Operating Instruction

D184B105U02

Field^IT

Electromagnetic Flowmeter FXE4000 (COPA-XE/MAG-XE) with Pulsed DC Magnetic Field Excitation

Industrial^IT enabled

Valid for Software Versions B.12
Valid for HART-Software Versions X.30
ModelsFXE4000-DE41 / FXE4000-DE43
FXE4000-DE21 / FXE4000-DE23

HART® FIELD COMMUNICATIONS PROTOCOL

PROFIBUS PROCESS FIELD BUS

Fieldbus Foundation

ABB

Instrument Designation
FXE4000

Operating Instruction

Part No. D184B105U02

Issue date: 04.04
Revision: 02

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1 Safety Information

1.1 Basic Safety Requirements

1.1.1 Safety Standards for the Instrument

- This instrument complies with the safety requirements of the Pressure Equipment Directive and state of the art technology. It was tested and shipped from our factory in a safe operating condition. In order to maintain this condition during operation, the requirements listed in this Operation Manual must be observed and followed.
- The instrument satisfies the EMC-Requirements in EN61326 / NAMUR NE21.
- When a power interruption occurs, all instrument parameters are stored in a NVRAM. After the power is restored, the instrument is ready for operation immediately.

1.1.2 Regulated Usage

This instrument is to be used for

- transporting the flowrate of electrically conductive liquids, slurries or sludges and metering:
- the volumetric flow or
- the mass flow (at constant density) when mass engineering units have been selected

The regulated usages include:

- installation within the specification limits
- observing and following the information in the Operation Manual
- observing and following the information in the accompanying documentation (Specifications, Diagrams, Dimensions)

The following usages of the instrument are not permissible:

- operation as an elastic compensation member in the pipeline, e.g. to compensate for pipe misalignment, pipeline vibrations, pipeline expansions, etc.,
- use as a climbing support, e.g. for assembly purposes,
- use as a support for external loads , e.g. support for the pipeline, etc.,
- material addition by painting over the factory tag or adding parts by welding or soldering
- material removal, e.g., by drilling into the housing
- repairs, modifications and expansions and the use of replacement parts is only permissible as described in the Operation Manual. Extensive activities must be approved by us. Excepted are repairs made in locations authorized by ABB. For unauthorized activities we accept no liability.

The operation and maintenance requirements in this Operation Manual must be observed. For damage resulting from improper or non-regulated usage the manufacturer assumes no liability.

1.1.3 Specification Limits

The instrument is to be used exclusively within the limits specified on the factory tag and listed in the Operation Manual. The following limits are to be observed:

- The allowable pressure (PS) and the allowable fluid temperature (TS) may not exceed the pressure/temperature values (p/T-ratings) listed in this Operation Manual.
- The max. and min. operating temperatures listed in the instrument specifications may not be exceeded.
- The allowable ambient temperature listed in the instrument specifications may not be exceeded.
- The Protection Class is IP 67 or IP 68 per EN60529.
- Graphite may not be used for the gaskets because, under certain conditions it may be possible that an electrically conductive coating may form on the interior of the meter pipe.
- The flowmeter may not be installed near strong electromagnetic fields, e.g. motors, pumps, transformers. A minimum distance of 100 mm should be maintained. For installations on or to steel parts (e.g. steel supports) a minimum distance of approx. 100 mm should be maintain. **(Values were determined based on IEC801-2 or IEC TC 77B (SEC 101))**.

1.1.4 Allowable Fluids

- Only such fluids should be metered for which assurance is available, either based on state of the art technology or past experience by the user, that the required chemical and physical resistance of the materials of the fluid wetted parts (electrodes, grounding electrodes, liner, process connections, grounding plates or protection plates) will not be adversely affected during the operating life of the instrument.
- Fluids with unknown characteristics may only be metered if the user initiates a regular and suitable inspection program to assure the safe condition of the instrument.
- The specifications on the factory tag are to be observed.

