 64 add together to make 81.

Switch 8 must be set to "On" in order that the bus address can be set with the miniature switch.

6.5 Setting the bus address (FOUNDATION Fieldbus)

On the FOUNDATION Fieldbus, the bus address is set automatically via the LAS (LinkActiveScheduler). Addresses are detected via a unique number (DEVICE_ID) made up of the manufacturer ID, the device ID and the device serial number.

6.6 Checking the parameters

ABB Automation Products sets the parameters of the measuring system and assigns all necessary values on the basis of the ordering information. Since the devices are suitable for universal use (i. e., for fluids and gases), we recommend checking and if necessary modifying the following parameters in the transmitter during installation and start-up.

Parameter	Check
Nominal size	• Check value on name plate.
k factor	• The value displayed must match the value on the flowmeter sensor.
Operating mode	• Select the required operating mode. • Which flow unit is the meter to display the flow in/is the flowmeter to add values? • Selection between units of volume and units of mass flow (depending upon the selected operating mode). • Enter the required measuring range in the unit selected above with the "Qmax operating mode" parameter. • Range 0.15 ... 1.15 x "QmaxDN operation"
Qmin operation	• Check the low flow value. • Range 0.05 ... 0.1 x QmaxDN
Unit totalizer	• Select the unit of flow for internal flow totalizing with the parameter. This unit is also valid for the pulse output (switching output via terminals 41 / 42).
Damping	• The response time of the electronics affects the local display, the pulse output and the transducer block.
Display submenu	• Configuration of the local display • Configuration of the switching output, if applicable

7 Communication

7.1 HART protocol communication

The HART protocol is used for digital communication between a process control system or PC, a handheld terminal, and the Vortex / Swirl flowmeter. It can be used to send all parameters (e.g., measuring point parameters) from the transmitter to the process control system or PC. Conversely, it also provides a means of reconfiguring the transmitter. Digital communication utilizes an alternating current superimposed on the analog output (4 ... 20 mA) that does not affect any meters connected to the output.

Transmission method

FSK modulation of the current output (4 ... 20 mA) is implemented in accordance with the Bell 202 standard. The maximum signal amplitude is 1.2 mA SS.

Logic 1 representation: 1200 Hz

Logic 0 representation: 2200 Hz

The SMART VISION® WINDOWS software is used for HART communication. Detailed documentation is available on request.

Current output load

Minimum > 250 Ω, maximum 750 Ω

The maximum cable length (shielded and twisted) is 1500 m with a cross-section of AWG 24 (0.25 mm^2).

Baud rate

1200 baud

Current output for alarm

The "High" state (= 21 ... 23 mA) is programmable and corresponds to NAMUR NE43. Operation using the HART protocol is described in operating instructions D184B108Uxx.

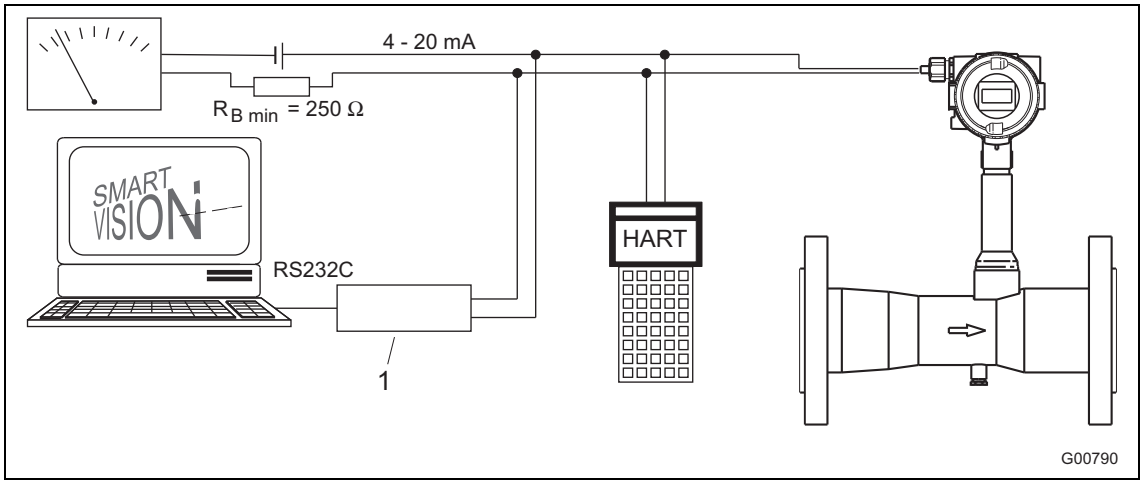


Fig. 41: HART communication
1 FSK modem

Important

Up-to-date DD/EDD data can also be downloaded from the ABB homepage at http://www.abb.com/flow.

7.2 PROFIBUS PA communication

Important

This section contains basic information about flowmeter designs supporting PROFIBUS PA and FOUNDATION Fieldbus communication. You will find more detailed information in the supplementary interface descriptions for the meter "PROFIBUS PA interface description" (part no. D184B093Uxx). These appear on the CD supplied with the meters (part no. D699D002Uxx), which, if necessary, can be ordered separately from ABB at any time free of charge.

The fieldbus transmitters are suitable for connection to DP / PA segment couplers and the ABB MB204 multibarrier. The meter's PROFIBUS PA interface conforms with Profile B V.3.0 (fieldbus standard PROFIBUS, EN 50170, DIN 19245 [PRO91]). The transmitter transmission signal is designed according to IEC 61158-2. Certification has been obtained to verify conformity with the standard. The meter's PROFIBUS PA ID no. is 05DC hex. The meter can also be operated using standard ID numbers 9700 hex and 9740 hex. The meter's intrinsically safe design conforms to the FISCO model.

Configuration instructions

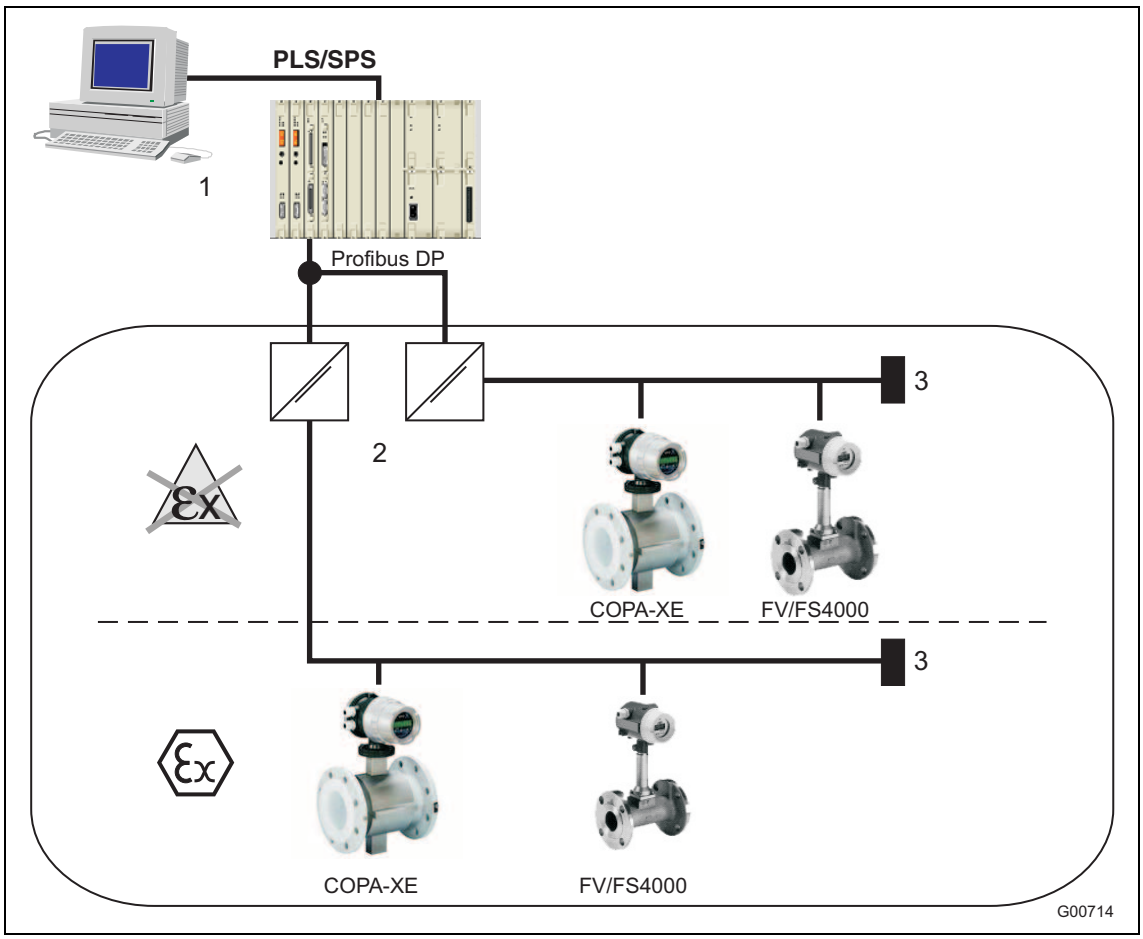


Fig. 42: Typical PROFIBUS PA network

1 I/O level
2 DP / PA bus coupler (with bus termination)
3 Bus termination

The maximum number of bus nodes in a segment is listed in the following table.

DP / PA segment coupler	Type I	Type II	Type III	Type IV
Area of application	EEx ia/ib IIC	EX ib IIC	EX ib IIC	Non-hazardous
Supply voltage	13.5 V	13.5 V	13.5 V	24 V
Supply current Is	≤ 110 mA	≤ 110 mA	≤ 250 mA	≤ 500 mA
Loop resistance Rs	≤ 40 Ω	≤ 40 Ω	≤ 18 Ω	≤ 130 Ω
Cable length, type B AWG 20 (0.5 mm^2)	≤ 500 m	≤ 500 m	≤ 250 m	≤ 1,700 m
Cable length, type A AWG 18 (0.8 mm^2)	≤ 900 m	≤ 900 m	≤ 400 m	≤ 900 m
No. of nodes at 10 mA	8	8	19	32

Brochure "PROFIBUS - Solutions from ABB" (no. 30/FB-10) contains more detailed information about configuration. Accessories such as terminal blocks, connectors, and cables are listed in data sheet 10/63-6.44. Supplementary information also appears both on the ABB homepage at http://www.abb.com and on the homepage of the PROFIBUS User Organization at http://www.profibus.com.

System integration

The use of the PROFIBUS PA Profile B, V3.0, means that the meters are not only interoperable (in other words, devices from different manufacturers can be physically connected to one and the same bus and communicate on it), they are also interchangeable (in other words, devices from different manufacturers can be interchanged without having to modify the configuration in the process control system).

To support interchangeability, ABB provides three different GSD (generic station description) files for system integration. During system integration, users decide whether to install the full range of functions or only part. Devices are interchanged using the ID number selector parameter, which can only be modified on an acyclic basis. The following table describes the available GSD files:

Number and type of function blocks	ID number	GSD file name	Bitmaps
1 x AI	0 x 9700	PA 139700.gsd	ABB05DCb.bmp ABB05DCn.bmp ABB05DCs.bmp
1 x AI; 1 x TOT	0 x 9740	PA 139740.gsd	
2 x AI; 1 x TOT and all manufacturer-specific parameters	0 x 05DC	ABB_05DC.gsd	

The GSD files appear on the CD included in the scope of supply. The standard GSD files "PA1397xx.gsd" are available for download from the PNO homepage at http://www.profibus.com.

The GSD files, along with the "PROFIBUS PA interface description" for the device (part no. D184B093Uxx) appear on the CD included in the scope of supply (part no. D699D002Uxx). The CD can be ordered separately from ABB at any time free of charge if required.

Block diagram

The diagram illustrates the function of the blocks available in the device. A communication tool or a PLC with "master class 2" functionality can access all blocks for parameterization acyclically.

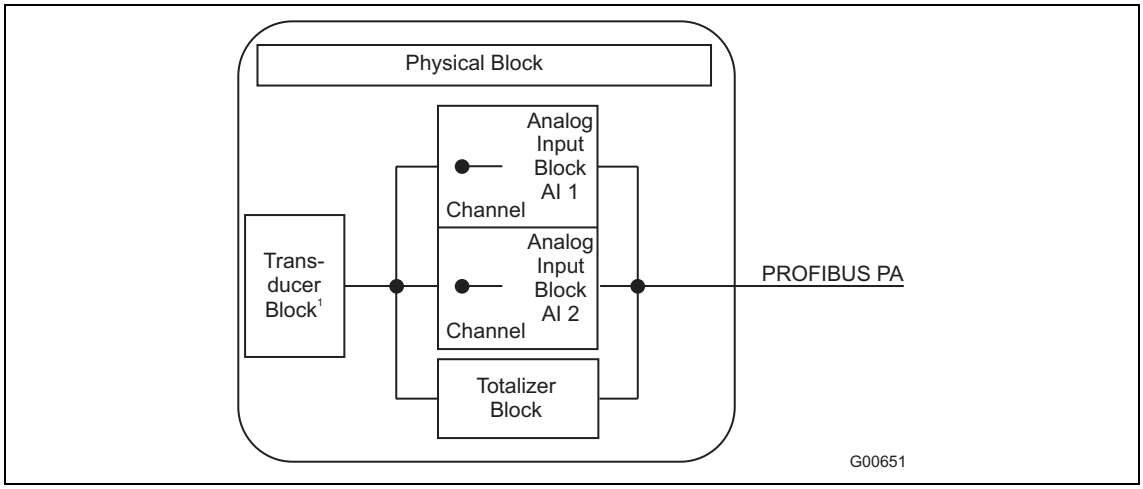


Fig. 43: Block diagram

1) Flow rate, temperature (option)

Block	Description
Physical block (meter properties and current status)	Contains device-specific properties such as software version, TAG no., etc.
Transducer block (measuring parameters)	Contains flowmeter data such as nominal size, k factor measuring ranges, etc., along with all manufacturer-specific parameters not contained in the function blocks.
Analog input block (output of measured value and status)	Users can select the measured values which are relevant for their applications (Qv (volume flow, Qn (volume flow under standard conditions), Qm (mass flow) or temperature (option)) via the channel selector.
Totalizer block	The totalizer reading can be checked or modified via the PROFIBUS PA-DTM in SMART VISION here acyclically, for example. The totalizer can be reset cyclically.

Important

Detailed descriptions of the blocks / parameters appear in the separate "PROFIBUS PA interface description" for the device (part no. D184B093Uxx). This appears on the CD included in the scope of supply.

Parameter settings are made acyclically via the device's PROFIBUS PA-DTM.

7.3 FOUNDATION Fieldbus communication

The fieldbus transmitters have been designed for connection to special bus power supply units and the ABB MB204 multibarrier. On the standard design (model ...40), the permissible output voltage range is 9 ... 32 V DC. On the intrinsically safe design (model ...4A), the voltage is limited to 9 ... 24 V DC. The device's FOUNDATION Fieldbus interface conforms to standards FF-890/891 and FF902/90. The transmission signal of the transmitter is designed in accordance with IEC 61158-2.

The device has been registered by the Fieldbus Foundation and meets all current requirements (successful completion of the FF Conformance Test, compliance with FF spec. 1.4 and successful completion of the test with the ITK 4.0). The reg. no. is IT013600. The device is registered with the Fieldbus Foundation under manufacturer ID 0x000320 and device ID 0x0015 . The device supports LAS functionality. The device's intrinsically safe design conforms to the FISCO model.

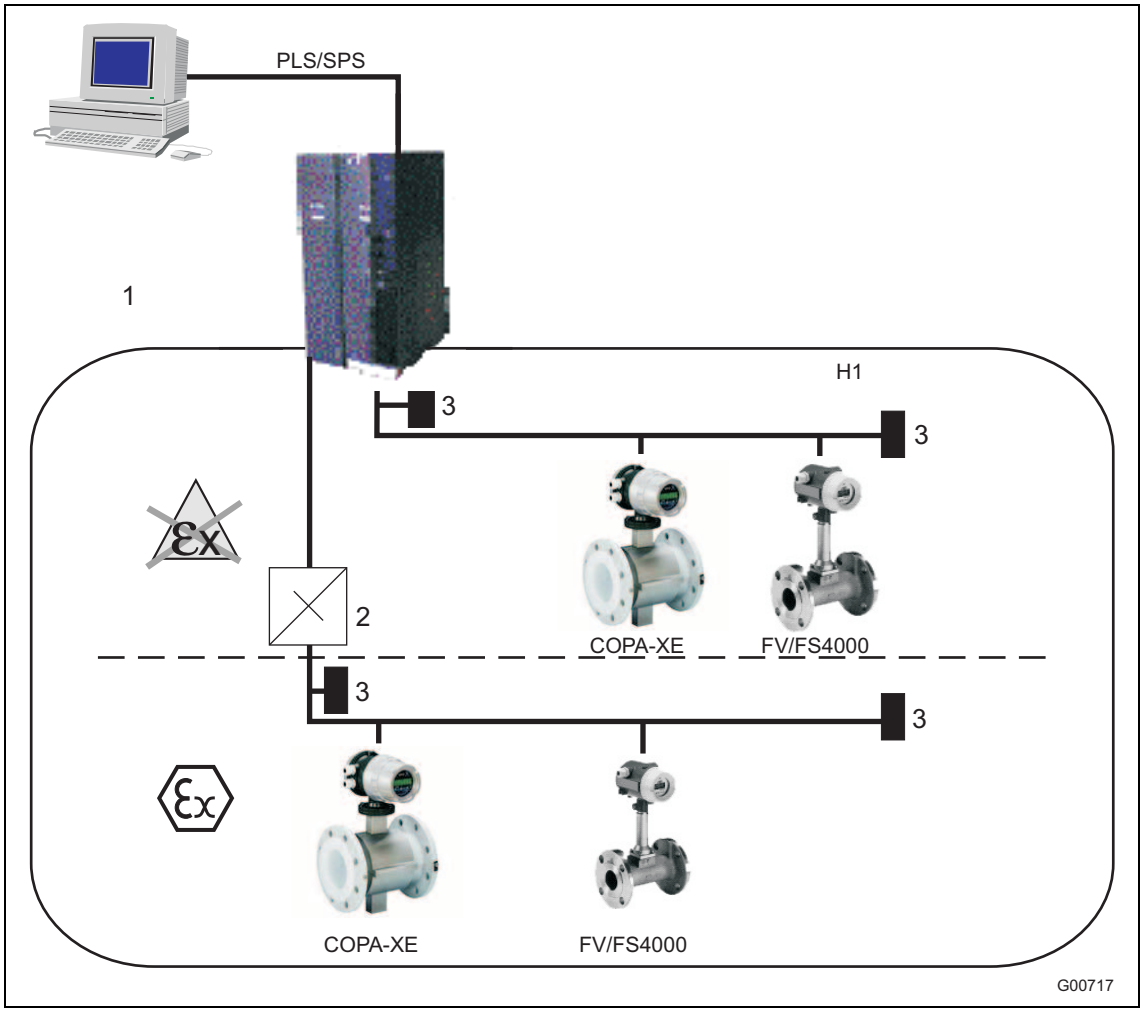


Fig. 44: Typical FOUNDATION Fieldbus network

1 I/O level / Linking device
2 Zener barrier
3 Bus termination

Important

In this level, the I/O level also provides the voltage supply for the FOUNDATION Fieldbus (H1).

Bus termination can also be implemented in the linking device.

The maximum number of bus nodes in a segment is listed in the following table:

2- or 4-wire technology	No explosion protection	Ex ia (intrinsic safety)
2-wire technology (bus-powered)	2 ... 12	2 ... 6
4-wire technology	2 ... 32	2 ... 6

For more detailed configuration instructions, please see brochure "FOUNDATION Fieldbus solutions from ABB" (brochure no. 7592 FF). Further information is also available on the ABB homepage at http://www.abb.com as well as on the homepage of the Fieldbus Foundation at http://www.fieldbus.org.

System integration

For integration into a process control system, a DD (device description) file, which contains the device description, as well as a CFF (common file format) file are required. The CFF file is required for segment engineering. Engineering can be performed online or offline.

The function blocks are described in the separate "FOUNDTAION Fieldbus interface description for the meter" (part no. D184B093U23).

You can find both files, as well as the interface description, on the CD included in the scope of supply (part no. D699D002U01). The CD can be ordered separately from ABB at any time free of charge if required. The files can also be downloaded from http://www.fieldbus.org.

Block diagram

The diagram illustrates the function of the blocks available in the device. Communication tools such as the NI Configurator, system tools or even a PLC supporting the appropriate function can be used to access all blocks for parameterization acyclically.

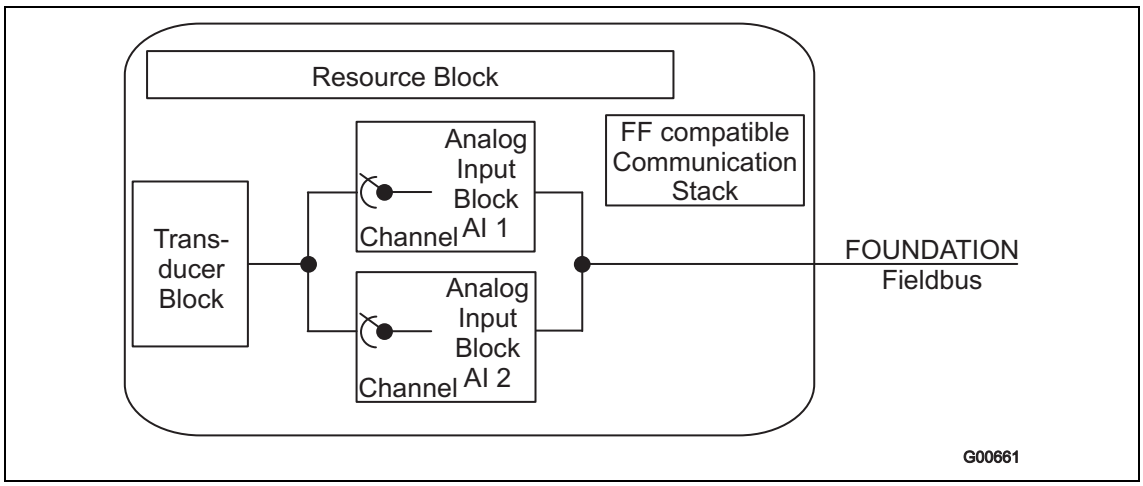


Fig. 45: Block diagram

1) Flow (instantaneous value, total) and temperature (option)

Block	Description
Resource block	Contains device-specific properties such as software version, TAG no., etc.
Transducer block	Contains flowmeter data such as nominal size, k factor, etc., along with all manufacturer-specific parameters not contained in the AI block. These include the volume flow totalizer parameters. The transducer block also contains a totalizer.
Analog input block	Users can select the measured values which are relevant for their applications (Qv (volume flow, Qn (volume flow under standard conditions), Qm (mass flow), totalizer or temperature (option)) via the channel selector.

Important

Detailed descriptions of the blocks / parameters appear in the separate "PROFIBUS PA interface description" for the device (part no. D184B093Uxx). This appears on the CD included in the scope of supply.

Parameter settings are made acyclically.

7.4 Software history

7.4.1 TRIO-WIRL FV4000 HART version

Software D699F004U01			
Software version	**Revision date**	**Type of changes**	**Documentation / Supplements**
A.1X	12/1999	Market entry	
A.2X	Not released	Function enhancement	
A.3X	07/2006	Function enhancement	Change to current output response to NAMUR NE43
A.4X	11/2008	Function enhancement	Masking of the current output in the event of error 3 / error 9
B.1X	11/2008	Market entry	Software for transmitter D674A659U10 and U12, launch 12/2008 onwards, same functionality at A.42

7.4.2 TRIO-WIRL FV4000 Profibus PA

Software D200SF003U01			
Software version	**Revision date**	**Type of changes**	**Documentation / Supplements**
A.1X	12/1999	Market entry	
A.2X	09/2006	Function enhancement	Totalizer arithmetic modified, higher internal readings possible

7.4.3 TRIO-WIRL FV4000 FOUNDATION Fieldbus

Software D200F002U01			
Software version	**Revision date**	**Type of changes**	**Documentation / Supplements**
A.1X	04/2002	Market entry	
A.2X	07/2007	Function enhancement	Reregistration due to new CFF file

8 Parameterization

8.1 Standard display format

When the device is switched on, the flowmeter runs various self-tests automatically.

The standard display then appears (process information). The configuration of the display can be defined by the user. The following display formats can be selected:

Display format	Display
Operating flow with physical display	
Totalized operating flow	
Media temperature	

8.2 Operation using the buttons on the transmitter

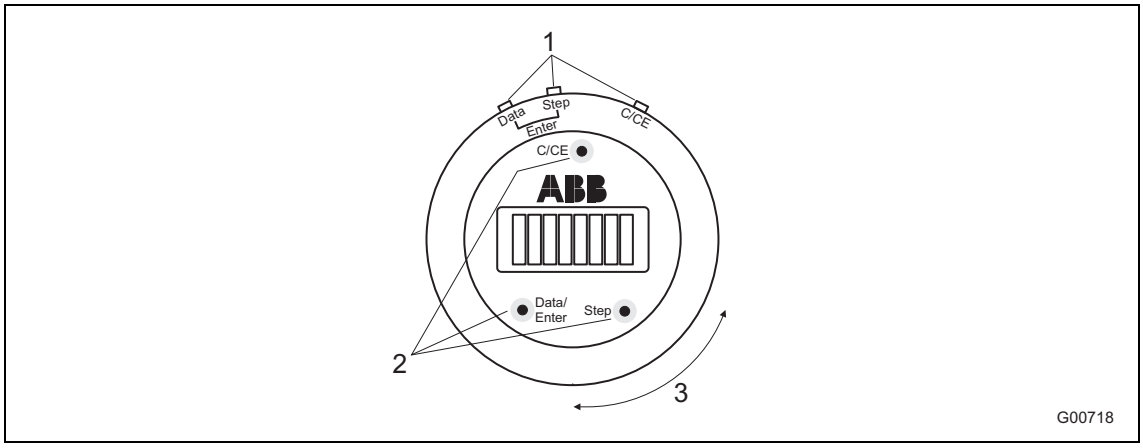


Fig. 46: Position of buttons and magnet sensors

1 Buttons
2 Magnet sensors
3 Rotating display panel

Button

To enter data with the housing cover removed, use the three buttons "Data", "Step" and "C/CE" at the top of the display panel.

Button	Function
C/CE	Press "C/CE" to change from the operating mode to the menu and vice versa.
Step	The "Step" button is one of two arrow buttons. Press "Step" to move forward through the menu. All required parameters can be called up.
Data	The "Data" button is one of two arrow buttons. Press "Data" to move backward through the menu. All required parameters can be called up.
Enter	The "Enter" function requires that both arrow buttons, "Step" and "Data", be pressed simultaneously. The "Enter" function activates and deactivates programming protection. It can also be used to call up further parameters for modification and apply new, selected or set parameters. The "Enter" function can also be activated by pressing and holding down just the "Data" button for more than 3 s. The display flashes to indicate that this function is active. As soon as the button is released, the "Enter" function is executed. If, following execution of the "Enter" button, no more entries are made for approx. 10 s, the display will revert to the previous value. After another 10 s without any entries, the process information will reappear.

Magnet sensors

When the housing cover is closed, data is entered with the "Data / ENTER", "Step", and "C/CE" magnet sensors and the magnet stick.

Button	Function
C/CE	These magnet sensors function in the same way as the buttons of the same name.
Step	
Data	
Enter	The "Enter" function is activated by pressing and holding down the "Data" magnet sensor for more than 3 s. The display flashes to indicate that this function is active. As soon as the magnet stick is taken away from the magnet sensor, the "Enter" function is executed.

Important

The flow continues to be measured during data entry.

8.3 Navigation and data entry

8.3.1 Selecting parameters in a submenu

1. Deactivate programming protection (see page 73).

Important

If an attempt is made to modify a parameter when programming protection is active, "* Prog. protect." will appear on the display.

2. Press the "C/CE" button once.

   The display changes to menu mode.
3. Press the "Data" and "Step" buttons to select the required menu.
4. Then execute the "Enter" function (by pressing "Data" and "Step" at the same time).

   The current parameter settings appear on the display.
5. Run the "Enter" function again.
6. Repeat steps 1 to 4.

   An underscore appears after the current parameter settings.
7. Now press "Data" or "Step" to select the new parameter and apply your selection with the "Enter" function.
8. Reactivate programming protection (see page 74).

8.3.2 Changing a parameter value

Where there are multiple parameters, a numerical value has to be entered. The "Data" and "Step" buttons are also used to enter numbers.

If a parameter requiring a numerical entry is selected, a "0" will appear in the top left-hand line and the corresponding unit will be shown in the line below.

1. Press "Data" to enter the numerical value.

   Pressing this button repeatedly will show the numbers 1 to 0 consecutively, along with special characters if these are required.
2. Once the correct numerical value has been set, press the "Step" button.

   Another "0" appears in the next numerical location.
3. Repeat step 1 to set the correct numerical value here.
4. Keep repeating steps 2 and 3 until the entire numerical value has been entered.
5. Finally, run the "Enter" function again.

   The numerical value of the parameter is applied.

8.3.3 Saving parameters

Important

Should the supply power fail, all device parameters and the meter reading will be backed up safely in an FRAM. This means that the transmitter will be ready to resume operation immediately when the power is restored.

8.4 Parameter overview

8.4.1 Menu levels

The menu system has three levels.

Menu level	Function
Standard (level 1)	The "Standard" menu is used for quick parameterization of the meter. All customer-specific menu entries required for the operation of the meter can be made here.
Specialist (level 2)	Unlike the "Standard" menu, the "Specialist" menu shows all customer-relevant menu parameters.
Service (level 3)	The "Service" menu is accessed exclusively for after-sales service of ABB Automation Products.

8.4.2 Menu level parameters

Standard	Specialist	Service
Progr. level	Progr. level	-
P.protect. code	P.protect. code	
Language	Language	
	Flowmeter sensor	
	Nominal size	
	Mean k factor	
	Operating mode	
	Unit Qvol	
QmaxDN operation	QmaxDN operation	
Qmax	Qmax	
	Qmin operation	
Totalizer	Totalizer	
Damping	Damping	
Hardware config.	Hardware config.	
	Iout for alarm	
	Error 3/9	
	Pulse factor	
Display	Display	
Error register	Error register	
	Function test	
	Device address	
	Order number	
	50VT4 02/10/07	

8.5 Programming protection

8.5.1 Deactivating programming protection

Important

Programming protection has to be deactivated prior to parameterization.

Step	Button / Magnet sensor	Display format	Comments
		Qv % **10.5**	Standard display
1. Activate parameterization mode.	"C/CE", "Step" or "Data"	**Sprache**	A parameter appears.
2. Find the "Progr. level" menu item.	"Step" or "Data"	**Progr.** **Ebene**	
3. Show the current programming level.	„Enter“	**Gesperrt**	
	„Enter“	**Gesperrt_**	
4. Select the required programming level.	"Step" or "Data"	**Standard_**	or
	"Step" or "Data"	**Spezialist_**	or
	"Step" or "Data"	**Service_**	
5. Return to the parameterization mode menu level.	„Enter“	**Progr.** **Ebene**	

8.5.2 Activating programming protection

Important

Programming protection has to be reactivated following parameterization.

Step	Button / Magnet sensor	Display format	Comments
1. Find the "Progr. level" menu item.	"Step" or "Data"	**Progr.** **Ebene**	
2. Show the current programming level.	„Enter“	**Spezialist**	
	„Enter“	**Spezialist_**	
3. Select the "Blocked" parameter.	"Step" or "Data"	**Service_**	or
	"Step" or "Data"	**Standard_**	or
	"Step" or "Data"	**Gesperrt_**	
4. Reactivate programming protection.	„Enter“	**Progr.** **Ebene**	
5. Go back to standard display.	„C/CE“	**Qv %** **10.5**	Standard display

8.6 Menu structure

Important

All parameters with a dark-gray background are part of the "Standard" menu level.

Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„C/CE“	**Progr. Ebene**	„Enter“ + „Enter“	**Gesperrt_**	„Step“	**Standard_**	"Standard" menu: Standard menu with all customer-specific menu entries needed to operate the meter.
				„Step“	**Spezialist_**	"Specialist" menu: Special menu with all customer-specific menu entries.
				„Step“	**Service_**	"Service" menu: Additional display of the service menu following entry of the correct service code number "SRV code" (this menu is only available to ABB Service). Entry type: from table
„Data“ „Step“	**P.Schutz Kode**	„Enter“ + „Enter“	**Alter Kode**	„Enter“	**0**	If a number other than "0" (factory setting) has been selected for the "P.protect. code", it will only be possible to deactivate programming protection by entering a number from 1 to 9999 as the "P.protect. code".
		„Enter“	**Neuer Kode**	„Enter“	**9999**	
„Data“ „Step“	**Sprache**	„Enter“ + „Enter“	**Englisch_**	„Data“ „Step“	**Deutsch_**	Languages: German, English
„Data“ „Step“	**Messaufnehmer**	„Enter“ + „Enter“	**VORTEX VT / VR_**	„Data“ „Step“	**DDM ST / SR_**	To select the flowmeter sensor: VORTEX: FV4000-VT4/VR4 DDM: FS4000-ST4/SR4
„Data“ „Step“	**Nenn weite**	„Enter“	**D 15mm 0.5in**			To display the nominal size of the flowmeter sensor: A: ANSI D: DIN
„Data“ „Step“	**Mittl. k-Faktor**	„Enter“	**52000.0 1/m3**			To display the mean calibration: k factor
„Data“ „Step“	**Durchm. Korrekt.**	„Enter“	**Sched.40**			Selection: Sched.40, Sched.80 This parameter only appears on flowmeter sensors with ANSI process connection. Correction of the inner diameter offset for connecting cables Sched. 40 or Sched.80.

Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Betriebs art**	„Enter“ + „Enter“	**Flüssig** **Qv**		**Flüssig** **Qv**	Medium: Fluid Operating mode: Operating volume Selection: Volume flow **Important** The selection of the possible operating modes depends upon the medium and the sensor design.
				„Step“	**Flüssig** **Qm (D)**	Medium: Fluid Operating mode: Mass Selection: Mass flow
				„Step“	**Flüssig** **Qm (D,T)**	Medium: Fluid Operating mode: Mass with correction (Pt100 required) Selection: Mass flow
				„Step“	**Flüssig** **Qm (V,T)**	Medium: Fluid Operating mode: Mass with correction (Pt100 required) Selection: Mass flow
				„Step“	**Gas** **Qv**	Medium: Gas / Steam Operating mode: Operating volume Selection: Operating flow
				„Step“	**Gas Norm** **Qn(pT)**	Medium: Gas Operating mode: Standard volume with correction (Pt100 required) Selection: Standard flow
				„Step“	**Gas Norm** **Qn(KmpF)**	Medium: Gas Operating mode: Standard volume Selection: Standard flow
				„Step“	**Gas Mass** **Qm (pT)**	Medium: Gas Operating mode: Mass with correction (Pt100 required) Selection: Mass flow
				„Step“	**Gas Mass** **Qm (D)**	Medium: Gas / Steam Operating mode: Mass Selection: Mass flow

Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
				„Step“	**S-Dampf Qm**	Medium: Saturated steam Operating mode: Mass with correction (Pt100 required) Selection: Saturated steam mass flow
				„Step“	**S-Dampf Qv**	Medium: Saturated steam Operating mode: Operating volume Selection: Saturated steam volume flow
„Data“ „Step“	**Einheit** **Dichte**	„Enter“ + „Enter“	**g/ml_**	„Step“	**g/cm3_**	Selection: g/ml, g/cm3, g/l, kg/l, kg/m3, lb/ft3, lb/ugl The menu appears when the following operating modes are selected: Fluid Qm (D,T), fluid Qm (V,T), gas mass Qm (pT), gas mass Qm (D)
„Data“ „Step“	**Bezugs** **dichte**	„Enter“ + „Enter“	**1.000** **kg/l**	„Enter“	**0** **kg/l**	Selection: 0.001 ... 1000000 The menu appears when the following operating modes are selected: Fluid Qm (D,T), fluid Qm (V,T), gas mass Qm (D)
„Data“ „Step“	**Norm** **dichte**	„Enter“ + „Enter“	**0.001 kg/l** **kg/l**	„Enter“	**0** **kg/l**	Selection: 0.000 ... 0.100 The menu appears when the following operating mode is selected: Gas mass Qm (pT)
„Data“ „Step“	**Normfaktor**	„Enter“ + „Enter“	**1.000**	„Enter“	**0**	Selection: 0.001 ... 1000000 The menu appears when the following operating mode is selected: Gas standard Qn (Kmpf) Standard factor = ρ_b / ρ_0
„Data“ „Step“	**Normzustand**	„Enter“ + „Enter“	**1.0133 bara** **0 °C**	„Enter“	**1.0133 bara** **20 °C**	Selection: 0.001 ... 1000000 The menu appears when the following operating modes are selected: Gas mass Qm (pT), gas standard Qn (pT)

Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Einheit Temp**	„Enter“ + „Enter“	**°C_**	„Enter“	**F_**	Selection: °C, F, K
„Data“ „Step“	**Bezugs-Temp**	„Enter“	**20.0 °C**			Selection: -200.0 ... 500 The menu appears when the following operating modes are selected: Fluid Qm (D), fluid Qm (D,T), gas standard Qn (Kmpf)
„Data“ „Step“	**Druck Pbtr abs**	„Enter“ + „Enter“	**1.0 bar**			The menu appears when the following operating mode is selected: Gas mass Qm (pT)
„Data“ „Step“	**Vol.Aus-dehnung**	„Enter“ + „Enter“	**1.00 %./K**			The menu appears when the following operating mode is selected: Fluid Qm (V,T)
„Data“ „Step“	**D. Ausg. koeffi**	„Enter“ + „Enter“	**1.00 %./K**			The menu appears when the following operating mode is selected: Fluid Qm (D,T)
„Data“ „Step“	**Einheit Qvol**	„Enter“ + „Enter“	**l/s _**	„Step“	**l/m _**	Selection: l/s, l/m, l/h, m3/s, m3/m, m3/h, m3/d, ft3/s, ft3/m, ft3/h, ft3/d, usgps, usgpm, usgph, usmgd, igps, igpm, igph, igpd, bbl/s, bbl/m, bbl/h, bbl/d The menu appears when the following operating modes are selected: Fluid Qm (D,T), fluid Qm (V,T), gas mass Qm (pT), gas mass Qm (D)
„Data“ „Step“	**Einheit Qm**	„Enter“ + „Enter“	**g/s _**	„Step“	**g/m _**	Selection: g/s, g/m, g/h, kg/s, kg/m, kg/h, kg/d, t/m, t/h, t/d, lb/s, lb/m, lb/h, lb/d The menu appears when the following operating modes are selected: Fluid Qm (D), fluid Qm (D,T), gas standard Qn (Kmpf), gas mass Qm (pT), gas mass Qm (D) **Important** The "Qvol" and "Qm" parameters are dependent upon the selection made under "Operating mode".