1.1.5 Safety Marks, Symbols, Type and Factory Tags and CE-Mark

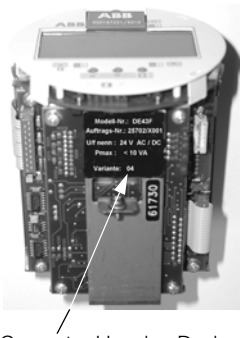
All safety marks, symbols and the factory and type tags should be maintained in a readable state and protected from damage or loss. Note the following generalized information:

	**Warning!**	Information indicating that a risk or danger exists which could result in serious or fatal injuries to personnel.
	**Caution!**	Information indicating a possible dangerous situation. If not corrected, the product or something in its vicinity may damaged.
	**Information!**	The Information symbol is a user tip or other particularly important information, which if ignored could result in loss of operating ease or affect the instrument functionality.
	**CE-Mark**	The CE-Mark identifies compliance of the instrument with the following guidelines and the satisfying the basic safety directives: • CE-Mark on the type tag (on the converter) – Compliance with the EMC-Directive 89/336/EWG – Compliance with the Low Voltage Directive 73/23/EWG • CE-Mark on the factory tag (on the flowmeter primary) – Compliance with the Pressure Equipment Directive PED/DGRL) 97/23/EU Pressure equipment will not have a CE-Mark on the factory tag if: – the max. allow, pressure (PS) is less than 0.5 bar. – there are minimal pressure risks (meter sizes ≤ DN 25 [1"]). For this equipment a certification procedure is not required – instruments used as water meters in Water/Waste Water facilities. Applies to sizes >DN 600 [24”].

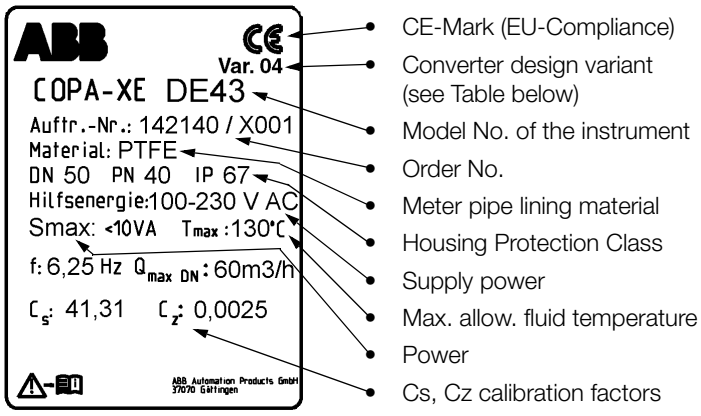
1.1.6 Type and Factory Tags

1.1.6.1 Type Tag Specifications

The type tag is located on the converter housing.



Converter Housing Design Variant



The identification of the converter design may be found on the tag on the metal frame of the converter (see Figure), or on the factory tag on the converter housing.

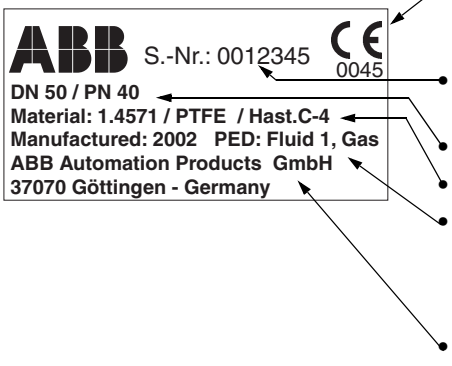
Variant 01	Current output + pulse output active + contact input + contact output
Variant 02	Current output + pulse output active + contact input + contact output + HART Protocol
Variant 03	Current output + pulse output passive + contact input + contact output
Variant 04	Current output + pulse output passive + contact input + contact output + HART Protocol
Variant 05	Current output + pulse output passive + contact output + RS485
Variant 06	Pulse output passive + contact output + PROFIBUS DP
Variant 14	PROFIBUS PA 3.0
Variant 15	FOUNDATION Fieldbus
Variant 16	PROFIBUS PA 3.0 (with M12 plug)