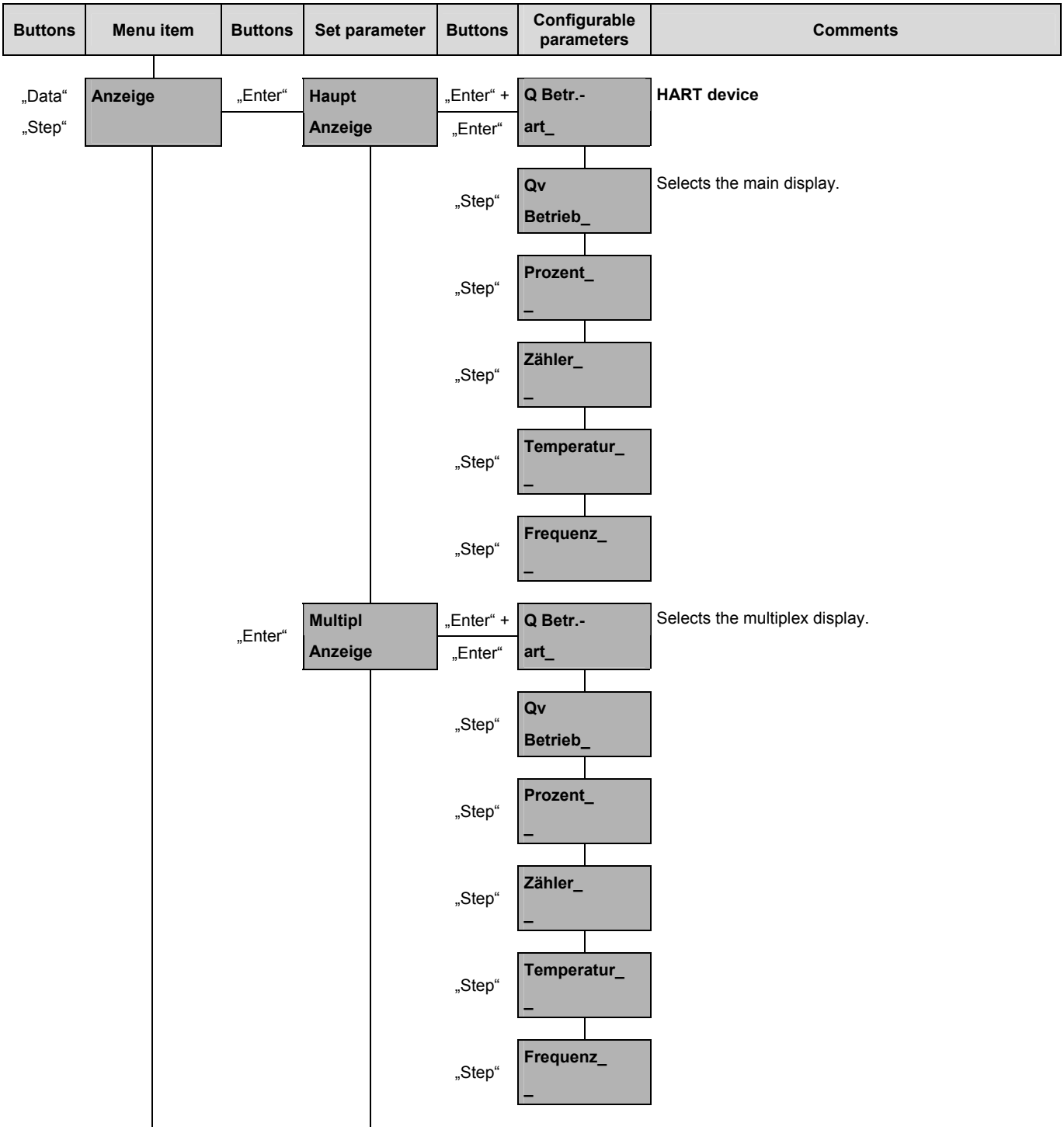
Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**QmaxDN** **Betrieb**	„Enter“ + „Enter“	**84.000** **m3/h**			Displays the maximum flowrate for the selected nominal size.
„Data“ „Step“	**Qmax**	„Enter“ + „Enter“	**84.000** **m3/h**	„Enter“	**0** **m3/h**	Selection: 0.15 ... 1.15 x QmaxDN QmaxDN = Upper range value for the selected flow mode (= 20 mA)
„Data“ „Step“	**Qmin** **Betrieb**	„Enter“	**1.000** **m3/h**	„Enter“	**0** **m3/h**	0 ... 10 % of the QmaxDN volume
„Data“ „Step“	**Zähler**	„Enter“	**Zähler** **Wert**	„Enter“	**0.0000** **m3**	Sets the totalizer to a defined starting value.
			Über- **lauf**	„Enter“	**10**	Displays the totalizer overflow: max. 65,535 1 overflow = 10,000,000
			Einheit **Zähler**	„Enter“	**m3**	Selection: m3, ft3, usgal, igal, igl, bbl, l, g, kg, t, lb
					ft3	Selects the totalizer unit as a function of the selected operating mode (volume or mass flow).
			Zähler **löschen**	„Enter“	**Löscht** **-> Enter_**	Press "Enter" to clear the totalizer and the overflow.
„Data“ „Step“	**Dämpfung**	„Enter“	**50.0** **s**	„Enter“	**0** **s**	Selection: 0.2 ... 100 s Attenuates the current output. Response time: 1 τ (= 63 %) for sudden changes in flow.

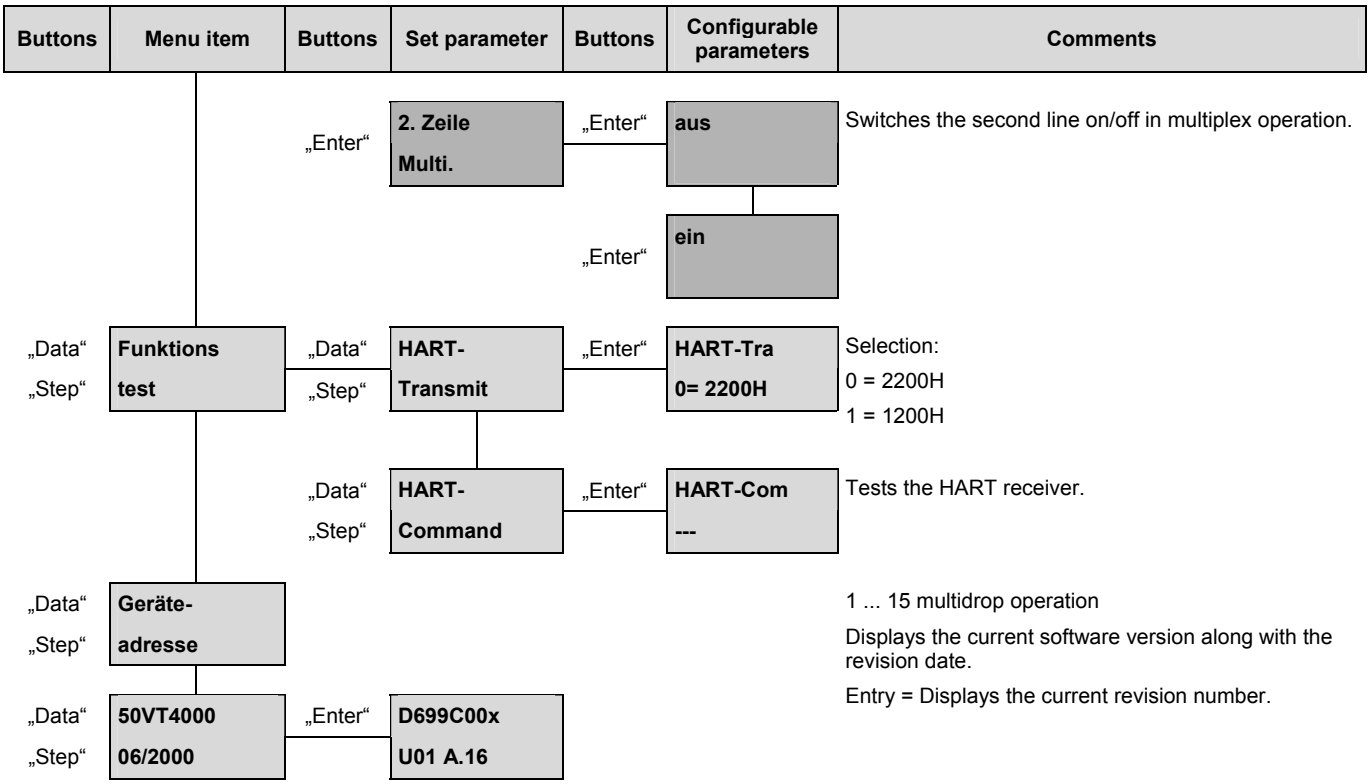
Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Hardware** **Config.**	„Enter“	**I/HART** **s**	„Enter“	**I/HART** **s**	Configuration of the switching output: Current, HART protocol
				„Step“	**I/HART/** **Puls_Bin_**	Current, HART protocol Switching output: Pulse
				„Step“	**I/HART/** **Q_Alarm_**	Current, HART protocol Switching output: "Flow" max./min. alarm with alarm closed.
				„Step“	**I/HART/** **T_Alarm_**	Current, HART protocol Switching output: "Temperature" max./min. alarm with alarm closed.
				„Step“	**I/HART/** **S_Alarm_**	Current, HART protocol Switching output: System alarm with alarm closed.
„Data“ „Step“	**Min.** **Q_Alarm**	„Enter“ + „Enter“	**10.000** **%_**	„Enter“	**0** **%_**	Selection: 0 ... 100 % of Qmax (0 % = off) Min. "flow" alarm
„Data“ „Step“	**Max.** **Q_Alarm**	„Enter“ + „Enter“	**80.000** **%_**	„Enter“	**0** **%_**	Selection: 0 ... 100 % of Qmax (100 % = off) Max. "flow" alarm
						Important The "Min. Q_Alarm" and "Max. Q_Alarm" menu items are only displayed if the "I/HART/Q_Alarm" parameter is selected.
„Data“ „Step“	**Min.** **T_Alarm**	„Enter“ + „Enter“	**50** **C_**	„Enter“	**0** **C_**	Selection: -60 ... 410 C (-60 C = off) Min. "temperature" alarm
„Data“ „Step“	**Max.** **T_Alarm**	„Enter“ + „Enter“	**180.000** **C_**	„Enter“	**0** **C_**	Selection: -60 ... 410 C (410 C = off) Max. "temperature" alarm
						Important The "Min. Q_Alarm" and "Max. Q_Alarm" menu items are only displayed if the "I/HART/T_Alarm" parameter is selected.

Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Fehler** **3 / 9**	„Enter“ + „Enter“	**Fehler** **3+9 aus_**	„Enter“	**Beide an** **Fehler 3** **aus**	Selection: on / off Activates / deactivates errors 3 + 9 (overshooting of measuring range by more than 3.125 %).
„Data“ „Step“	**Iout bei** **Alarm**	„Enter“	**22.4** **mA_**	„Enter“	**0** **mA_**	Selection: 21 ... 23 mA Current output value for alarm programmable.
„Data“ „Step“	**Impuls** **Faktor**	„Enter“	**100.000** **1/m3**	„Enter“	**5** **1/m3**	Selection: 0.001 ... 1000 pulses / unit Selected unit for the output for the internal and external flow totalizer. **Important** The "Pulse width" menu is only displayed if the "I/HART/Pulse_Bin" parameter is selected.
„Data“ „Step“	**Impuls-** **breite**	„Enter“	**10** **ms**	„Enter“	**0** **ms**	Selection: 1 ... 256 ms Maximum 50 % on / off. If this value is overshot, a warning will appear on the display.
„Data“ „Step“	**Fehler-** **register**	„Enter“	**Netzausfall**	„Enter“	**14**	Totalizer for the number of power failures since first use.
		„Data“ „Step“	. . . .			Displays any errors that have occurred. Press the "Enter" button to reset.

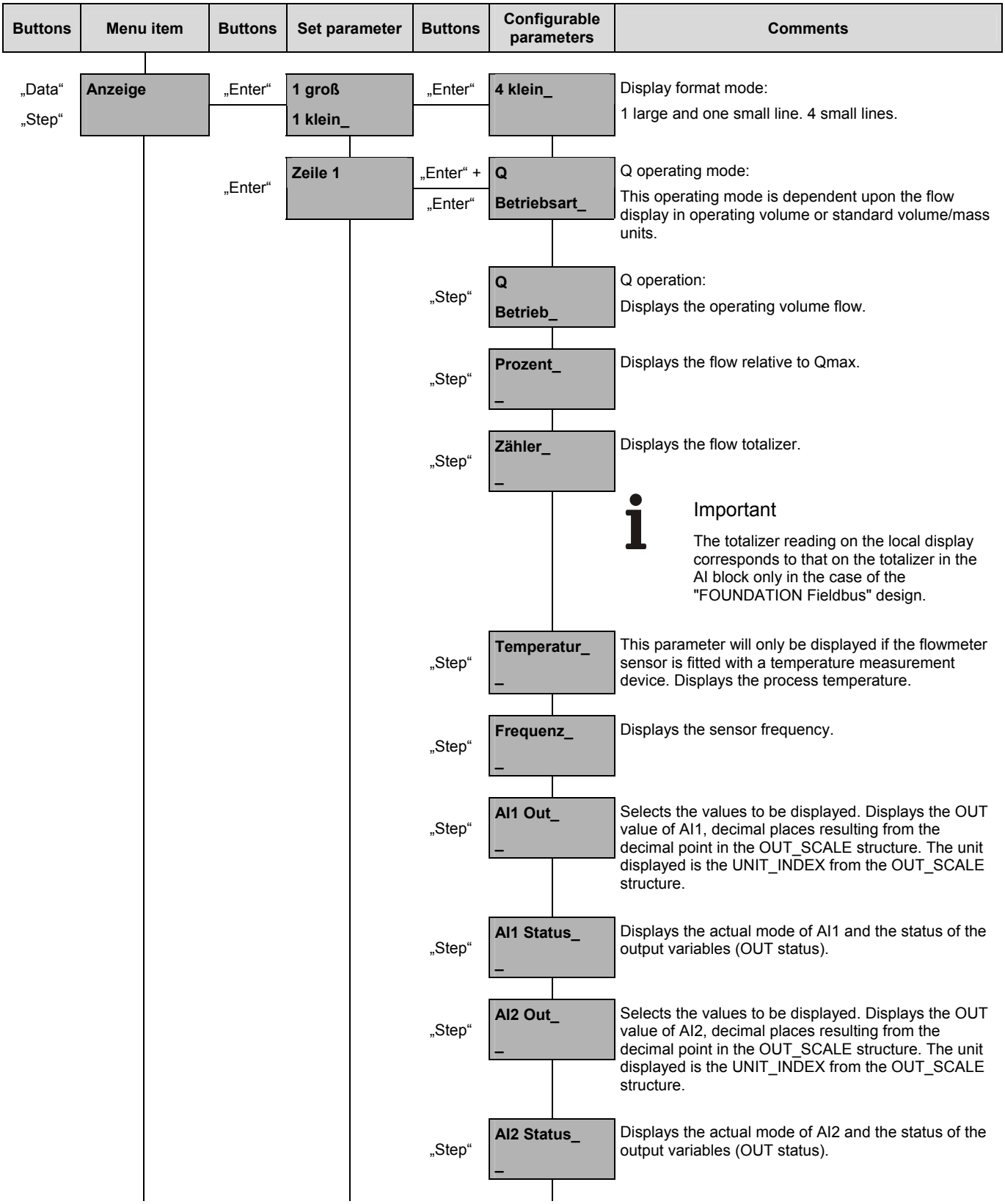
Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Funktions test**	„Enter“	**Iout**	„Enter“	**0** **%**	Manually controlled test of current output. (100 % = 20 mA)
		„Data“ „Step“	**Q Simu-lation**	„Enter“	**0.0** **Hz**	Selection: 0 ... 2500 Hz sensor frequency Simulation (current and pulse output). Switch on by entering the starting value in "Hz". Switch off by entering "0" Hz. On changing to the process display, the frequency can be modified with the "Data" and "Step" buttons (± 5 Hz).
		„Data“ „Step“	**Main FRAM**			To be completed ...
		„Data“ „Step“	**Backup FRAM**			To be completed ...
		„Data“ „Step“	**Schalt-ausgang**	„Enter“	**Kontakt aus**	The contact is switched on or off as required with the "Data" and "Step" buttons.
		„Data“ „Step“	**Impuls-ausgang**	„Enter“	**4Hz Rate ein**	Selection: 0 = pulses 1 = no pulse

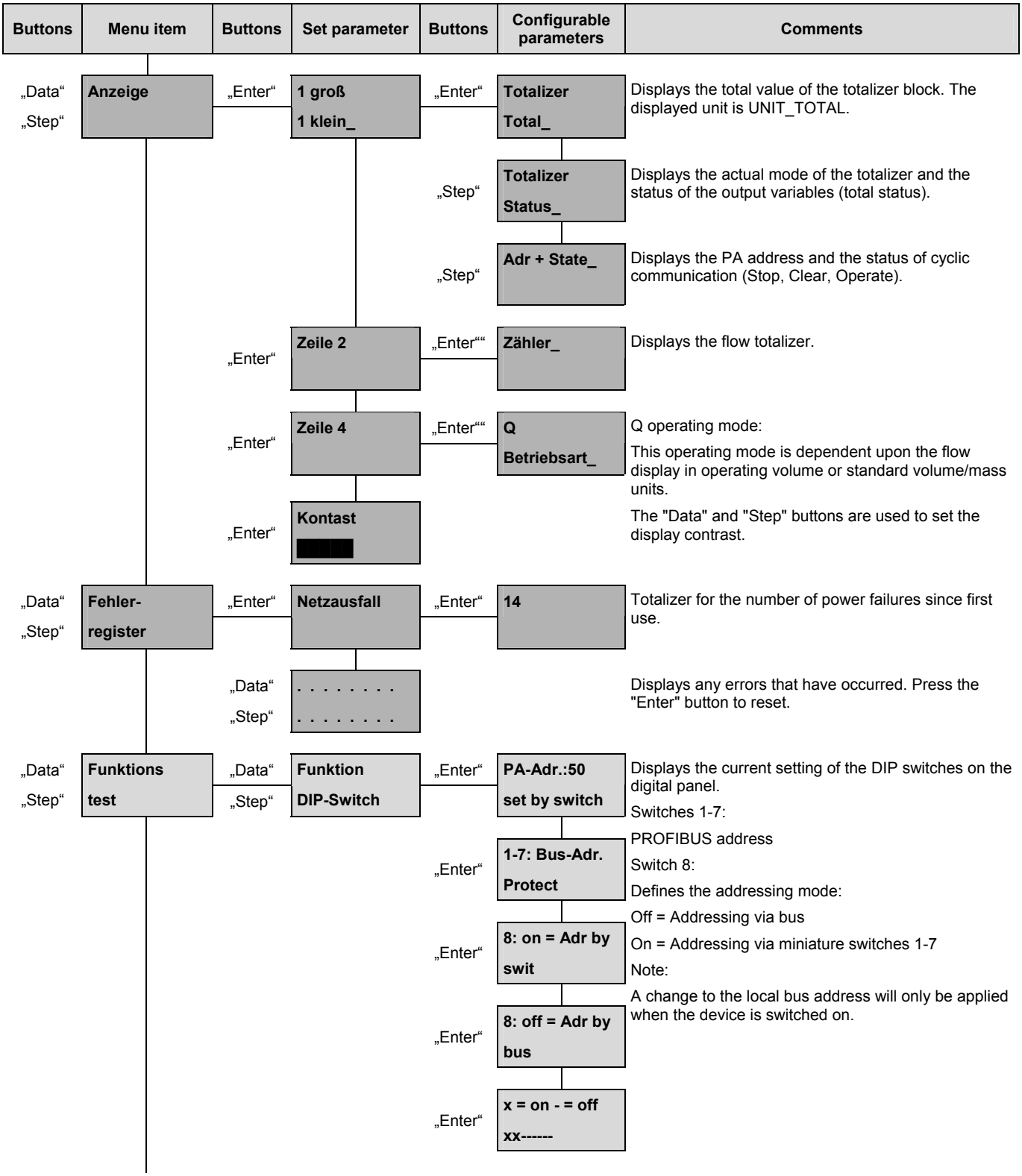
8.6.1 Menu structure – Enhancement for HART

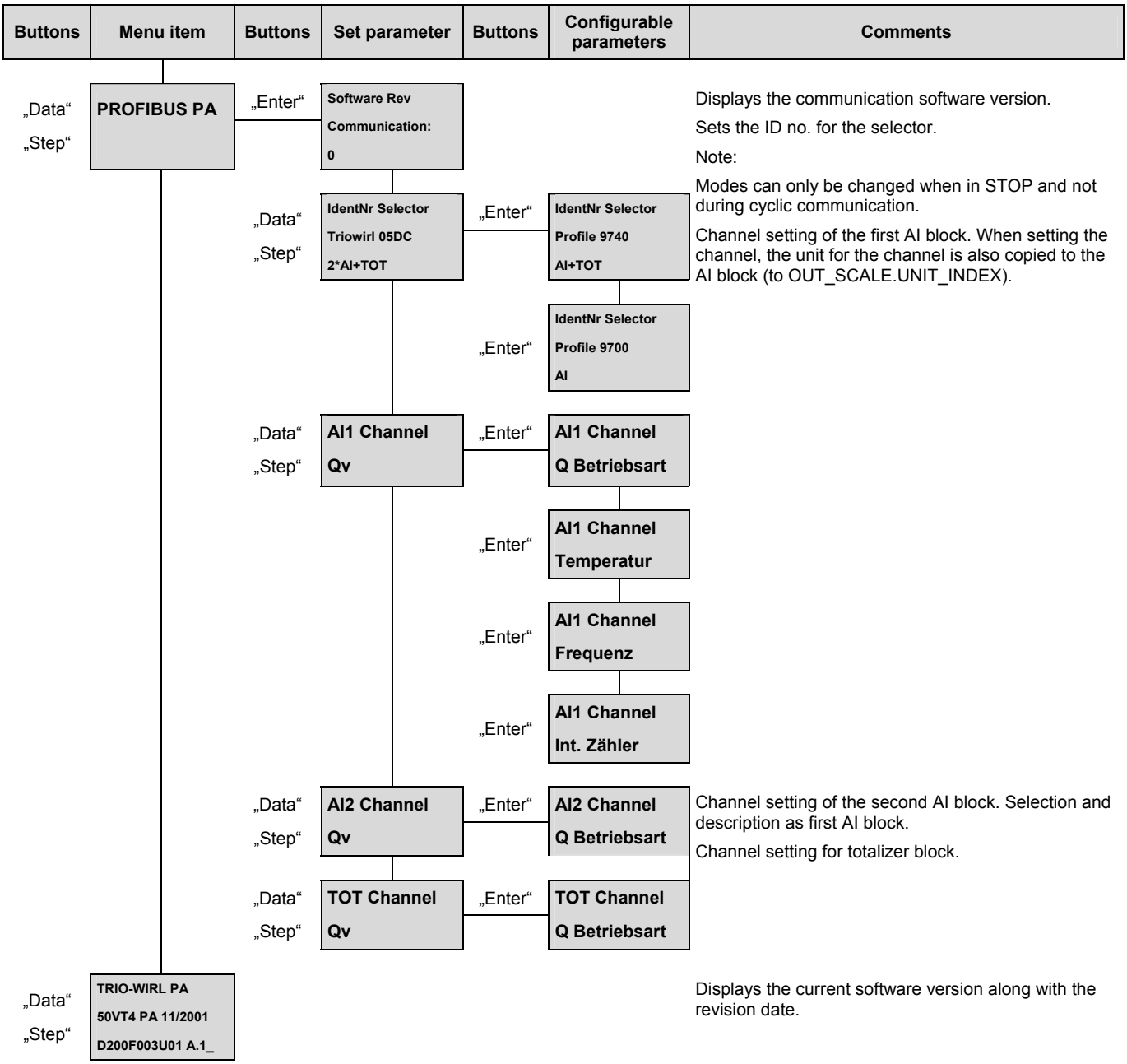



Buttons
Menu item
Buttons
Set parameter
Buttons
Configurable parameters
Comments
„Enter“
2. Zeile Multi.
„Enter“
aus
Switches the second line on/off in multiplex operation.
„Enter“
ein
„Data“
„Step“
Funktions test
„Data“
„Step“
HART-Transmit
„Enter“
HART-Tra 0= 2200H
Selection:
0 = 2200H
1 = 1200H
„Data“
„Step“
HART-Command
„Enter“
HART-Com ---
Tests the HART receiver.
„Data“
„Step“
Geräte-adresse
1 ... 15 multidrop operation
„Data“
„Step“
50VT4000 06/2000
„Enter“
D699C00x U01 A.16
Displays the current software version along with the revision date.
Entry = Displays the current revision number.

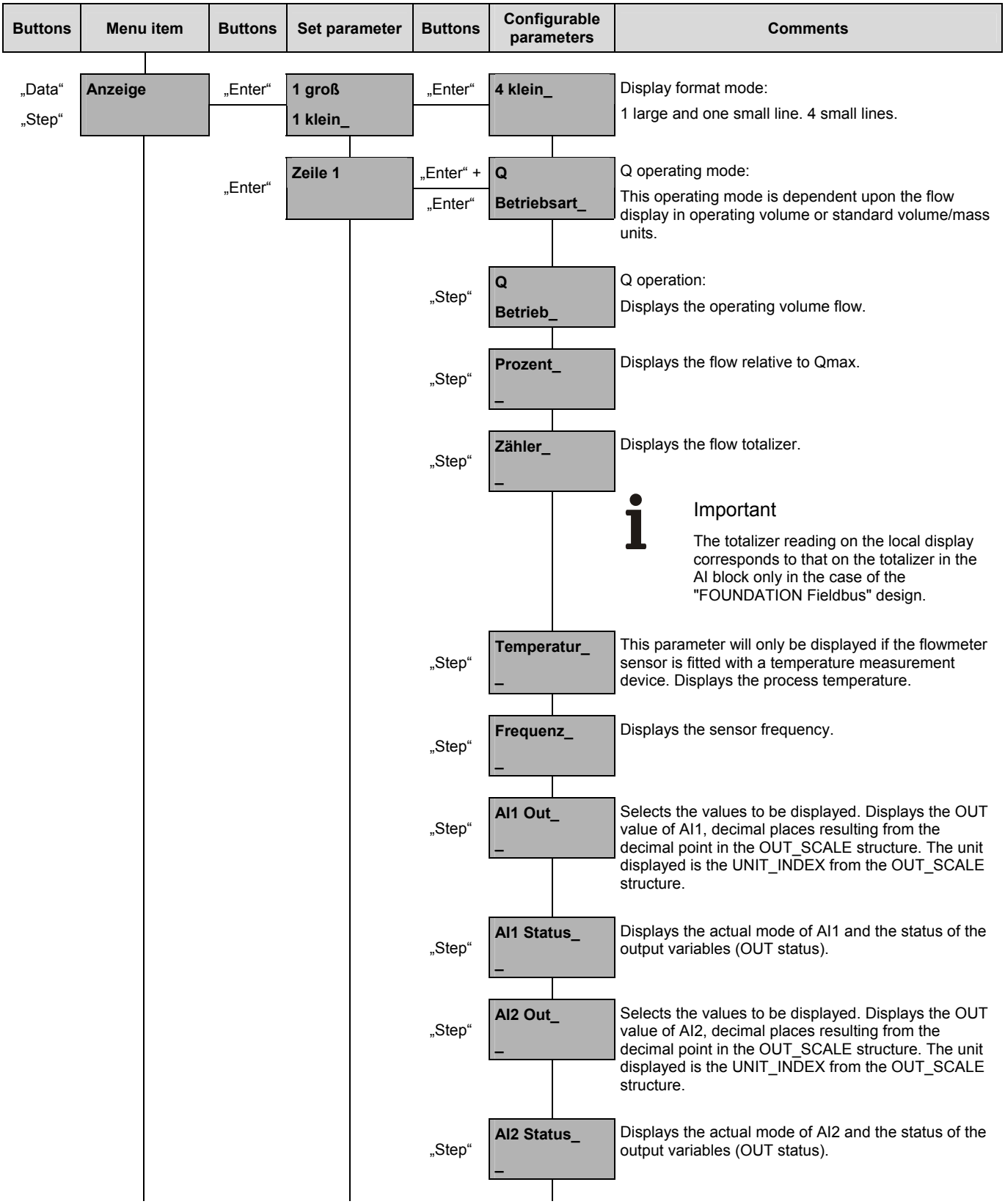
8.6.2 Menu structure – Enhancement for PROFIBUS PA




Buttons
Menu item
Buttons
Set parameter
Buttons
Configurable parameters
Comments
„Data“
„Step“
Anzeige
„Enter“
1 groß
1 klein_
„Enter“
Totalizer
Total_
Displays the total value of the totalizer block. The displayed unit is UNIT_TOTAL.
„Step“
Totalizer
Status_
Displays the actual mode of the totalizer and the status of the output variables (total status).
„Step“
Adr + State_
Displays the PA address and the status of cyclic communication (Stop, Clear, Operate).
„Enter“
Zeile 2
„Enter““
Zähler_
Displays the flow totalizer.
„Enter“
Zeile 4
„Enter““
Q
Betriebsart_
Q operating mode:
This operating mode is dependent upon the flow display in operating volume or standard volume/mass units.
The "Data" and "Step" buttons are used to set the display contrast.
„Enter“
Kontast
„Data“
„Step“
Fehler-
register
„Enter“
Netzausfall
„Enter“
14
Totalizer for the number of power failures since first use.
„Data“
„Step“
. . . . . .
. . . . . .
Displays any errors that have occurred. Press the "Enter" button to reset.
„Data“
„Step“
Funktions
test
„Data“
„Step“
Funktion
DIP-Switch
„Enter“
PA-Adr.:50
set by switch
Displays the current setting of the DIP switches on the digital panel.
Switches 1-7:
PROFIBUS address
Switch 8:
Defines the addressing mode:
Off = Addressing via bus
On = Addressing via miniature switches 1-7
Note:
A change to the local bus address will only be applied when the device is switched on.
„Enter“
1-7: Bus-Adr.
Protect
„Enter“
8: on = Adr by
swit
„Enter“
8: off = Adr by
bus
„Enter“
x = on - = off
xx------


Buttons
Menu item
Buttons
Set parameter
Buttons
Configurable parameters
Comments
„Data“
„Step“
PROFIBUS PA
„Enter“
Software Rev
Communication:
0
Displays the communication software version.
Sets the ID no. for the selector.
Note:
Modes can only be changed when in STOP and not during cyclic communication.
„Data“
„Step“
IdentNr Selector
Triowirl 05DC
2*AI+TOT
„Enter“
IdentNr Selector
Profile 9740
AI+TOT
Channel setting of the first AI block. When setting the channel, the unit for the channel is also copied to the AI block (to OUT_SCALE.UNIT_INDEX).
„Enter“
IdentNr Selector
Profile 9700
AI
„Data“
„Step“
AI1 Channel
Qv
„Enter“
AI1 Channel
Q Betriebsart
„Enter“
AI1 Channel
Temperatur
„Enter“
AI1 Channel
Frequenz
„Enter“
AI1 Channel
Int. Zähler
„Data“
„Step“
AI2 Channel
Qv
„Enter“
AI2 Channel
Q Betriebsart
Channel setting of the second AI block. Selection and description as first AI block.
Channel setting for totalizer block.
„Data“
„Step“
TOT Channel
Qv
„Enter“
TOT Channel
Q Betriebsart
„Data“
„Step“
TRIO-WIRL PA
50VT4 PA 11/2001
D200F003U01 A.1_
Displays the current software version along with the revision date.

8.6.3 Menu structure – Enhancement for FOUNDATION Fieldbus



Buttons	Menu item	Buttons	Set parameter	Buttons	Configurable parameters	Comments
„Data“ „Step“	**Funktions test**	„Data“ „Step“	**Funktion DIP-Switch**	„Enter“	**1: Simulate Enable**	Displays the current setting of the DIP switches on the digital panel. Switch 1: Releases the simulation of the AI function blocks. Switch 2: Hardware write protection for write access via bus (locks all blocks). Switch 3: Write protection for local operation of device (button and magnet stick).
				„Enter“	**2: Write Protect**	
				„Enter“	**3: Simulate Enable**	
				„Enter“	**x = on - = off xx------**	
„Data“ „Step“	**FF**	„Enter“	**Software Rev Communication: 0**			Displays the communication software version for the FOUNDATION Fieldbus. Displays the current software version along with the revision date.
„Data“ „Step“	**TRIO-WIRL FF 50VT4 FF 11/2001 D200F002U01 A.1_**					

8.7 Description of parameters

8.7.1 Nominal size

This parameter is used to adapt the electronics, which are the same for all nominal sizes, to the corresponding flowmeter sensor. The nominal size is factory-set as appropriate for the corresponding flowmeter sensor (see name plate).

8.7.2 Mean k factor

The mean k factor shown on the display has to match the value on the flowmeter sensor. Every meter is calibrated with five measuring points on the test bench. The calibration factors (k factors) are entered in the flowmeter sensor and recorded on the test log. A mean calibration factor is calculated and engraved on the flowmeter sensor. The following tables show the typical k factors for corresponding nominal sizes, along with the frequencies generated in the flowmeter when measuring fluids and gases.

Important

The values indicated are typical k factors and frequencies for the associated device models. Precise data can be found in the test logs included in the respective scopes of supply.

FV4000-VT4/VR4 Vortex flowmeter

Nominal size		Typical k factor	Fluid f_{max} at Qvmax (Hz)		Gas f_{max} at Qvmax (Hz)	
DN	Inch	Max. (1/m³)	DIN	ANSI	DIN	ANSI
15	1/2	225000	370	450	1520	1980
25	1	48000	240	400	2040	1850
40	1 1/2	14500	190	270	1550	1370
50	2	7500	140	176	1030	1180
80	3	2100	102	128	700	780
100	4	960	72	75	500	635
150	6	290	50	50	360	405
200	8	132	45	40	285	240
250	10	66	29	36	260	225
300	12	39	26	23	217	195

FS4000-ST4/SR4 Swirl flowmeter

Nominal size		Typical k factor	Fluid f_{max} at Qvmax (Hz)	Gas f_{max} at Qvmax (Hz)
DN	Inch	Max. (1/m³)		
15	1/2	440000	185	1900
20	3/4	165000	100	1200
25	1	86000	135	1200
32	1 1/4	33000	107	1200
40	1 1/2	24000	110	1330
50	2	11100	90	1100
80	3	2900	78	690
100	4	1620	77	700
150	6	460	40	470
200	8	194	23	270
300	12	54	16	92
400	16	27	13	80

The transmitter calculates the operating flow using the following formula:

$$Q = \frac{f}{k}$$

Q Operating flow [m^3/s]

F Frequency [1/s]

K Calibration k factor [$1/m^3$]

8.7.3 Hardware config.

This submenu allows users to specify the response of the switching output (terminals 41, 42). Depending upon the selection ("Pulse", "Flow alarm", "Temperature alarm", "System alarm"), the "Pulse width", "Min Q_Alarm", "Max Q_Alarm", "Min T_Alarm" or "Max T_Alarm" menus will appear respectively.

8.7.4 Error 3/9

Error detection for errors "3" and "9" can be activated/deactivated in the "Error 3/9" menu. The following settings are possible:

Configuration	Function
"Errors 3+9 off" (factory setting)	If the set measuring range is overshot by more than 3.125 %, the current output will maintain the 20.5 mA it will have reached by this point until the flow returns to a level below the upper range value set for the measuring range.
"Both on"	If the set measuring range is overshot by more than 3.125 %, the current output will switch to the set fault current (factory setting 22.4 mA). If QmaxDN is overshot by more than 20 %, error "9" will also be output as a warning before the device is overloaded.
"Error 3 off"	If the set measuring range is overshot by more than 3.125 %, the current output will maintain the 20.5 mA it will have reached by this point. If QmaxDN is overshot by more than 20 %, error "9" will also be output and the current output will switch to the set fault current.

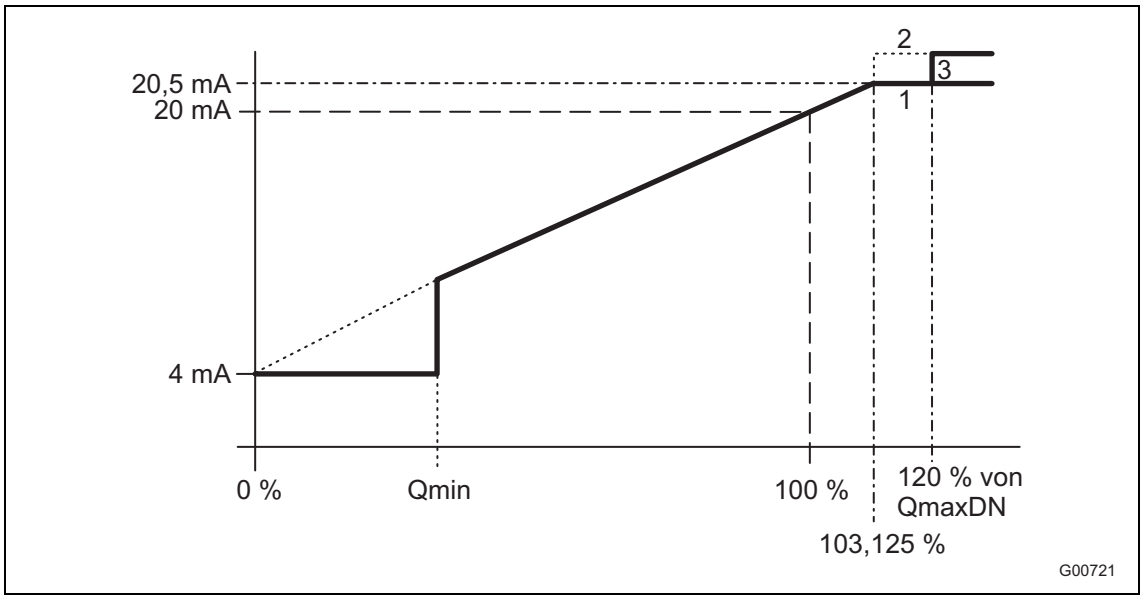


Fig. 47: Current output in the event of an alarm

1 Current output without errors "3" and "9", output: 20.5 mA (NAMUR NE43)
2 Current output with errors "3" and "9", the output switches to alarm status (21 ... 23 mA, configurable)
3 Current output with error "9", the output switches to alarm status at 120 % of QmaxDN (21 ... 23 mA, configurable)
Qmin Low flow

8.7.5 Standard factor

Under constant operating conditions (constant pressure and temperature), the standard factor can be entered here.

The standard factor is defined as the ratio between standard flow and operating flow:

$$\text{Standard factor} = \frac{Qn}{Qv} = \frac{(1{,}013\ \text{bar} + p)}{1{,}013\ \text{bar}} \times \frac{273}{(273 + T)}$$

Qn Standard flow

Qv Operating flow

P Operating pressure [bar ü]

T Temperature [°C]

ρV Operating density

ρN Standard density

Since the mass flow is constant, the following formula applies:

$$\frac{Qn}{Qv} = \frac{\rho V}{\rho N}$$

8.7.6 Operating density

Please refer to the "AP-Calc" product selection and dimensioning program, which ABB provides free of charge.

8.8 Parameterization of gases, steams, and liquids

The selection of possible operating modes, the required parameters associated with them and the additional menu items that become visible are summarized in the following tables.

Important

The selection of possible operating modes is dependent upon how the flowmeter is calibrated.

Operating mode	Medium	Flow type	Calculation	Correction parameter	Additional menus that become visible
Fluid Qv	Fluid	Volume flow	-	-	-
Fluid Qm(D)		Mass flow	$Qm = Qv \times \rho_b$	Reference density constant	Unit of density Reference density Unit Qm
Fluid [1] Qm (D, T)			$Qm = Qv \times \rho(T_b)$ $\rho(T) = \rho_b \times (1 + (T_b - T_0) \times \beta 2)$	Reference density ρ_b Reference temperature T_0 Temperature measured T_b Density compensating coefficient ß2	Unit of density Reference density Reference temperature Unit Qm D. comp. coeffi.
Fluid [1] Qm (V, T)			$Qm = Qn \times \rho_b$ $Qn = \frac{Qv}{(1 + (T_b - T_0) \times \beta 1)}$	Vol.expansion coefficient [%/K]ß1 Reference temperature T_0 Temperature measured T_b Reference density ρ_b	Unit of density Reference density Reference temperature Vol._expansion Unit Qm

Qm	Mass flow	β1	Volume expansion coefficient
Qv	Operating flow	β2	Density compensating coefficient
Qn	Standard flow	ρ_0	Standard density
Pbtr	Reference pressure	ρ_b	Reference density

1) These operating modes can only be selected if the flowmeter is fitted with a temperature measurement device.

Operating mode	Medium	Flow type	Calculation	Correction parameter	Additional menus that become visible
Gas standard [1] Qn (pT)	Gas	Standard flow 1.013 bar / 0 °C 0 ... 1.013 bar / 20 ° C	$Qn = Qv \times \frac{Pbtr}{1{,}013\ bar} \times \frac{273\ K}{273\ K + T_b}$	Reference pressure Pbtr abs Temperature measured T_b	Reference pressure Unit of pressure Standard condition
Gas stnd [1] Qs (pT)		Standard flow 14.7 psia / 60 °F	$Qs = Qv \times \frac{Pbtr}{14{,}7\ psia} \times \frac{60\ °F}{60\ °F + T_b}$	Reference pressure Pbtr abs Temperature measured T_b	Reference pressure Unit of pressure Standard condition
Gas standard Qn (KmpF)		Standard flow 1.013 bar / 0 °C	$Qn = Qv \times Normfaktor$ $Normfaktor = \frac{\rho_b}{\rho_0}$	Standard factor as constant (compression factor)	Standard factor
Gas mass [1] Qm (pT)		Mass flow standard condition at 1.013 bar / 0 °C or 1.013 bar / 20 °C	$Qm = \rho_0 \times Qn$ $Qn = Qv \times \frac{Pbtr}{1{,}013\ bar} \times \frac{273\ K}{273\ K + T_b}$	Reference pressure Pbtr abs Standard density ρ_0 Temperature measured T_b	Unit of density Standard density Standard condition Reference temperature Pressure_Pbtr_abs Unit Qm
Gas Qv	Gas / Steam	Operating flow	-	-	-
Gas mass Qm (D)		Mass flow	$Qm = Qv \times \rho_b$	Reference density constant ρ_b	Unit of density Reference density Unit Qm
S steam [1] Qm	Saturated steam	Mass flow	$Qm = Qv \times \rho_b(T_b)$ Correction using saturated steam table	Temperature measured T_b	Unit Qm
S steam Qv		Operating flow	-	-	-

Qm Mass flow
Qv Operating flow
Qn Standard flow
Pbtr Reference pressure

β1 Volume expansion coefficient
β2 Density compensating coefficient
ρ_0 Standard density
ρ_b Reference density

1) These operating modes can only be selected if the flowmeter is fitted with a temperature measurement device.