1.1.6.2 Factory Tag Specifications

The factory tag is located on the flowmeter primary housing. There are two different factory tags dependent on whether the instrument falls into the applicability range of the PED, (see also Sect. 3 Par. 3 PED/DGRL 97/23/EU), :

a) Pressure Equipment within the Applicability Range of PED/DGRL

The factory tag contains the following specifications:



- CE-Mark (with the number identifying the testing agency) to certify compliance of the instrument with the requirements of the Pressure Equipment Directive 97/23/EU.
- Serial number provided by the manufacturer to identify the pressure equipment.
- Meter size and pressure rating of the pressure equipment
- Flange, liner and electrode materials (fluid wetted).
- Year of manufacture of the pressure equipment and specification of the Fluid Group per PED/DGRL (Pressure Equipment Directive) Fluid Group 1 = hazardous liquids, gases
- Manufacturer of the pressure equipment.

b) Pressure Equipment not within the Applicability Range of PED/DGRL

The factory tag includes essentially the same specifications as the one described in a) above with the following differences:

- There is no CE-Mark for the pressure equipment per Sect. 3 Par. 3 of the PED/DGRL because the pressure equipment is not within the applicability range of the Pressure Equipment Directive 97/23/EU.
- In the PED the basis for the exception is given in Sect. 3 Par. 3 of the PED/DGRL. The pressure equipment is categorized under the section SEP (=Sound Engineering Practice).

1.1.7 Qualification of the Personnel

- The electrical installation, start-up and maintenance of the instrument should only be carried out by trained personnel authorized by the system operator. The personnel must read and understand the Operation Manual and follow its instructions.

1.1.8 Responsibilities of the Operator

- Before metering corrosive or abrasive fluids the operator must evaluate the resistance of the fluid wetted parts. ABB will gladly provide assistance in their selection, but cannot assume any liability.
- Observe the national standards in your country applicable to testing the operation, repair and maintenance of electrical instruments.

1.1.9 Possible Dangers When Transporting the Instruments

Note when transporting the instrument to the installation site:

- the center of gravity may be off-center.
- the protection plates or caps mounted on the process connections for PTFE/PFA lined meters should only be removed just prior to installing the instrument in the pipeline.
- care must be exercised to assure that the liner is not cut off or damaged during installation to avoid leaks.

1.1.10 Possible Dangers During Installation

Before installing assure that:

- the flow direction corresponds with the arrow on the instrument, if present.
- the maximum torque vales are observed for all flange bolts.
- the instrument is installed in a stress free manner (torsion, bending), flanged and wafer design instruments are installed with axisymmetric, parallel mating flanges and gaskets are used that are suitable for the anticipated operating conditions.

1.1.11 Possible Dangers During Electrical Installation

The electrical installation is to be completed only by authorized trained personnel in accordance with the Interconnection Diagrams.

- In particular observe the information regarding the electrical connections in this Operation Manual, otherwise the electrical protection type may be adversely affected.
- Ground the flowmeter system.

Attention!

When the housing cover is removed, EMC and personnel protection are no longer provided.

- There are circuits inside the housing which are dangerous to touch. Therefore, before opening the housing cover the supply power should be turned off.
- Installation and maintenance tasks may only be performed by trained personnel.

1.1.12 Possible Dangers During Normal Operation

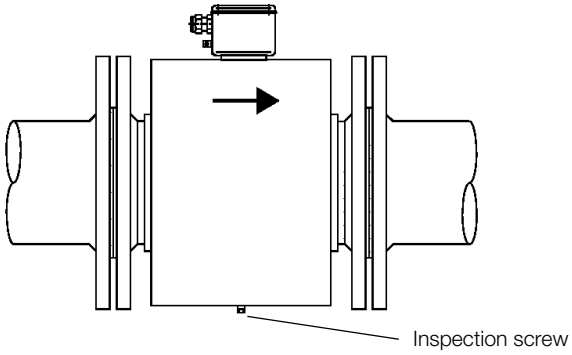
- When metering hot fluids, touching the flowmeter primary surface could cause burns.
- Aggressive or corrosive fluids could cause damage to the liner or electrodes resulting is unexpected leakage of fluid under pressure.
- Due to fatigue of the flange or process connection gaskets (e.g. Food Industry fittings, Tri-Clamp etc.) leaks of the fluid under pressure could occur.
- The internal flat gaskets in Models DE21 and DE23 can be come brittle due to the CIP/SIP process.