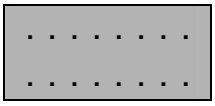
9 Error messages

9.1 Error register

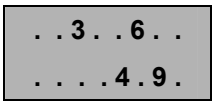
This menu contains the error register and the power failure totalizer.

All errors are saved permanently in the error register, regardless of whether they prevail for a short or a prolonged period. Every digit or letter on the error register display represents an error.

9.1.1 Error register display when no errors are pending



9.1.2 Error register display when errors are pending



9.1.3 Power failure totalizer

The transmitter counts the number of power failures. This information can be read from the error register.

Important

Only ABB Service personnel are able to clear the power failure totalizer.

9.1.4 Clearing the error register

The error register is cleared using the "ENTER" function.

9.2 Error description

Error no.	Plain text message	Priority	Description	Possible cause	Troubleshooting
0	Steam calculation	7	Mass flow for saturated steam calculated incorrectly	Steam temperature < 55 °C (131 °F)	Increase steam temperature
				Steam temperature > 370 °C (698 °F)	Reduce steam temperature
1	Front End	1	Problem affecting preamplifier board	-	Replace transmitter plug-in module / Contact ABB Service
2	Not assigned	-	-	-	-
3	Flow > 3 %	2	The value set in Qmax is being exceeded by more than 3 %	Measuring range too small	Increase "Qmax!" measuring range
				Flow too large	Reduce flow
4	Not assigned	-	-	-	-
5	M database	0	Main database damaged beyond repair, loss of transmitter's internal database	Reduce flow	Replace meter and switch back on, replace transmitter plug-in module if necessary, contact ABB Service
6	Meter damaged beyond repair	1	Flowmeter damaged beyond repair, values displayed are invalid	-	Reprogram the meter
7	Temperature	7	Problem affecting temperature measurement	PT100 faulty	Replace sensor
				Wiring errors between sensor and transmitter affecting VR / SR models	Check wiring
8	Not assigned	-	-	-	-
9	Qv > 120 % of QmaxDN	2	Maximum possible measuring range (QmaxDN) overshot	Flow too large (software only) level < A30	Reduce flow
B	B base	0	Backup database damaged beyond repair, loss of external database (sensor board)	External database faulty	Switch the meter off and back on again, sensor board might be faulty, contact ABB Service

10 Maintenance / Repair

Repair and maintenance activities may only be performed by authorized customer service personnel.

When replacing or repairing individual components, original spare parts must be used.

Warning - Potential damage to parts!

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.

When the housing is open, EMC protection is limited.

10.1 Returning devices

Use the original packaging or a suitably secure packaging for returning the device for repair or for recalibration. Include the properly filled out return form (see attachment) with the device.

According to EC guidelines for hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for its shipping:

All delivered devices to ABB Automation Products GmbH must be free from any hazardous materials (acids, alkali, solvents, etc.).

Rinse out and neutralize hazardous materials from all hollow spaces such as between meter tube and housing. These activities must be confirmed in writing using the return form.

The flowmeters do not require any maintenance if they are used as intended under normal operating conditions. It is sufficient to check them following the instructions in this section.

Warning - General risks

Explosion-proof flowmeters must either be repaired by the manufacturer or approved by a certified expert following repair work. The relevant safety precautions must be taken before, during, and after repair work.

Only disassemble the flowmeter to the extent necessary for cleaning, inspection, repairs, and replacement of damaged components.

Returns

Defective flowmeters sent to the repairs department must, wherever possible, be accompanied by your own description of the fault and its underlying cause.

Important

Please use the form for returned products, provided in the Appendix.

This helps us to perform repairs quickly and without the need to contact you for further details. Before you return the device, please clean it and pack it safely and securely. When ordering spare parts or replacement devices, please quote the serial number (S/N) of the original device as well as the year of manufacture (Yr.).

10.1.1 Contact information

Address

ABB Automation GmbH
- Service Instruments -
Dransfelder Straße 2
D-37079 Göttingen
GERMANY

Spare parts

e-mail: parts-repair-goettingen@de.abb.com

Technical support

Phone: +49 (0) 180-5-222 580
Fax: +49 (0) 621 38 193 129 031
e-mail: automation.service@de.abb.com

10.2 Maintenance for the flowmeter

Essentially no maintenance is required for the flowmeter primary. The following items should be checked annually:

- Ambient conditions (air circulation, humidity)
- Seal integrity of the process connections
- Cable entry points and cover screws
- Operational reliability of the supply power feed, the lightning protection and the grounds

Important

When sending the flowmeter to the head office of ABB Automation Products GmbH, complete the return form in the appendix and include with device.

10.3 Cleaning

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the seals.

10.4 Replacing the transmitter

Notice - Potential damage to parts

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.

When the housing is open, EMC protection is limited.

1. Disconnect the flowmeter from the line supply.
2. Unscrew the front housing cover. The lock on the cover needs to be undone first on meters for hazardous areas.

Important

Observe the waiting times for meters for hazardous areas (see the section titled "Technical data for hazardous areas").

3. Remove the transmitter from the housing. To do this, unscrew the three Phillips head screws and carefully take the transmitter out of the housing.

4. Set the configuration switch as illustrated below.

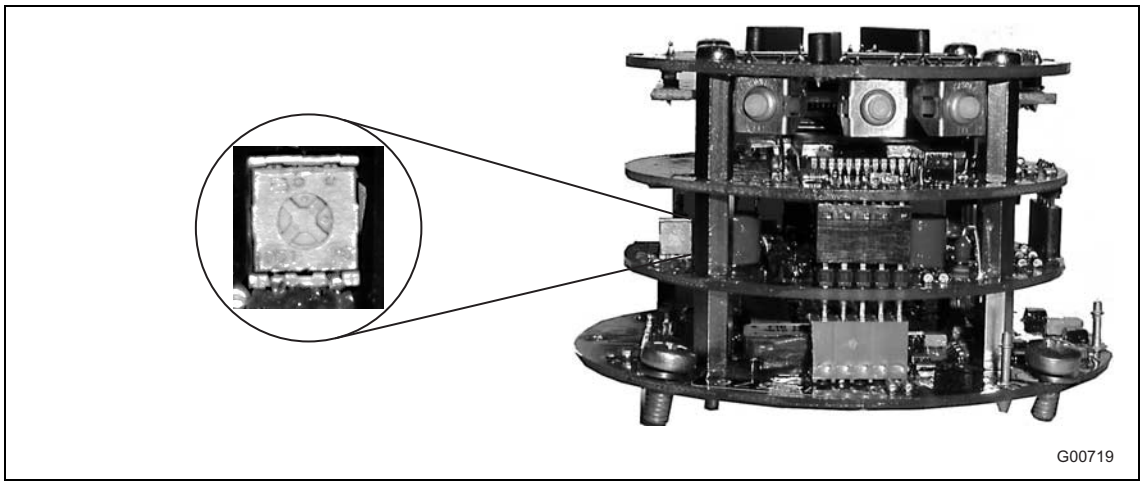


Fig. 48: Position and function of the configuration switch

5. Carefully put the transmitter back into the housing. Make sure it is centered correctly.

Notice - Potential damage to parts

If the transmitter is not placed into the housing correctly, the electrical plug-in connectors at the rear can twist or break off.

Position the transmitter so that the three screw holes on the base plate are located exactly in front of the threaded bolts.

6. Then tighten the three screws again.
7. Finally, tighten the housing cover hand-tight. The lock on the cover needs to be re-attached on meters for hazardous areas.

10.5 Disassembling the flowmeter

1. Before starting work on the flowmeter, make sure that it and any adjacent lines or vessels have been depressurized.

Warning - General risks

Prior to disassembly, check whether hazardous materials have been used as flow media.

Residual amounts of hazardous material may still be present in the device and could escape when it is opened.

The pipeline must be depressurized prior to opening the device.

Warning - Potential damage to parts

Never unscrew the fixing screws from the base or the transmitter from the base. Doing so can damage the meter beyond repair.

In the event of problems, please contact ABB Service.

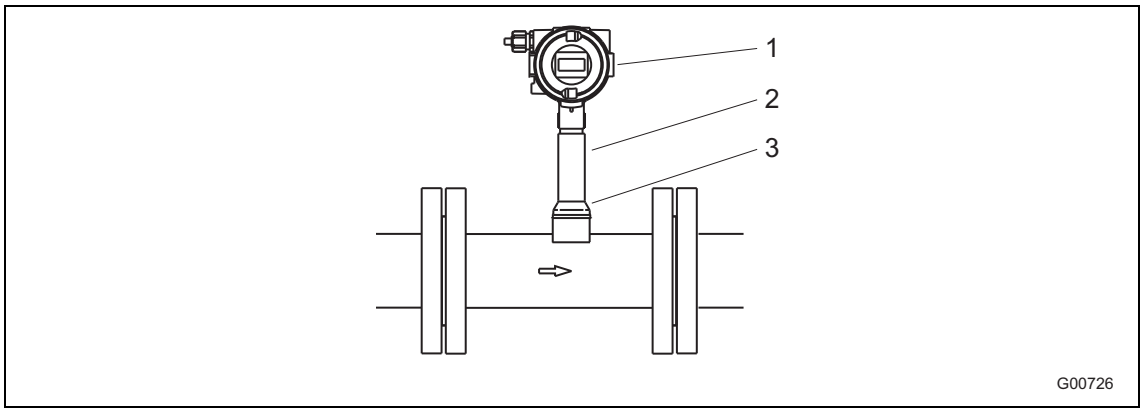


Fig. 49: Parts attached to the Swirl and Vortex meters

1 Transmitter
2 Base
3 Fixing screws

11 Ex relevant specifications

11.1 General technical data for hazardous areas

11.1.1 HART devices

Models designed for hazardous areas with ATEX / IECEx approval

Models	Approvals
VT41 / ST41 / VR41 / SR41	• Operation in Zone 1: Ex ib IIC (intrinsically safe supply) • Operation in Zone 2: Ex nA [nL] IIC (non-intrinsically safe supply) • Operation in Zone 21 / 22: Ex tD A21 / Ex tD A22 (non-intrinsically safe supply or intrinsically safe supply)

Important

All types of protection are noted on the name plate.

Flowmeters operating in Category 3 (Zone 2 / 22) may subsequently be operated in Category 2 (Zone 1 / 21) without modification.

The respective applicable maximum values must be complied with.

Models	Approvals
VT42 / ST42 / VR42 / SR42	• Operation in Zone 1: Ex d [ib] IIC (non-intrinsically safe supply) • Operation in Zone 1: Ex ib IIC (intrinsically safe supply) • Operation in Zone 2: Ex nA [nL] IIC (non-intrinsically safe supply) • Operation in Zone 21 / 22: Ex tD A21 / Ex tD A22 (non-intrinsically safe supply or intrinsically safe supply)

Important

All types of protection are noted on the name plate. In the case of operation in Zone 1, the user specifies the type of protection by means of the type of supply.

Flowmeters operated in Category 3 (Zone 2) may subsequently be operated in Category 2 (Zone 1) without modification. Within Category 2, the Ex d [ib] design may subsequently be operated as EX ib without modification.

The respective applicable maximum values must be complied with. The significant differences between models are listed in the table titled "Differences between explosion-proof designs with regard to safety engineering". Detailed descriptions appear later in this section.

Models designed for hazardous areas with American approval

Models	Approvals
VT43 / ST43 / VR43 / SR43	• Explosion-proof XP/Class I/Div 1/BCD/T4 Ta = 70 °C Type 4X • Dust-ignition-proof DIP/Class II,III/Div 1/EFG/T4 Ta = 70 °C Type 4X DIP/Class II,III /Div 2 /EFG /T4 Ta=70°C Type 4X • Intrinsic safety IS/Class I, II,III/Div 1 ABCDEFG/T4 Ta = 70 °C Entity Type 4X • Non-incendive NI/Class I/Div 2/ABCD/T4 Ta = 70 °C Type 4X

11.1.2 Fieldbus devices

Models: VT4A, VR4A, ST4A, SR4A

The hazardous area design of the device is based on the PTB's FISCO model (FISCO = fieldbus intrinsically safe concept).

Proof of intrinsic safety for interconnection with other intrinsically safe equipment is not required under the boundary conditions specified.

- All nodes must have FISCO approval, e.g., from the PTB, TÜV, BVS, KEMA.
- The maximum cable length in a segment is restricted to 1,000 m for EEx ia and 1,900 m for EX ib.
- The bus cable (type A) has to exhibit the following values: R' = 15 Ω/km, L' = 0.4 ... 1 mH/km, C' = 80 ... 200 nF/km
- The following applies for every field device (U_I, I_I, P_i): $U_0 \leq U_I$, $I_0 \leq I_I$, $P_0 \leq P_i$
- All nodes act as passive current sinks.
- No power is fed in when a bus node is sending.

There is only one active device per segment (supply unit / segment coupler).

Designation: II 2G EEx ia IIC T4

11.1.3 Differences between explosion-proof designs with regard to safety engineering

Difference		Model					
		VT42/ST42 VR42/SR42	**VT42/ST42 VR42/SR42 VT41/ST42 VR41/SR41**	**VT42/ST42 VR42/SR42 VT41/ST42 VR41/SR41**	**VT42/ST42 VR42/SR42 VT41/ST42 VR41/SR41**	**VT43/ST43 VR43/SR43**	**VT43/ST43 VR43**
Type of protection		Ex d [ib]	Ex ib	Ex nA [nL]	Dust / housing	XP	IS
Zone (category)		1 (2G)	1 (2G)	2 (3G)	21 (2D)	Class I DIV 1	Class I, II, III DIV 1
Housing components in addition to the housing with particular relevance for explosion protection		Flameproof cable gland, safety catch	None	None	Safety catch	NPT thread prepared for conduit fitting, safety catch	
Waiting time on opening the transmitter		2 min	2 min	2 min	2 min	2 min	No
Temperature class		T6 (sensor T4)	T4	T4	T85 °C ... T_{med}	T4	T4
Permissible ambient temperature	...41	-	(-55) -20 to +70 °C		-20 to +60 °C	-	-
	...42	(-40) -20 to +60 °C			-20 to +60 °C	-	-
	...43	-	-	-	-	-20 to +70 °C	
Supply voltage		Um = 60 V UB = 14-46 V	ib: Ui = 28 V	Um = 60 V UB = 14-46 V	Um = 60 V UB = 14-46 V Ui = 28 V	UB = 14-46 V	Vmax = 14-28 V

11.2 Ex "ib" / Ex "n" design for VT41/ST41 and VR41/SR41 (4 ... 20 mA / HART)

Important
The devices may only be operated in explosive areas if the housing covers have been fully closed.

EC type-examination certificate TÜV 08 ATEX 554808 X
Designation:
II 2G Ex ib IIC T4
II 2D Ex tD A21 T85°C...T_{medium} IP67

Declaration of conformity TÜV 08 ATEX 554833 X
Designation:
II 3G Ex nA [nL] IIC T4
II 3D Ex tD A22 T85°C...T_{medium} IP67

Certificate of conformity IECEx TUN 07.0014 X
Designation:
Ex ib IIC T4...T1
Ex nA [nL] IIC T4...T1
Ex tD A21 IP6X TX°C

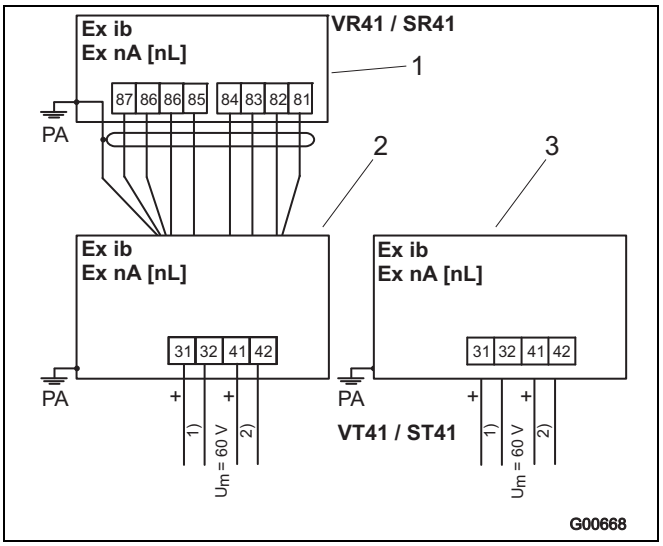


Fig. 50: Connection diagram for VT41 / ST41 and VR41 / SR41

1 Flowmeter sensor
2 Transmitter
3 Flowmeter

Flowmeter sensor wire colors

Terminal	Wire color
81	Red
82	Blue
83	Pink
84	Gray
85	Yellow
86	Green
86	Brown
87	White

1) Supply power terminals 31 / 32
a) Ex ib: U_i = 28 V DC
b) Ex nA [nL] U_B = 14 … 46 V DC

2) Switching output, terminals 41/ 42
The switching output (passive) optocoupler is designed as a NAMUR contact (to DIN 19234).
When the contact is closed, the internal resistance is approx. 1,000 Ω. When the contact is open, it is > 10 KΩ. The switching output can be changed over to "optocoupler" if required.
a) NAMUR with switching amplifier
b) Switching output (optocoupler)
- Ex ib: U_i = 15 V
- Ex nA [nL]: U_B = 16 … 30 V
I_B = 2 … 15 mA

Important
The installation instructions in accordance with EN 60079-14 must be complied with.
When commissioning the flowmeter, refer to EN 50281-1-2 regarding use in areas with combustible dust. After switching off the supply power, wait t > 2 minutes before opening the transmitter housing.

11.2.1 Supply power or supply current

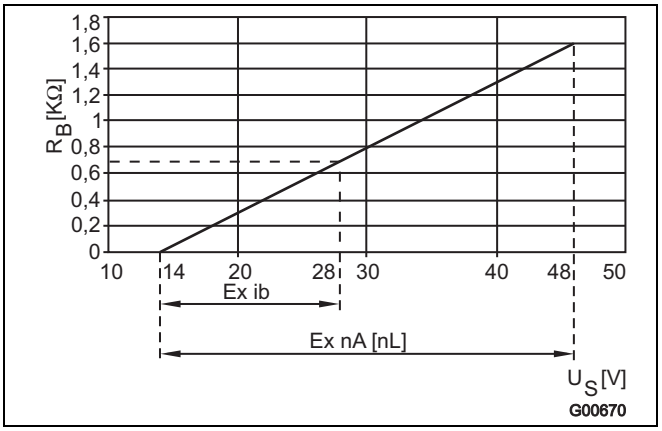


Fig. 51

The minimum voltage U_S of 14 V is based on a load of 0 Ω.

U_S = supply voltage

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

11.2.2 Approval data for hazardous areas

Power supply circuit	Terminals 31, 32
Type of protection U_m = 60 V	Zone 1: Ex ib IIC T_{amb} = (-55 °C) -20 ... 70 °C U_i = 28 V I_i = 110 mA P_i = 770 mW Effective internal capacitance: 14.6 nF Effective internal capacitance to ground: 24.4 nF Effective internal inductance: 0.27 mH
	Zone 2: Ex nA [nL] IIC T_{amb} = (-55) -20 ... 70 °C U_B = 14 … 46 V
	Zone 21 / 22: Ex tD A21 / Ex tD A22 T_{amb} = -20 °C ... 60 °C

Power supply circuit	Terminals 41, 42
Type of protection U_m = 60 V	Zone 1: Ex ib IIC U_i = 15 V I_i = 30 mA P_i = 115 mW Effective internal capacitance: 11 nF Effective internal capacitance to ground: 19.6 nF Effective internal inductance: 0.14 mH
	Zone 2: Ex nA [nL] IIC U_B = 16 … 30 V I_B = 2 … 15 mA
	Zone 21 / 22: Ex tD A21 / Ex tD A22 T_{amb} = -20 °C ... 60 °C

The devices must be installed in a protected environment in accordance with the specific conditions on the test certificate. Pollution degree 3 (see IEC 60664-1) must not be exceeded for the macro environment of the device. The devices conform to degree of protection IP65/IP67. If the device is installed as intended, this requirement is met by the housing as standard.

When connected to the line supply / not connected to the line supply, the electrical circuits must not exceed overvoltage category III / II.

11.2.3 Medium temperatures / Temperature classes

For the supply circuit "Terminals 31, 32" and the switching outputs "Terminals 41, 42", cables suitable for temperatures up to T = 110 °C (T = 230 °F) can be used without restriction.

Category 2/3G

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the interconnection of both circuits needs to be taken into account in the event of a fault. Otherwise, the restricted temperature ranges listed in the following table shall apply.

Category 2D

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the restricted temperature ranges listed in the following table shall apply.

Ambient temperature 2)	Max. temperature at used connecting cable, "Terminals 31, 32", "Terminals 41, 42"	Max. permissible medium temperature
(-55) -20 ... 70 °C ((-67) -4 ... 158 °F)	110 °C (230 °F)	280 °C / 400 °C 1) (536 °F / 752 °F) 1)
(-55) -20 ... 70 °C ((-67) -4 ... 158 °F)	80 °C (176 °F)	160 °C (320 °F)
(-55) -20 ... 60 °C ((-67) -4 ... 140 °F)		240 °C (464 °F)
(-55) -20 ... 55 °C ((-67) -4 ... 131 °F)		280 °C (536 °F)
(-55) -20 ... 50 °C ((-67) -4 ... 122 °F)		320 °C (608 °F) 1)
(-55) -20 ... 40 °C ((-67) -4 ... 104 °F)		400 °C (752 °F) 1)

1) Medium temperatures > 280 °C (> 536 °F) with FV4000 Vortex flowmeter only
2) The permissible limits for the ambient temperature are approval- and order-specific (standard: -20 °C (-4 °F)).

Maximum medium temperature	Temperature class
130 °C (266 °F)	T4
195 °C (383 °F)	T3
290 °C (554 °F)	T2
400 °C (752 °F)	T1

11.3 Ex "d" / Ex "ib" / Ex "n" design for VT42/ST42 and VR42/SR42 (4 ... 20 mA / HART)

Important
The devices may only be operated in explosive areas if the housing covers have been fully closed.

EC type-examination certificate TÜV 08 ATEX 554955 X

Designation

- Transmitter / Flowmeter
  II 2G Ex d [ib] IIC T6
  II 2G Ex ib IIC T4
  II 2D Ex tD A21 T 85 °C ... T_{med} IP 67

- Flowmeter sensor
  II 2G Ex ib IIC T4
  II 2D Ex tD A21 T 85 °C ... T_{med} IP 67

Declaration of conformity TÜV 08 ATEX 554956 X

Designation on sensor / transmitter / flowmeter
II 3G Ex nA [nL] IIC T4
II 3D Ex tD A22 T85°C...T_{med} IP67

Certificate of conformity IECEx TUN 08.0010 X

Designation:
Ex d [ib] IIC T6 to T1
Ex ib IIC T4 to T1
Ex tD A21 IP6X T85°C...T_{medium}
Ex nA [nL] IIC T4 to T1

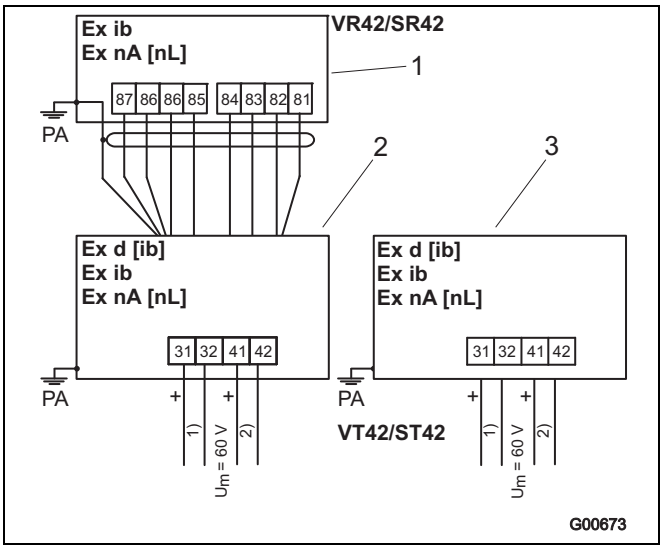


Fig. 52: Connection diagram for VT42 / ST42 and VR42 / SR42

1 Flowmeter sensor
2 Transmitter
3 Flowmeter

Flowmeter sensor wire colors

Terminal	Wire color
81	Red
82	Blue
83	Pink
84	Gray
85	Yellow
86	Green
86	Brown
87	White

1) Supply power terminals 31 / 32
   a) Ex ib: U_i = 28 V DC
   b) Ex d [ib] / Ex nA [L] U_B = 14 … 46 V DC

2) Switching output, terminals 41/ 42
   The switching output (passive) is designed as an optocoupler. If required, the switching output (passive) can be designed as a NAMUR contact (to DIN 19234).
   a) NAMUR with switching amplifier
   b) Switching output (optocoupler)
   - Ex ib: U_i = 15 V
   - Ex d [ib] / Ex nA [L]: U_B = 16 … 30 V
     I_B = 2 … 15 mA

Important
Supply current (supply power) and switching output must be either only intrinsically safe or only non-intrinsically safe. A combination of the two is not permitted. On intrinsically safe circuits, equipotential bonding must be in place along the entire length of the cable used.

11.3.1 Supply power or supply current

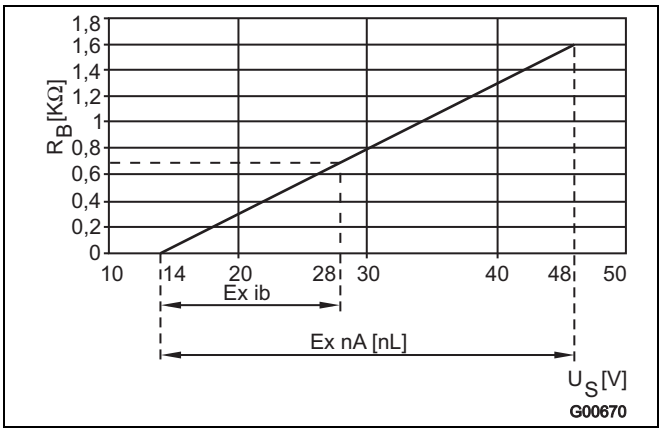


Fig. 53

The minimum voltage U_S of 14 V is based on a load of 0 Ω.

U_S = supply voltage

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

Important

The installation instructions in accordance with EN 60079-14 must be complied with.

When commissioning the flowmeter, refer to EN 50281-1-2 regarding use in areas with combustible dust. After switching off the supply power, wait t > 2 minutes before opening the transmitter housing.

11.3.2 Approval data for hazardous areas

Power supply circuit	**Terminals 31, 32**
Type of protection U_m = 60 V	Zone 1: Ex d [ib] IIC Zone 2: Ex nA [nL] IIC U_B = 14 ... 46 V
	Zone 1: Ex ib IIC T_{amb} = (-55 °C) -20 ... 70 °C U_i = 28 V I_i = 110 mA P_i = 770 mW Effective internal capacitance: 14.6 nF Effective internal capacitance to ground: 24.4 nF Effective internal inductance: 0.27 mH
	Zone 21 / 22; Ex td A21 / Ex tD A22 T_{amb} = -20 °C ... 60 °C

Power supply circuit	**Terminals 41, 42**
Type of protection U_m = 60 V	Zone 1: Ex d [ib] IIC Zone 2: Ex nA [nL] IIC U_B = 16 ... 30 V I_B = 2 ... 15 mA
	Zone 1: Ex ib IIC U_i = 15 V I_i = 30 mA P_i = 115 mW Effective internal capacitance: 11.6 nF Effective internal capacitance to ground: 19.6 nF Effective internal inductance: 0.14 mH
	Zone 21 / 22: Ex td A21 / Ex td A22 T_{amb} = -20 °C ... 60 °C

When connected to the line supply / not connected to the line supply, the electrical circuits must not exceed overvoltage category III / II.

11.3.3 Medium temperatures / Temperature classes

For the supply circuit "Terminals 31, 32" and the switching outputs "Terminals 41, 42", cables suitable for temperatures up to T = 110 °C (T = 230 °F) can be used without restriction.

Category 2D

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the restricted temperature ranges listed in the following table shall apply.

Ambient temperature 2)	Max. temperature at used connecting cable, "Terminals 31, 32", "Terminals 41, 42"	Max. permissible medium temperature
(-40) -20 ... 60 °C (-40) -4 ... 140 °F)	110 °C (230 °F)	280 °C / 400 °C 1) (536 °F / 752 °F) 1)
(-40) -20 ... 60 °C (-40) -4 ... 140 °F)	80 °C (176 °F)	240 °C (464 °F)
(-40) -20 ... 55 °C (-40) -4 ... 131 °F)		280 °C (536 °F)
(-40) -20 ... 50 °C (-40) -4 ... 122 °F)		320 °C (608 °F) 1)
(-40) -20 ... 40 °C (-40) -4 ... 104 °F)		400 °C (752 °F) 1)

1) Medium temperatures > 280 °C (> 536 °F) with FV4000 Vortex flowmeter only
2) The permissible lower limits for the ambient temperature are approval- and order-specific (standard: -20 °C (-4 °F)).

Hazardous area design	Maximum medium temperature	Temperature class
Ex d [ib] IIC	80 °C (176 °F)	T6 3)
	95 °C (203 °F)	T5 3)
Ex ib IIC bzw. Ex nA [nL]	130 °C (266 °F)	T4
	195 °C (383 °F)	T3
	290 °C (554 °F)	T2
	400 °C (752 °F)	T1

3) Not possible for flowmeter sensor version VR42/SR42

11.4 FM approval design for the USA and Canada for VT43/ST43 and VR43/SR43 (4 ... 20 mA / HART)

Important

The devices may only be operated in explosive areas if the housing covers have been fully closed.

Designation

Explosion-proof	XP/Class I/Div 1/BCD/T4 Ta = 70 °C Type 4X
Dust-ignition-proof	DIP/Class II,III/Div 1/EFG/T4 Ta = 70 °C Type 4X
Intrinsic safety	IS/Class I, II,III/Div 1/ABCDEFG/T4 Ta = 70 °C Entity Type 4X
Non-incendive	NI/Class I/Div 2/ABCD/T4 Ta = 70 °C Type 4X
Suitable	S/Class II,III/Div 2/FG/T4 Ta = 70 °C Type 4X

The devices must be installed in a protected environment in accordance with the specific conditions on the test certificate. Pollution degree 3 (see IEC 60664-1) must not be exceeded for the macro environment of the device. The devices conform to degree of protection IP65/IP67. If the device is installed as intended, this requirement is met by the housing as standard.
When connected to the line supply / not connected to the line supply, the electrical circuits must not exceed overvoltage category III / II.

IS Entity see: SD-50-2681 (Fig. 35)
Parameters: Vmax, Imax, Pi, Li, Ci
Enclosure: Type 4X

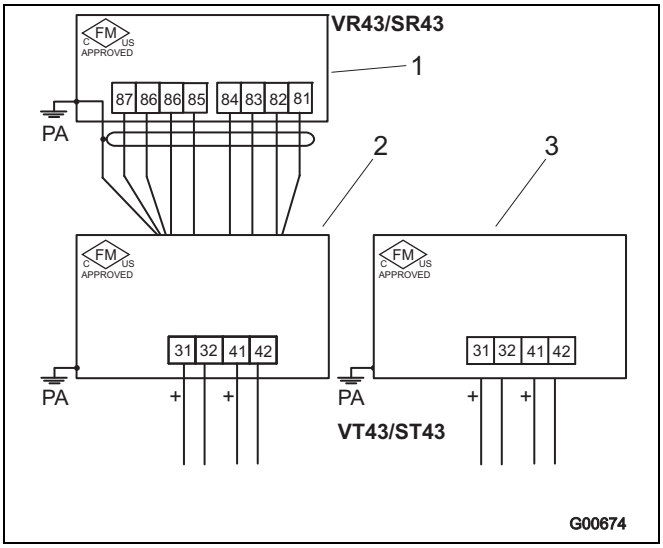


Fig. 54: Connection diagram for VT43 / ST43 and VR43 / SR43
1 Flowmeter sensor
2 Transmitter
3 Flowmeter

Flowmeter sensor wire colors

Terminal	Wire color
81	Red
82	Blue
83	Pink
84	Gray
85	Yellow
86	Green
86	Brown
87	White

11.4.1 Supply power or supply current

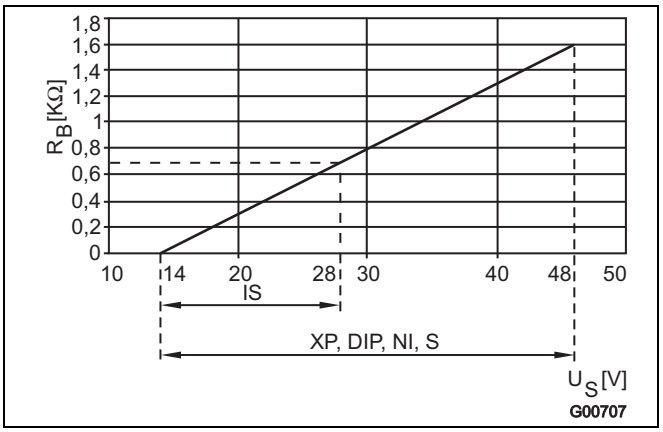


Fig. 55

The minimum voltage U_S of 14 V is based on a load of 0 Ω.

U_S = supply voltage

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

11.4.2 Medium temperatures / Temperature classes

For the supply circuit "Terminals 31, 32" and the switching outputs "Terminals 41, 42", cables suitable for temperatures up to T = 110 °C (T = 230 °F) can be used without restriction.

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the restricted temperature ranges listed in the following table shall apply.

Ambient temperature	Max. temperature at used connecting cable, "Terminals 31, 32", "Terminals 41, 42"	Max. permissible medium temperature
-20 ... 60 °C (-4 ... 140 °F)	110 °C (230 °F)	280 °C / 400 °C 1) (536 °C / 752 °F) 1)
-20 ... 60 °C (-4... 140 °F)		240 °C (464 °F)
-20 ... 55 °C (-4 ... 131 °F)		280 °C (536 °F)
-20 ... 50 °C (-4 ... 122 °F)		320 °C (608 °F) 1)
-20 ... 40 °C (-4 ... 104 °F)		400 °C (752 °F) 1)

1) Medium temperatures > 280 °C (> 536 °F) with VT43 / VR43 Vortex flowmeter only

11.4.3 Approval data for hazardous areas

Supply circuit terminals 31, 32

Explosion-proof	XP/Class I/Div 1/BCD/T4 Ta = 70 °C Type 4X	U_B = 14 ... 46 V
Dust-ignition-proof	DIP/Class II,III/Div 1/EFG/T4 Ta = 70 °C Type 4X DIP/Class II,III /Div 2 /EFG /T4 Ta=70°C Type 4X	
Intrinsic safety	IS/Class I, II,III/Div 1 ABCDEFG/T4 Ta = 70 °C Entity Type 4X	V_{max} = 28 V I_{max} = 110 mA P_i = 770 mW Effective internal capacitance: 14.6 nF Effective internal inductance: 0.27 mH
Non-incendive	NI/Class I/Div 2/ABCD/T4 Ta = 70 °C Type 4X	U_B = 14 ... 46 V

Supply circuit terminals 41, 42

Explosion-proof	XP/Class I/Div 1/BCD/T4 Ta = 70 °C Type 4X	U_B = 16 ... 30 V I_B = 2 ... 15 mA
Dust-ignition-proof	DIP/Class II,III/Div 1/EFG/T4 Ta = 70 °C Type 4X DIP/Class II,III /Div 2 /EFG /T4 Ta=70°C Type 4X	
Intrinsic safety	IS/Class I, II,III/Div 1 ABCDEFG/T4 Ta = 70 °C Entity Type 4X	V_{max} = 15 V I_{max} = 30 mA P_i = 115 mW Effective internal capacitance: 11 nF Effective internal inductance: 0.14 mH
Non-incendive	NI/Class I/Div 2/ABCD/T4 Ta = 70 °C Type 4X	U_B = 16 ... 30 V I_B = 2 ... 15 mA

11.4.4 Trio-Wirl control drawing

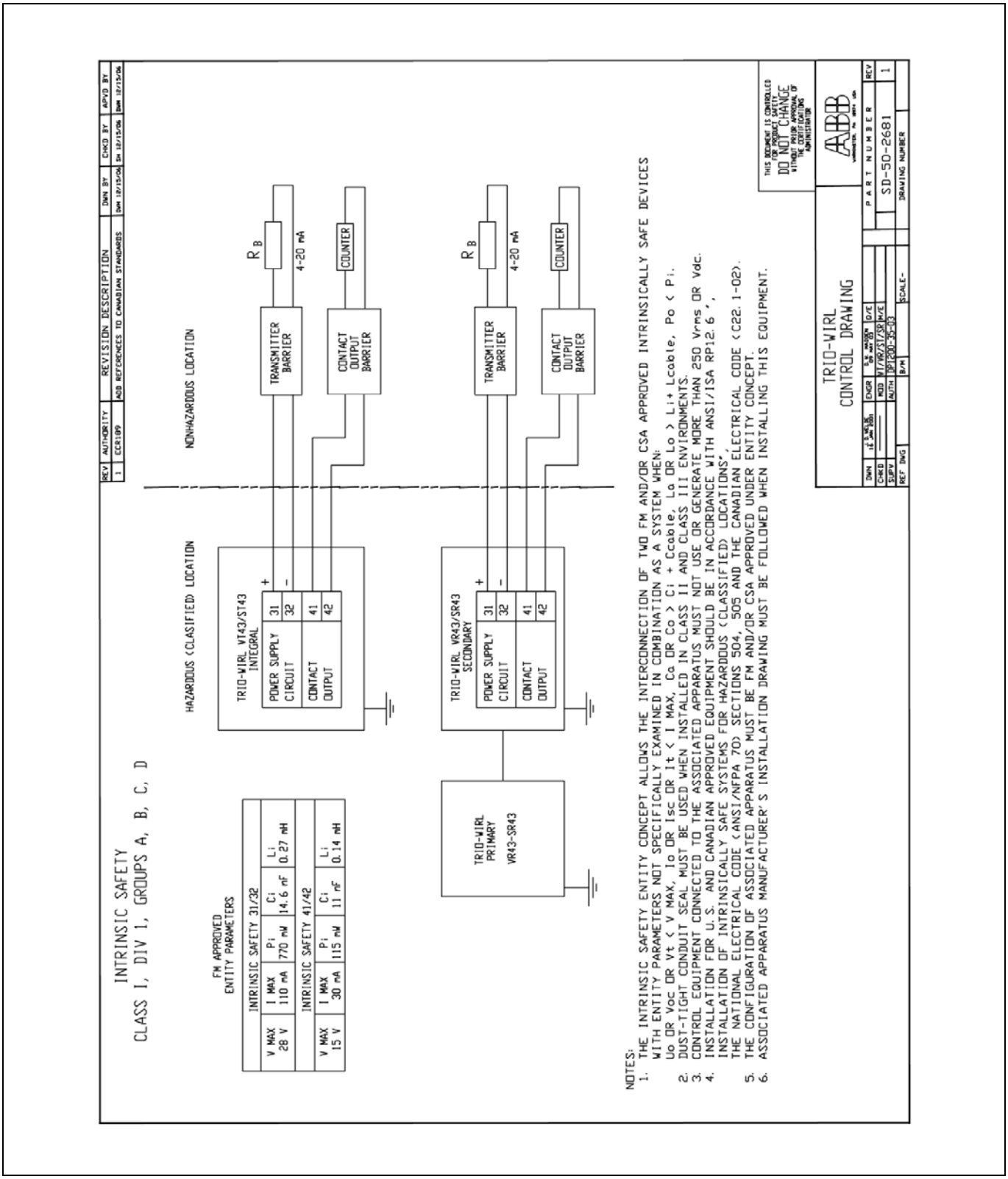


Fig. 56: Connection diagram and data VT43 / VR43 and ST43 / SR43

11.5 EEX "ia" design for VT4A/ST4A and VR4A/SR4A (fieldbus)

Important
The devices may only be operated in explosive areas if the housing covers have been fully closed.