1.1.13 Possible Dangers During Inspection and Maintenance

- Before removing the instrument assure that the instrument and the adjacent piping or tanks have been depressurized.
- Before removing the instrument, check if the instrument was used to meter dangerous fluids. It may be possible that hazardous residues may still be present in the instrument which could exit when the meter is uninstalled.
- We recommend when pipeline vibrations exist to secure the flange bolts and nuts against loosening.
- Within the framework of user responsibilities, perform a regular inspection of the instrument including:
  - the pressure containing walls/liners of the pressure equipment
  - the proper metering function
  - the seal integrity
  - wear (corrosion)

Warning!

- The inspection screw (for blowing out condensate) in instruments ≥ DN 350 [14"] may be under pressure. Fluid may squirt out and cause severe injuries.
- If the instrument fails, it is possible that hazardous fluids may exit when the cover is removed. Make sure that the pipeline is depressurized before opening the cover. .



1.1.14 Returns

- If it is necessary to return the instrument for repair or recalibration to the ABB factory in Goettingen, Germany, use the original packaging material or a suitably protective packing material. Please indicate the reason for the return.

Information! EU-Hazardous Material Directives

The owner of special wastes is responsible for its decontamination and must satisfy the following requirements before shipping the materials:

- All flowmeter primaries and/or flowmeter converters which are returned to ABB for repair are to be free of any hazardous materials (acids, bases, solvents, etc.). This includes flushing and decontaminating the hazardous materials which may be present in the cavities in the primaries between the meter pipe and the housing. For flowmeter primary sizes ≥ DN 350 [14"] the inspection screw (for blowing out condensate) in the lower section of the housing is to be removed so that and hazardous materials may be decontaminated or to flush the area of the coils and electrodes to neutralize it. Written confirmation that these measures have been carried out should accompany the flowmeter.
- If the user cannot completely remove the hazardous materials, then appropriate documents should accompany the shipment acknowledging this condition. Any costs incurred by ABB to remove and decontaminate the hazardous materials during the repair will be billed to the owner of the instrument.

2 Principle of Operation, Flowmeter Primary and Converter Coordination

2.1 Principle of Operation

The electromagnetic flowmeters (EMF) from ABB Automation Products are the ideal flowmeters for metering the flow of all liquids, slurries and sludges that have a specific minimum electrical conductivity. These flowmeters measure accurately, create no additional pressure drop, contain no moving or protruding parts, are wear free and corrosion resistant. Installations are possible in any existing piping system.

The ABB Automation Products EMF has proven itself over many decades and is the preferred flowmeter in the Chemical, Pharmaceutical and Cosmetic industries, Municipal Water and Waste Water treatment facilities and in the Food and Paper industries.

2.2 Measurement Principle

Faraday's Laws of Induction form the basis for the electromagnetic flowmeter which states that a voltage is generated in a conductor as it moves through a magnetic field.

This principle is applied to a conductive fluid which flows through the meter tube perpendicular to the direction of the magnetic field (see Schematic).

$$U_E \sim B \cdot D \cdot V$$

The voltage induced in the fluid is measured by two electrodes located diametrically opposite to each other. This signal voltage $\mathbf{U_E}$ is proportional to the magnetic induction **B**, the electrode spacing **D** and the average flow velocity **v**. Noting that the magnetic induction **B** and the electrode spacing **D** are constant values indicates that a proportionality exists between the signal voltage $\mathbf{U_E}$ and the average flow velocity **v**. From the equation for calculating the volume flowrate*) $\mathbf{U_E} \sim \mathbf{q_v}$, it follows that the signal voltage is linear and proportional to the volumetric flowrate.