EC type-examination test certificate
TÜV 01 ATEX 1771

Designation
II 2G EEx ia IIC T4
II 2D T85 °C ... T_{med} IP 67

The hazardous area design is based on the PTB's FISCO model (FISCO = fieldbus intrinsically safe concept).

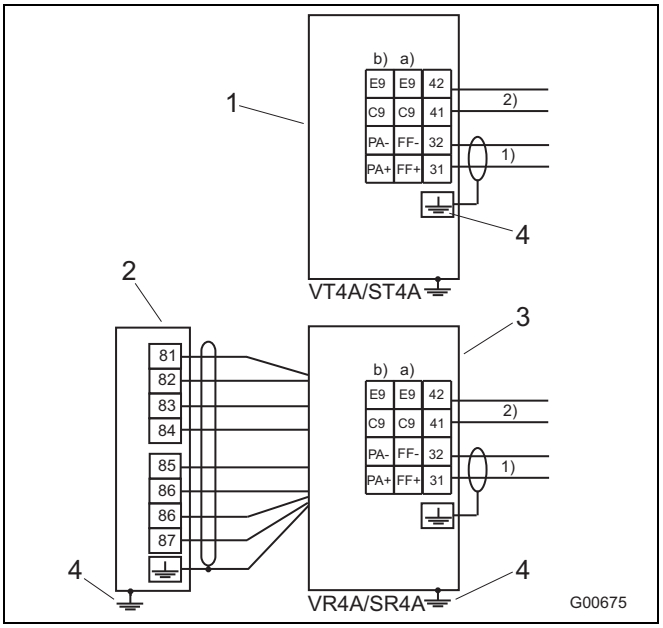


Fig. 57: Connection diagram for PROFIBUS PA interface connection

1 Flowmeter
2 Flowmeter sensor
3 Transmitter
4 Functional ground

Flowmeter sensor wire colors

Terminal	Wire color
81	Red
82	Blue
83	Pink
84	Gray
85	Yellow
86	Green
86	Brown
87	White

11.5.1 PROFIBUS PA electrical connection

1) Terminals 31, 32
Function PA+, PA-
Connection for PROFIBUS PA to IEC 1158-2
U = 9 –32 V, I = 10 mA (normal operation)
13 mA (in the event of an error / FDE)

2) Terminals 41, 42
Function C9, E9
Switching output: Function can be selected via software as a pulse output (fmax: 100 Hz, 1 ... 256 ms), min. / max. alarm or system alarm.
Configured as NAMUR contact to DIN 19234.
Closed: 1 KΩ
Open: > 10 KΩ

M12 plug-in connector

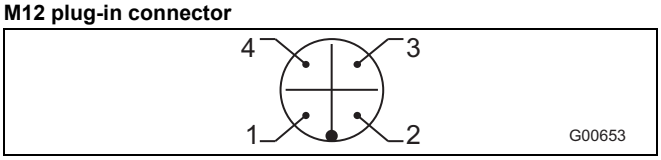


Fig. 58: Assignment for connection using optional M12 plug-in connector (view from the front looking at pin insert and pins)

Pin	Assignment
1	PA+ (31)
2	NC
3	PA- (32)
4	Shield

11.5.2 FOUNDATION Fieldbus electrical connection

1) Terminals 31, 32
Function FF+, FF-
Connection for FOUNDATION Fieldbus (H1) to IEC 1158-2
U = 9 – 32 V, I = 10 mA (normal operation)
13 mA (in the event of an error / FDE)

2) Terminals 41, 42
Function C9, E9
Switching output: Function can be selected via software as a pulse output (fmax: 100 Hz, 1 ... 256 ms), min. / max. alarm or system alarm.
Configured as NAMUR contact to DIN 19234.
Closed: 1 KΩ
Open: > 10 KΩ

Important
The installation instructions in accordance with EN 60079-14 must be complied with.
When commissioning the flowmeter, refer to EN 50281-1-2 regarding use in areas with combustible dust. After switching off the supply power, wait t > 2 minutes before opening the transmitter housing.

11.5.3 Approval data for hazardous areas

II 2D T 85 °C ... T_{med} IP 67 /
T_{amb} = -20 °C ... 60 °C

Power supply circuit	Terminals 31, 32
Type of protection	II 2G EEx ia IIC T4 / T_{amb} = (-40 °C) -20 ... 70 °C U_i = 24 V I_i = 380 mA P_i = 9.12 mW The effective internal capacitance and inductance are negligibly low.

Power supply circuit	Terminals 41, 42
Type of protection	II 2G EEx ia IIC T4 U_i = 15 V I_i = 30 mA P_i = 115 mW Effective internal capacitance: 3.6 nF Effective internal capacitance to ground: 3.6 nF Effective internal inductance: 0.14 mH

VR4A / SR4A only

Type of protection	II 2G EEx ia IIC T4
Piezo sensor	U_0 = 8.5 V
Terminals 85, 86, 86, 87	I_0 = 1,073 mA
Pt100 circuit, terminals 81, 82, 83, 84	P_0 = 2,280 mW

11.5.4 Medium temperatures / Temperature classes

For the supply circuit "Terminals 31, 32" and the switching outputs "Terminals 41, 42", cables suitable for temperatures up to T = 110 °C (T = 230 °F) can be used without restriction.

Category 2/3G

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the interconnection of both circuits needs to be taken into account in the event of a fault. Otherwise, the restricted temperature ranges listed in the following table shall apply.

Category 2D

For cables suitable only for temperatures up to T= 80 °C (T = 176 °F), the restricted temperature ranges listed in the following table shall apply.

Ambient temperature 2)	Max. temperature at used connecting cable, "Terminals 31, 32", "Terminals 41, 42"	Max. permissible medium temperature
(-40) -20 ... 70 °C ((-40) -4 ... 158 °F)	110 °C (230 °F)	280 °C / 400 °C 1) (536 °C / 752 °F) 1)
(-40) -20 ... 70 °C ((-40) -4 ... 158 °F)	80 °C (176 °F)	160 °C (320 °F)
(-40) -20 ... 60 °C ((-40) -4 ... 140 °F)		240 °C (464 °F)
(-40) -20 ... 55 °C ((-40) -4 ... 131 °F)		280 °C (536 °F)
(-40) -20 ... 50 °C ((-40) -4 ... 122 °F)		320 °C (608 °F) 1)
(-40) -20 ... 40 °C ((-40) -4 ... 104 °F)		400 °C (752 °F) 1)

1) Medium temperatures > 280 °C (> 536 °F) with FV4000 Vortex flowmeter only
2) The permissible limits for the ambient temperature are approval- and order-specific (standard: -20 °C (-4 °F)).

Maximum medium temperature	Temperature class
130 °C (266 °F)	T4
195 °C (383 °F)	T3
290 °C (554 °F)	T2
400 °C (752 °F)	T1

12 Specifications

12.1 Static overpressure in the case of fluids

To avoid cavitation, a static overpressure is required downstream of the flowmeter (downstream pressure). This can be estimated using the following formula:

$$p_2 \geq 1{,}3 \times p_{Dampf} + 2{,}6 \times \Delta p'$$

p_2 = Static overpressure downstream of the flowmeter (mbar)

p_{Dampf} = Steam pressure of fluid at operating temperature (mbar)

$\Delta p'$ = Pressure drop, medium (mbar)

12.2 Standard densities of selected gases

Gas	Standard density	
	kg/m^3	lb/ft^3
Acetylenes	1,172	0,07
Ammonia	0,771	0,05
Argon	1,780	0,11
Ethane	1,350	0,08
Ethylene	1,260	0,08
Butane	2,700	0,17
Natural gas	0,828	0,05
Carbon dioxide	1,970	0,12
Carbon monoxide	1,250	0,08
Air	1,290	0,08
Methane	0,717	0,04
Neon	0,890	0,06
Propane	2,020	0,13
Propylene	1,915	0,12
Oxygen	1,430	0,09
Nitrogen	1,250	0,08
Hydrogen	0,0899	0,01

Conversion of standard density (ρn) --> operating density (ρ)

$$\rho = \rho_n \times \frac{1{,}013 + \rho}{1{,}013} \times \frac{273}{273 + T}$$

12.3 Overload capability

Gases

15 % above maximum flow

Fluids

15 % above maximum flow (no cavitation permitted!)

12.4 Measured value deviation for flow measurement

Measured value deviation as a percentage of the measured value under reference conditions (including transmitter), linear measuring range upwards of Re min (see the table titled "Minimum Reynolds number").

	FV4000-VT4/VR4	FS4000-ST4/SR4
Fluids	≤ ± 0,75 %	± 0,5 %
Gases / Steam	≤ ± 1 %	

12.4.1 Minimum Reynolds number Re min for linear start of scale value

FV4000-VT4/VR4

Nominal size		Re min x 1,000	
DN	Inch	DIN	ANSI
15	1/2“	10	11
25	1“	20	23
40	1 1/2“	20	23
50	2“	20	22
80	3“	43	48
100	4“	33	44
150	6“	67	80
200	8“	120	128
250	10“	96	115
300	12“	155	157

FS4000-ST4/SR4

DN		Re min
15	1/2“	2100
20	3/4“	3500
25	1“	5200
32	1 1/4“	7600
40	1 1/2“	13500
50	2“	17300
80	3“	15000
100	4“	17500
150	6“	43000
200	8“	44000
300	12“	115000
400	16“	160000

12.4.2 Reproducibility as a percentage of the measured value

DN	Inch	FV4000-VT4/VR4	FS4000-ST4/SR4
15	1/2“	0,3 %	
25 ... 250	1“ ... 6“	0,2 %	
200 ... 300	8“ ... 12“	0,25 %	0,2 %

12.5 Measured value deviation for temperature

Measured value deviation (including transmitter)
± 2 °C

Reproducibility
≤ 0.2 % of measured value

Important
Please note the information in the section titled "Explosion protection".
Compliance with the permissible temperature range for the gaskets is mandatory.

	FV4000-VT4/VR4	FS4000-ST4/SR4
Standard	-55 ... 280 °C (-67 ... 536 °F)	
HT design	-55 ... 400 °C (-67 ... 752 °F)	-

12.6 Temperature of medium

12.7 Reference conditions for flow measurement

	FV4000-VT4/VR4	FS4000-ST4/SR4
Set flow range	0.5 ... 1 x QvmaxDN	
Ambient temperature	20 °C (68 °F) ± 2K	
Humidity	65 % rel. humidity ± 5 %	
Air pressure	86 ... 106 kPa	
Supply power	24 V DC	
Signal cable length	10 m (32.8 ft) (FV4000-VR or FS4000-SR only)	
Current output load	250 Ω (4 ... 20 mA only)	
Fluid for calibration	Air: 20 °C (68 °F), ambient pressure Water: approx. 20 °C (68 °F), 2 bar (29 psi)	
Calibration loop internal diameter	= internal diameter of meter	
Unobstructed straight upstream section	15 x DN	3 x DN
Downstream section	5 x DN	1 x DN
Pressure measurement	3 ... 5 x DN downstream of meter	
Temperature measurement	2 ... 3 x DN downstream after pressure measurement	

12.8 Process connections

	Flange design		Wafer flange design	
	Process connection	**Operating pressure**	**Process connection**	**Operating pressure**
FV4000-VT4/VR4	DN15 ... DN300	**O-ring gasket:** DIN PN 10 ... PN 40, option up to PN 160 ASME Class 150 / 300, option up to 900 lb **Flat gasket (graphite):** Maximum PN 64 / ASME Class 300 lb	DN25 ... DN150	**O-ring gasket:** DIN PN 64, option up to PN 100 ASME Class 150 / 300, option up to 600 lb **Flat gasket (graphite):** Maximum PN 64 / ASME Class 300 lb
FS4000-ST4/SR4	DN 15 ... DN 200 [1)]	DIN PN 10 ... PN 40 ASME Class 150/300	-	-
	DN 300 ... DN 400 [1)]	DIN PN 10 ... PN 16 ASME Class 150		

1) Other designs on request.

12.9 Materials

Component	Material	Temperature range	
		FV4000-VT4/VR4	FS4000-ST4/SR4
Flowmeter sensor	Material no. 1.4571, option: Hastelloy-C	-55°C ... 400°C (-67 ... 752°F)	-55°C ... 280°C (-67 ... 536°F)
Meter housing	Material no. 1.4571, option: Hastelloy-C		
Flange	Material no. 1.4571, option: Hastelloy-C		
Inlet/outlet pipes	Material no. 1.4571, option: Hastelloy-C		
Sensor	Material no. 1.4571, option: Hastelloy-C		
Sensor gasket [1)]	Kalrez (3018) O-ring	0 ... 280 °C (32 ... 536 °F)	0 ... 280 °C (32 ... 536 °F)
	Kalrez (6375) O-ring	-20 ... 275 °C (-4 … 527 °F)	20 ... 275 °C (68 … 527 °F)
	Viton O-ring	-55 ... 230 °C (-67 … 446 °F)	-55 ... 230 °C (-67 … 446 °F)
	PTFE O-ring	-55 ... 200 °C (-67 … 392 °F)	-55 ... 200 °C (-67 … 392 °F)
	Graphite	-55 ... 280 °C (-67 … 536 °F)	-55 ... 280 °C (-67 … 536 °F)
	Graphite special	-55 ... 400 °C (-67 ... 752 °F) (Hochtemperatur)	-
Housing, electronics	Cast aluminum, varnished		

1) Other designs on request.

12.10 Ambient conditions

Resistance to climate to DIN 40040

Permissible ambient temperature range

Explosion protection / Model	Temperature range
None /	-20 ... 70 °C (-4 … 158 °F)
VT40 and VR40 / ST40 and SR40	-55 … 70 °C (-67 … 158 °F)
Ex ib /	-20 ... 70 °C (-4 … 158 °F)
VT41 and VR41 / ST41 and SR41	-55 … 70 °C (-67 … 158 °F)
Ex ia /	-20 ... 60 °C (-4 … 140 °F)
VT4A and VR4A / ST4A and SR4A	-40 ... 60 °C (-40 … 140 °F)
Ex d /	-20 ... 60 °C (-4 … 140 °F)
VT42 and VR42 / ST42 and SR42	-40 ... 60 °C (-40 … 140 °F)
$C^{FM}{}_{US}$ / VT43 and VR43 / ST43 and SR43	-20 … 70 °C (-4 … 158 °F)

Permissible air humidity

Design	Humidity
Standard	Relative humidity max. 85 %, annual mean ≤ 65 %
Climate-proof	Relative humidity ≤ 100 % permanent

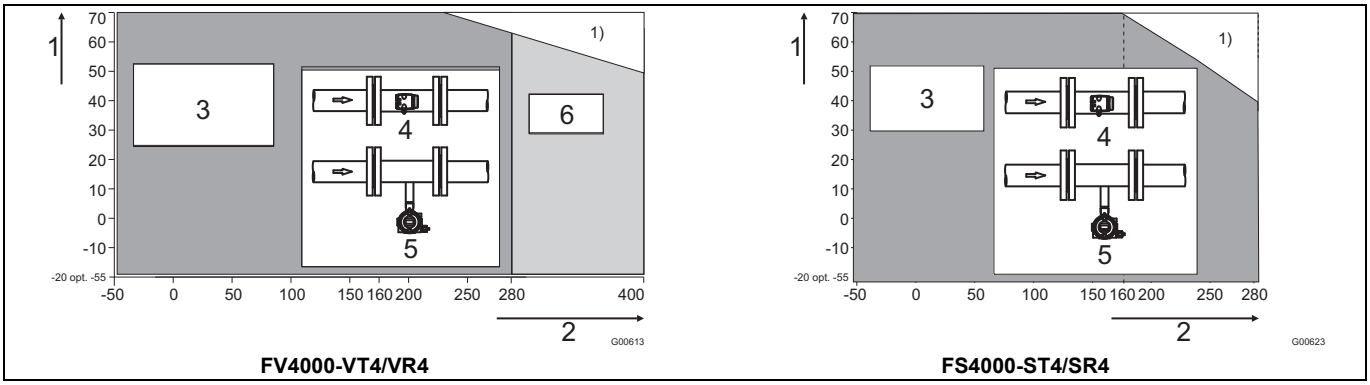


Fig. 59: Relationship between the temperature of the fluid and the ambient temperature

1 Ambient temperature
2 Fluid temperature
3 Permissible temperature range for standard design (≤ 280 °C (≤ 536 °F))
4 Side elevation of pipeline
5 Installation for fluid temperature > 150 °C (302 °F)
6 HT design (≤ 400 °C (≤ 752 °F))

1) For the supply circuit (terminals 31, 32) and switching outputs 41, 42, cables suitable for temperatures up to T = 110 °C (230 °F) may be used without restriction. Cables which are only suitable for temperatures up to T = 80 °C (176 °F) restrict the temperature ranges. These restrictions also apply for the VR model (remote mount design) and the PROFIBUS PA model with plug connector.

Important

The legibility of the display can be impaired at temperatures < 0 °C (< 32 °F) and > 55 °C (> 131 °F). The functionality of the meter and the outputs remains unaffected by this. Please refer to the order information for ambient temperatures < -20 °C (< -4 °F).

Please note the information in the section titled "Technical data for hazardous areas, transmitter".