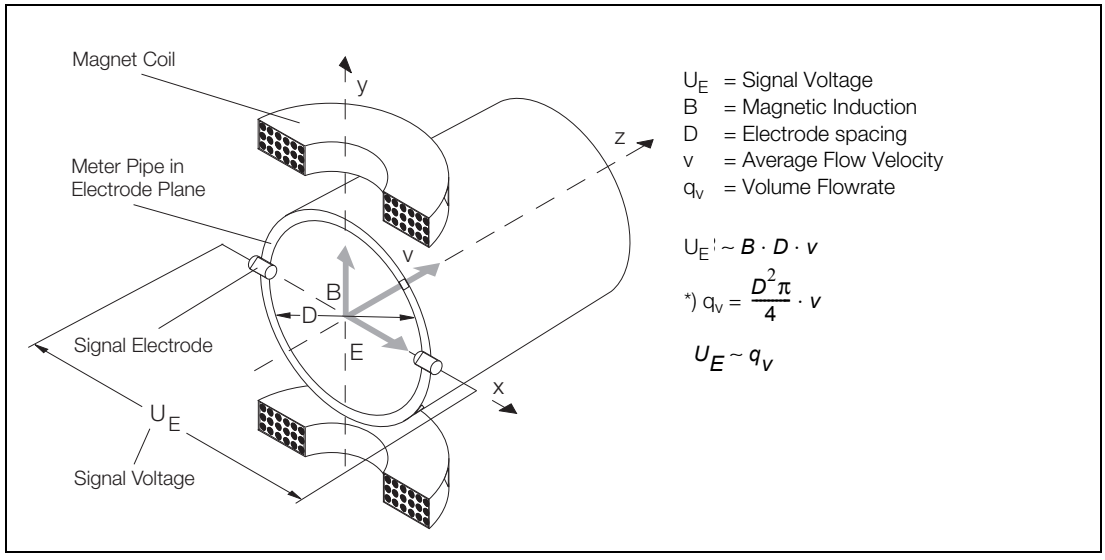
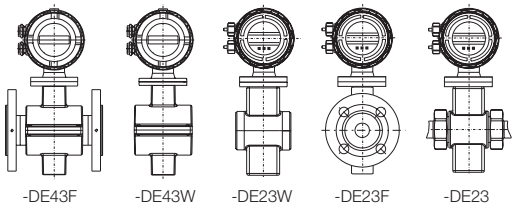
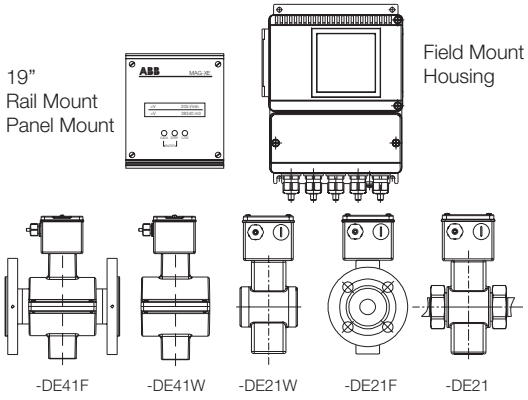


Fig. 1: Schematic of an Electromagnetic Flowmeter

2.3 Design

An electromagnetic flow metering system consists of a flowmeter primary and a converter. The flowmeter primary is installed in the specified pipeline while the converter can be mounted locally (MAG-XE_) or at a central location. In the Compact Design (COPA-XE_) the flowmeter primary and converter constitute a single entity.

2.4 Flowmeter Primary and Converter Coordination

Compact Design FXE4000 (COPA-XE)	**Remote Design FXE4000 (MAG-XE)**
The µP-converter and the flowmeter primary constitute a single mechanical entity. Flowmeter primary with Aluminum housing: Models FXE4000-DE43F and FXE4000-DE43W Flowmeter primary with a stainless steel housing: Model FXE4000-DE23_	The µP-converter is mounted remote from the flowmeter primary. Cable lengths up to 50 m are permitted for conductivities above 5 µS/cm. The electrical interconnection between the converter and flowmeter primary are made in connection boxes using a single signal cable. Flowmeter primary with Aluminum housing: Models FXE4000-DE41F and FXE4000-DE41W Flowmeter primary with a stainless steel housing: Model FXE4000-DE21_
FXE4000 (COPA-XE)  -DE43F -DE43W -DE23W -DE23F -DE23 Flanged Wafer Design Multiple Process Connections Stainless Steel	**FXE4000 (MAG-XE)**  19" Rail Mount Panel Mount Field Mount Housing -DE41F -DE41W -DE21W -DE21F -DE21 Flanged Wafer Design Multiple Process Connections Stainless Steel

3 Assembly and Installation

3.1 Inspection

Before installing the electromagnetic flowmeter system, check for mechanical damage due to possible mishandling during shipment. All claims for damage are to be made promptly to the shipper before installing the flowmeter.

3.2 Transport General

Note when transporting the instrument to the meter installation site:

- the center of gravity may be off-center.
- the protection plates or caps mounted on the process connections for PTFE/PFA lined meters should only be removed just prior to installing the instrument in the pipeline.
- care must be exercised to assure that the liner is not cut off or damaged during installation to avoid leaks
- flanged meters should not be lifted by the converter housing or connection box.
- when transporting flanged instruments ≤ DN 300 [12”] please use lifting straps and position them around both process connections (Fig. 2). Chains are to be avoided since they might damage the housing.

Warning!

The center of gravity of the complete instrument may be above the lifting points of the straps. Injury may result if the instrument moves! Assure that the instrument does not unintentionally slip or rotate during transport.

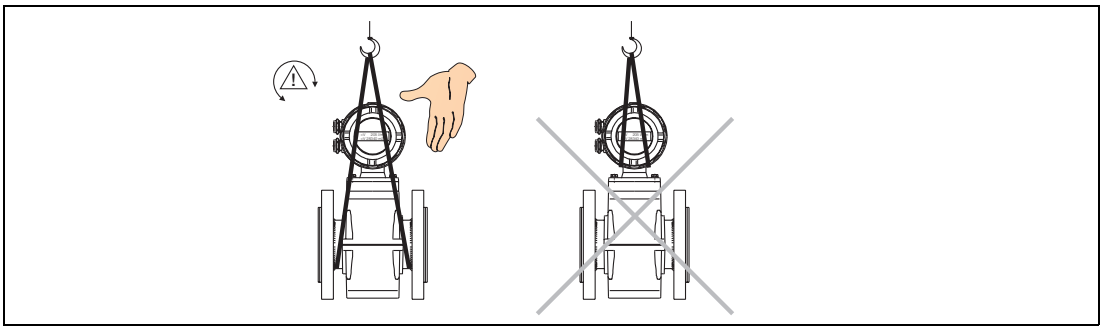


Fig. 2: Transport of Flanged Instruments ≤ DN 300 [12”]

3.2.1 Transport of Flanged Instruments ≥ DN 350 [14"] [14”]

Flanged instruments may not be lifted by the connection box. Exclusively use the lifting eye bolts on the instrument to lift and position the flowmeter in the pipeline.

Attention!

Do not lift using a fork truck in the middle of the housing for flanged meters. The housing could be crushed and the internal coils may be damaged.

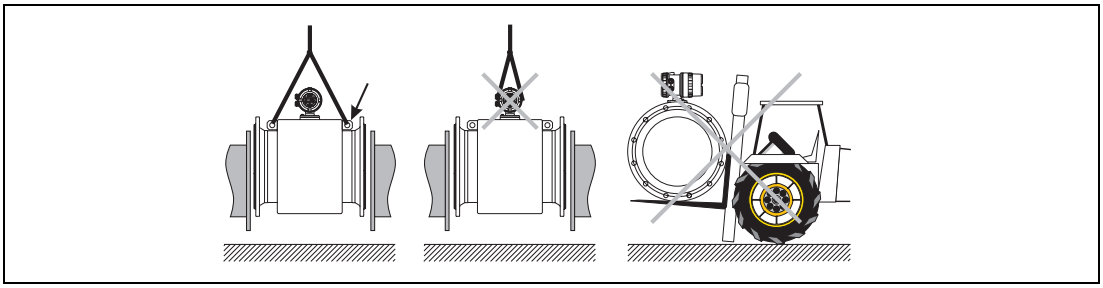


Fig. 3: Transport of Flanged Instruments ≥ DN 350 [14"] [14”]