12.10.1 Permissible operating pressures FV4000

Process connection DIN flange

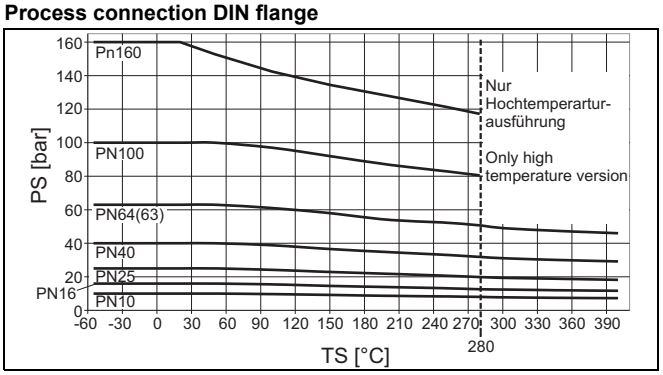


Fig. 60: High temperature design only, version FV4000 (TRIO-WIRL VT / VR)

PS Pressure (bar) TS Temperature (°C)

Process connection ASME flange

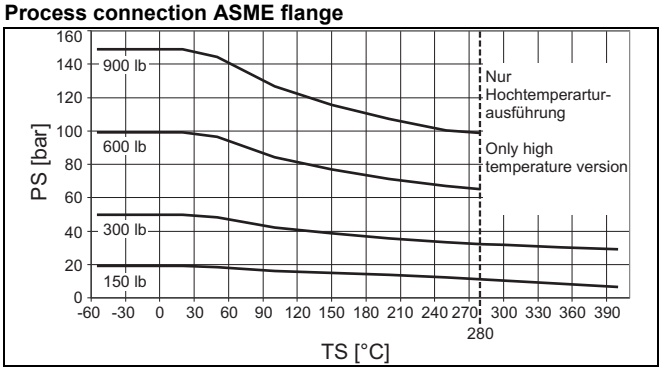


Fig. 61: High temperature design only, version FV4000 (TRIO-WIRL VT / VR)

PS Pressure (bar) TS Temperature (°C)

Aseptic flange to DIN 11864-2

- DN 25 to DN 40:
  PS = 25 bar to TS = 140 °C if suitable gasket materials are selected
- DN 50 and DN 80:
  PS = 16 bar to TS = 140 °C if suitable gasket materials are selected

Process connection DIN wafer

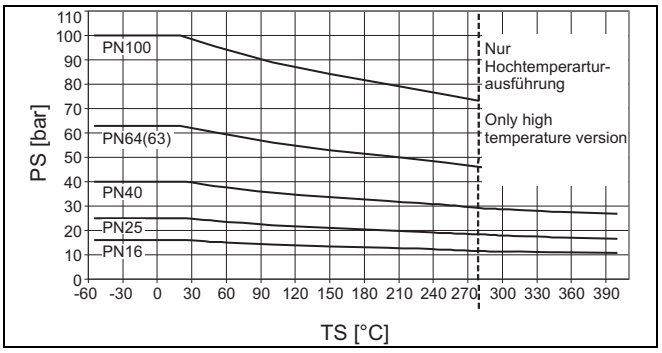


Fig. 62: High temperature design only

PS Pressure (bar) TS Temperature (°C)

Process connection ASME wafer

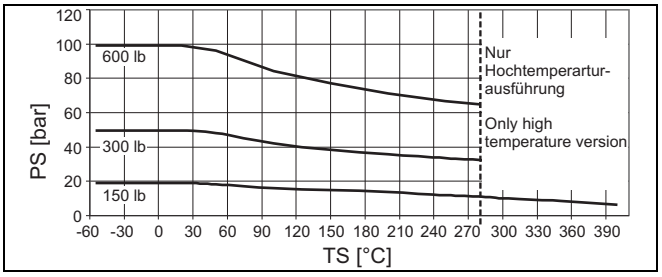


Fig. 63: High temperature design only

PS Pressure (bar) TS Temperature (°C)

12.10.2 Permissible operating pressures FS4000

Process connection DIN flange

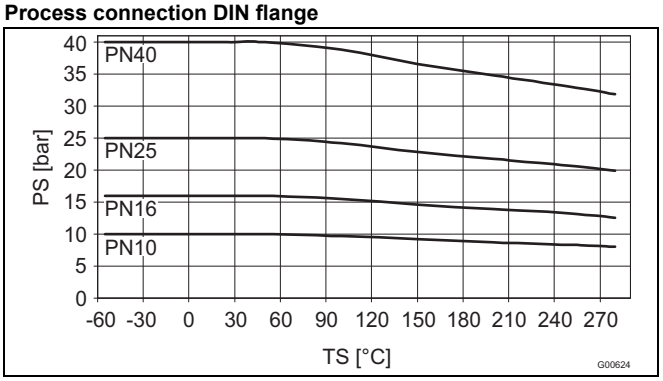


Fig. 64

PS Pressure (bar) TS Temperature (°C)

Process connection ASME flange

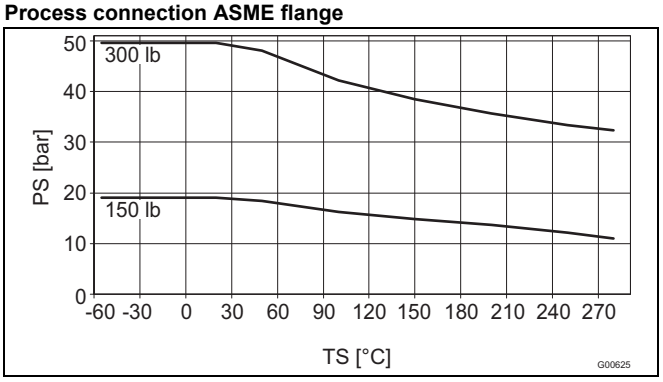


Fig. 65

PS Pressure (bar) TS Temperature (°C)

12.11 Transmitter

12.11.1 General specifications

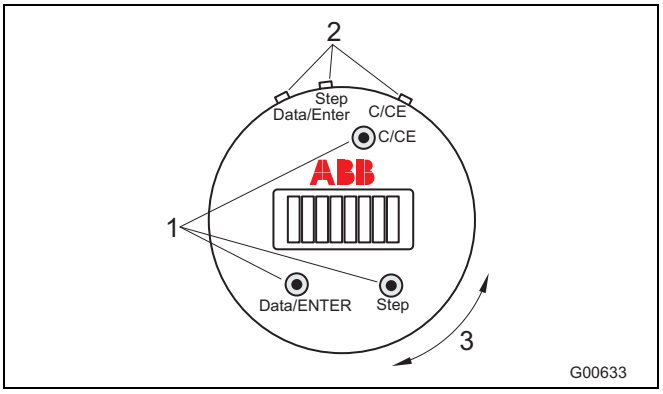


Fig. 66: Transmitter keypad and display

1 Magnet sensors
2 Buttons for direct entry
3 Can be rotated +/- 90 °

Measuring ranges

The full-scale value can be set at any point between the maximum possible upper range value 1.15 x Q_{maxDN} and 0.15 x Q_{maxDN}.

Parameter setting

Data can be entered using 3 buttons (not on the Ex "d" hazardous area design) or, if the housing is sealed, directly externally using a magnet stick.

Data is entered in plain text with the display or using digital communication via the HART protocol or PROFIBUS PA/FOUNDATION Fieldbus.

Flow operating modes

The following operating modes can be selected dependent upon the design purchased (with or without Pt100):

Fluid medium:

- Operating flow
- Mass flow with constant or temperature-dependent density

Gas/steam medium:

- Operating flow
- Mass flow with constant or temperature-dependent density (at constant pressure)
- Standard flow with constant or temperature-dependent standard factor (at constant pressure)
- Mass flow with saturated steam and temperature-driven density

Data backup

Counter readings and parameters for specific measuring points backed up in FRAM (more than 10 years without supply power) in the case of shutdown or should the supply voltage fail.

Important

The flowmeter corresponds to NAMUR recommendations NE21. Electromagnetic compatibility of equipment for process and lab control technology 5/93 and EMC Directive 89/336/EEC (EN 50081-1, EN 50082-2). Note: EMC protection and protection against accidental contact are limited when the housing cover is open.

Damping

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

$Q_{V\ min}$ (low flow)

Configurable between 0 ... 10 % of Q_{maxDN} (max. operating flow per nominal size). The actual low flow is determined by application and installation.

Function tests

Software-internal function tests can be used to test individual internal modules. For the purpose of commissioning and testing, the current output (4 ... 20 mA design) or the digital output signal (fieldbus designs) can be simulated in line with flowrates selected by the user (manual process control). The switching output can also be controlled directly for the purpose of function testing.

Electrical connection

Screw-type terminals, plug-in connection on PROFIBUS PA (option) cable gland: -standard., Ex "ib" / Ex "ia": M20 x 1.5; NPT 1/2 " -Ex d": NPT 1/2"

Degree of protection

IP 67 to EN 60529

Display

High contrast LCD, 2 x 8 digits (4 ... 20 mA design) or 4 x 16-digit (PROFIBUS PA / FOUNDATION Fieldbus fieldbus design). Shows the instantaneous flowrate along with the totalized flow or temperature of the medium (option).

On the 4 ... 20 mA design, the multiplex function enables 2 values (e.g., flowrate and totalized flow) to be displayed virtually in parallel. Up to 4 values can be displayed on the fieldbus design.

Switching output terminals 41 / 42
(standard on all designs)

The function can be selected via the software:

- Max./min. alarm for flow or temperature
- System alarm
- Pulse output: f_{max}: 100 Hz; t_{on}: 1 ... 256 ms

Contact type:

- Standard and Ex "d": Optocoupler U_H = 16 ... 30 V
  I_L = 2 ... 15 mA
- Ex "ib" / Ex "ia": Configured as NAMUR contact

Error message on the display

Automatic system monitoring with error diagnostics in plain text on the display and an error message.

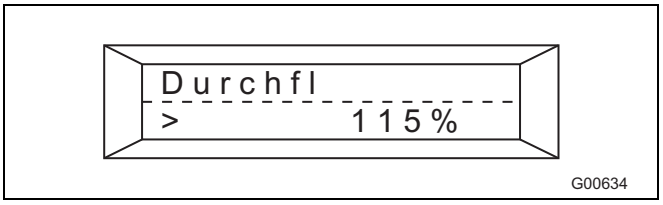


Fig. 67

Examples

The illustration shows the display on the 4 ... 20 mA design.

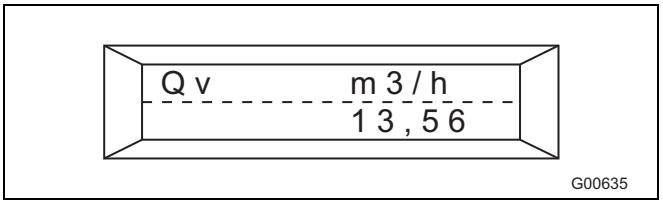


Fig. 68: Operating flow

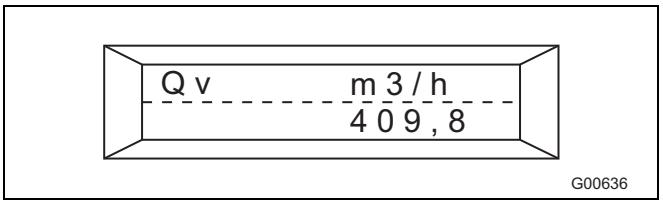


Fig. 69: Totalized operating flow

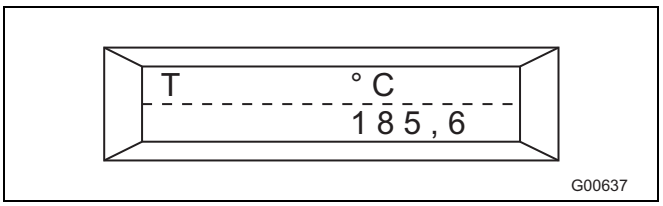


Fig. 70: Temperature of medium

13 Appendix

13.1 Additional documents

- Data sheet (D184S035Uxx)

Important

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

www.abb.de/durchfluss

13.2 Approvals and certifications

CE mark	CE	The version of the meter in your possession meets the requirements of the following European directives: - ATEX directive 94/9/EC - EMC directive 89/336/EEC - Pressure equipment directive (PED) 97/23/EC Pressure equipment does not receive a CE mark indicating PED compliance on the factory tag in the event of the following conditions prevailing: - The maximum permissible pressure (PS) is less than 0.5 bar - Due to low pressure risks (meter size ≤ DN 25 / 1") no approval procedures are required.
Explosion Protection	Ex IECEx FM C US APPROVED	Identification for intended use in potentially explosive atmospheres according to: - ATEX directive - IEC standards - $_{c}FM_{us}$ Approvals for Canada and United States

EG-Konformitätserklärung
EC-Certificate of Compliance

Hiermit bestätigen wir die Übereinstimmung der
Herewith we confirm that our

TRIO-WIRL Durchflußmesser
TRIO-WIRL Flowmeter

Modell VT41.; VT42.; ST41.; ST42.; VR41.; VR42.; SR41.; SR42.
Model VT41.; VT42.; ST41.; ST42.; VR41.; VR42.; SR41.; SR42.

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 TRIO-WIRL Durchflußmesser dienen zur Messung des Durchflusses von Gasen, Dämpfen und Flüssigkeiten.
The TRIO-WIRL Fowmeters are utilized to meter the flowrate of gases, steam or liquids.

EG-Baumusterprüfbescheinigung: *EC-Type Examination Certificate:*	TÜV 08 ATEX 554808 X; TÜV 08 ATEX 554955 X
Konformitätsaussage: Conformity Declaration	TÜV 08 ATEX 554833 X; TÜV 08 ATEX 554956 X
Benannte Stelle: *Notified Body:*	TÜV Hannover/Sachsen-Anhalt e.V., Kennummer 0044
Geräte-Kennzeichnung: *Apparatus code:*	II 2G Ex d [ib] IIC T6 bzw. II 2G Ex ib IIC T4 bzw. II 3G Ex nA[nL] IIC T4 bzw. II 3D Ex tD A22 T85°C …T_{Medium} *II 2G Ex d [ib] IIC T6 or II 2G Ex ib IIC T4 or II 3G Ex nA[nL] IIC T4 or II 3D Ex tD A22 T85°C … T_{Medium}*
Sicherheitstechnische Daten: *Safety values:* Angewandte Normen: *Standards:*	siehe EG-Baumusterprüfbescheinigung *refer to EC-Type Examination Certificate* und siehe Konformitätsaussage. *and refer to Conformity Declaration.*

Göttingen, 20. November 2008

BZ-13-8019, Rev01, 12165

ppa.
Unterschrift / *Signature*
Dr. Dieter Binz
Innovation Manager DEAPR Instrumentation

i. A.
Unterschrift / *Signature*
Dipl. Ing. Karl-Heinz Rackebrandt
R&D Manager Sensors

ABB Automation Products GmbH

Postanschrift:
Dransfelder Str. 2
D-37079 Göttingen

Besuchsanschrift:
Dransfelder Str. 2
D-37079 Göttingen
Telefon +49 (0) 551 905 0
Telefax+49 (0) 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

Vorsitzender des Aufsichtsrats:
Hans-Georg Krabbe
Geschäftsführung:
Christian Wendler

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

EG-Konformitätserklärung
EC-Certificate of Compliance

Hiermit bestätigen wir die Übereinstimmung der
Herewith we confirm that our

TRIO-WIRL Durchflußmesser
TRIO-WIRL Flowmeter

Modell V_4A.; S_4A. "Feldbus"
Model V_4A.; S_4A. "Fieldbus"

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 TRIO-WIRL Durchflußmesser dienen zur Messung des Durchflusses von Gasen, Dämpfen und Flüssigkeiten.
The TRIO-WIRL Flowmeters are utilized to meter the flowrate of gases, steam or liquids.

EG-Baumusterprüfbescheinigung: *EC-Type Examination Certificate:*	TÜV 01 ATEX 1771	
Benannte Stelle: *Notified Body:*	TÜV Hannover/Sachsen-Anhalt e.V., Kennummer 0032	
Geräte-Kennzeichnung: *Apparatus code:*	II 2G EEx ia IIC T4 *II 2G EEx ia IIC T4*	Feldbus PA/FF (FISCO) *Fieldbus PA/FF (FISCO)*
Sicherheitstechnische Daten: *Safety values:*	siehe EG-Baumusterprüfbescheinigung TÜV 01 ATEX 1771 *refer to EC-Type Examination Certificate TÜV 01 ATEX 1771*	
Angewandte Normen: *Standards:*	EN 50 014: 1997 EN 50 020: 1994	

Göttingen, 27. November 2001

i. V.

Unterschrift / *Signature*

BZ-13-8014, Rev.1, 4101

ABB Automation Products GmbH

Postanschrift: D-37070 Göttingen
Besuchsanschrift: Dransfelder Str. 2 D-37079 Göttingen
Telefon: +49(0)551 905-0
Telefax: +49(0)551 905-777
http://www.abb.de/automation
USt-IdNr.: DE 115 300 087
Sitz der Gesellschaft: Eschborn
Registergericht: Amtsgericht Frankfurt/Main
Handelsregister: HRB 49651
Vorsitz des Aufsichtrates: Bengt Pihl
Geschäftsführung: Uwe Alvardt (Vorsitz) Burkhard Block Erik Huggare
Commerzbank AG Frankfurt
Konto: 569 035 200
BLZ: 500 400 00

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

Herewith we confirm that the listed instruments are in compliance with the council directives of the European Community. The safety and installation requirements of the product documentation must be observed.

Modell: *Model:*	VT4... VR4... ST4... SR4...	
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *	
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-1, 3/93 *	EN 50081-2, 3/94 * EN 50082-2, 2/96 *

* einschließlich Nachträge
including alterations

Göttingen, 15.05.2000

.....
Unterschrift / Signature

BZ-13-5029, Rev.1, 1699

ABB Automation Products GmbH

Postanschrift:
D-37070 Göttingen

Besuchsanschrift:
Dransfelder Str. 2
D-37079 Göttingen

Telefon:
+49(0)551 905-0
Telefax:
+49(0)551 905-777
http://www.abb.de/automation
USt-IdNr.: DE 115 300 097

Sitz der Gesellschaft:
Göttingen
Registergericht:
Göttingen
Handelsregister:
HRB 423

Vorsitz des Aufsichtrates:
Bengt Pihl
Geschäftsführung:
Uwe Alwardt (Vorsitz)
Burkhard Block
Erik Huggare

Commerzbank AG Frankfurt
Konto: 589 835 200
BLZ: 500 400 00

EG-Konformitätserklärung
EC-Declaration of Conformity

CE 0045

Hiermit bestätigen wir die Übereinstimmung des aufgeführten Gerätes mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
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: *manufacturer:*	ABB Automation Products GmbH, 37070 Göttingen - Germany
Modell: *model:*	V_4.. *V_4..*
Richtlinie: *directive:*	Druckgeräterichtlinie 97/23/EG *pressure equipment directive 97/23/EC*
Einstufung: *classification:*	Ausrüstungsteile von Rohrleitungen *piping accessories*
Normengrundlage: *technical standard:*	AD 2000 Merkblätter
Konformitätsbewertungsverfahren: *conformity assessment procedure:*	B1 (EG-Entwurfsprüfung) + D (Qualitätssicherung Produktion) *B1 (EC design-examination) + D (production quality assurance)*
EG-Entwurfsprüfbescheinigungen: *EC design-examination certificates:*	Nr. 07 202 0124 Z 0052/2/0003 Nr. 07 202 0124 Z 0413/2/0001
benannte Stelle: *notified body:*	TÜV Nord e.V. Rudolf-Diesel-Str. 5 37075 Göttingen - Germany
Kennnummer: *identification no.*	0045

Göttingen, den 21.10.2002

ppa .....
(B.Kammann, Standortleiter APR Göttingen)

BZ-25-0003 Rev.03

2310

EG-Konformitätserklärung
EC-Declaration of Conformity

CE 0045

Hiermit bestätigen wir die Übereinstimmung des aufgeführten Gerätes mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
Herewith we confirm that the listed instrument is in compliance with the council directives of the European Community and are marked with the CE markíng. The safety and installation requirements of the product documentation must be observed.

Hersteller: *manufacturer:*	ABB Automation Products GmbH, 37070 Göttingen - Germany
Modell: *model:*	S_4.. *S_4..*
Richtlinie: *directive:*	Druckgeräterichtlinie 97/23/EG *pressure equipment directive 97/23/EC*
Einstufung: *classification:*	Ausrüstungsteile von Rohrleitungen *piping accessories*
Normengrundlage: *technical standard:*	AD 2000 Merkblätter
Konformitätsbewertungsverfahren: *conformity assessment procedure:*	B1 (EG-Entwurfsprüfung) + D (Qualitätssicherung Produktion) *B1 (EC design-examination) + D (production quality assurance)*
EG-Entwurfsprüfbescheinigung: *EC design-examination certificate:*	Nr. 07 202 0124 Z 052/2/0004
benannte Stelle: *notified body:*	TÜV Nord e.V. Rudolf-Diesel-Str. 5 37075 Göttingen - Germany
Kennnummer: *identification no.*	0045

Göttingen, den 21.05.2002

ppa .....
(K.Wiskow, Personalleiter APR Göttingen)

13.3 Overview of technical design and setting parameters

Measuring point:	TAG no.:
Sensor model:	
Order no.	Device no.:
Medium:	Voltage supply:

Parameter		Setting range
Prog. protection code:		0-9999 (0=factory setting)
Language:		
Nominal size:		DN 15 - 400
Operating mode:		
Q_{max}		0.15 Q_{max} DN to 1.15 Q_{max} DN
Standard factor:		0.001 - 1,000 (operating density / standard density)
Reference density:		
Density unit:		g/ml, g/cm3, g/l, kg/l, kg/m3, lb/ft3, lb/ugl
Unit Q_{vol}		l/s, l/min, l/h, l/d, m³/s, m³/min, m³/h, m³/d, ft3/s, ft3/m, ft3/h, ft3/d, bbl/s, bbl/min, bbl/h, bls/d, Usgps, USgpm, USgph, Usmgd, igps, igpm, igph, igpd
Unit Q_m		kg/s, kg/min, kg/h, kg/d, t/min, t/h, t/d, g/s, g/min, g/h, lb/s, lb/min, lb/h, lb/d
Unit totalizer:		l, m³, igal, USgal, ft3, bbl, kg, t, g, lb
Max. alarm:		%
Min. alarm:		%
Pulse factor:		0.001 to 1,000 pulse/phys. unit
Pulse width:		0.100 - 2,000 ms
Low flow (Q_{min}):		2 - 10 % of flow range upper range value
Damping:		0.5 - 99.99 seconds
1st display line:		Q (%), Q (unit), totalizer, temperature
2nd display line:		Q (%), Q (unit), totalizer, temperature
2nd multiplex line:		ON / OFF

Communication:	☐ HART protocol	
	☐ PROFIBUS PA	☐ FOUNDATION Fieldbus FF

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:	E-mail:

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

14 Index

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www.abb.com/flow

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

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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