3.2.2 Foundation and Supports ≥ DN 350 [14"]

These instruments must be set on appropriate foundations on supports.

Attention!

The instruments may not be set directly on the sheet metal housing drum without supports, otherwise the coils inside the housing could be damaged.

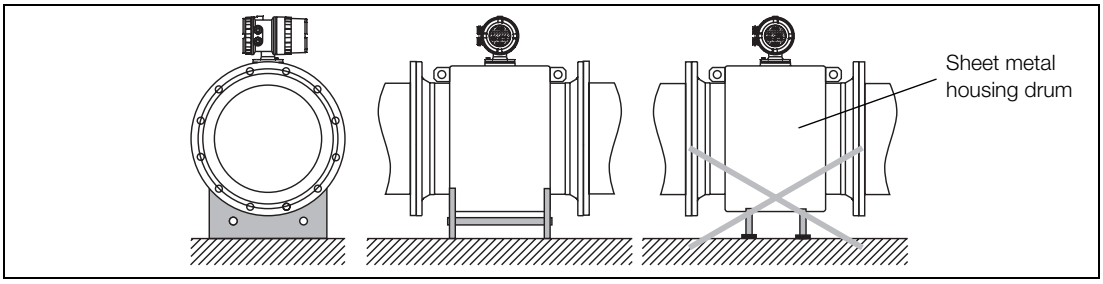


Fig. 4: Supports for Flowmeter Sizes ≥ DN 350 [14"]

3.2.3 Installation Requirements

During installation assure that:

- the flow direction agrees with the flow arrow - if present - on the flowmeter primary.
- all flange bolts are tightened to the max. torque value.
- instrument is installed without mechanical stresses (torsion, bending), the mating flanges for flanged/ wafer designs are axisymmetrical and parallel and that appropriate gaskets are used.
- gasket do not extend into the flow area as this might cause eddies which could affect the accuracy of the instrument.
- the pipeline does not cause any unallowable forces or moments on the instrument.
- the display faces the user.
- the protective plugs in the cable connectors should only be removed when the cables are installed.
- the remote mounted converter (MAG-XE) is installed in an essentially vibration free location.
- the converter is not exposed to direct sunlight (provide a sun protector).

3.2.4 Recommended Installation Conditions

- Meter pipe must always be completely filled.
- Electrode axis should be horizontal if at all possible or no more that 45° from horizontal (Fig. 5)
- Slight pipeline slope for degassing see Fig. 6
- Vertical Installations when abrasion may be present, flowrate upward, max. 3 m/s (Fig. 7)
- Valves and shut of devices should be installed downstream
- For free flow in- and outlet, provide invert as required, to assure that the pipeline is always full (Fig. 8)
- For free outflow do not install instrument at the highest point or in the drop line (meter pipe may drain, air bubbles), (Fig. 9.)

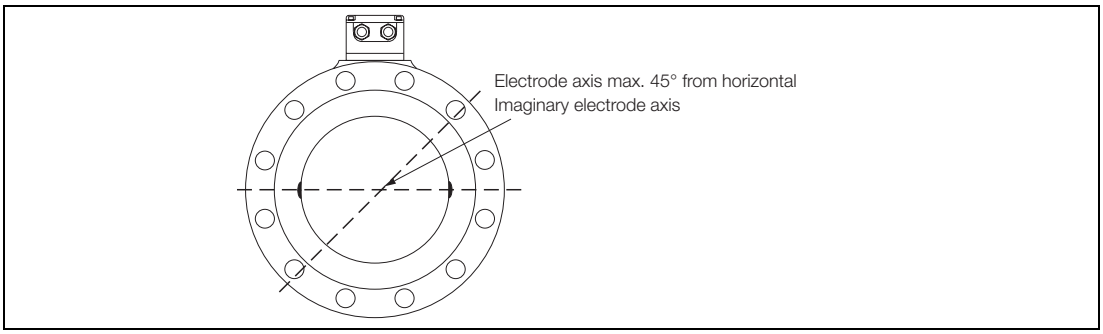


Fig. 5:

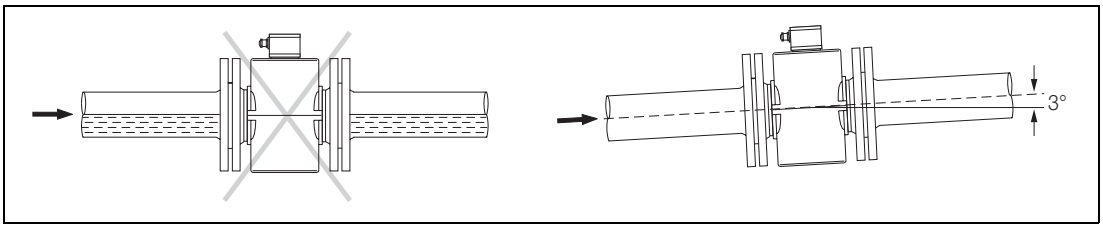


Fig. 6: Installation in Horizontal Pipeline

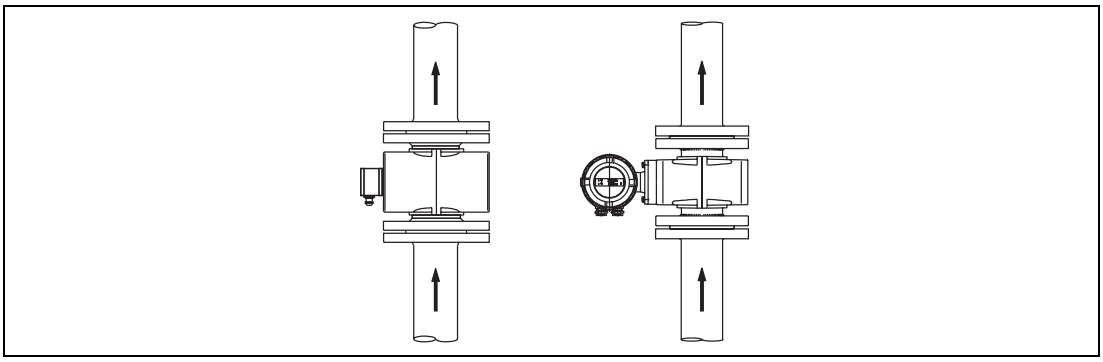


Fig. 7: Installation in Vertical Pipeline

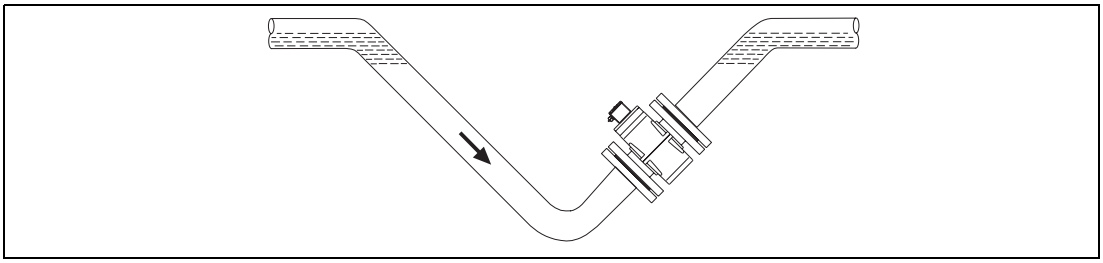


Fig. 8:

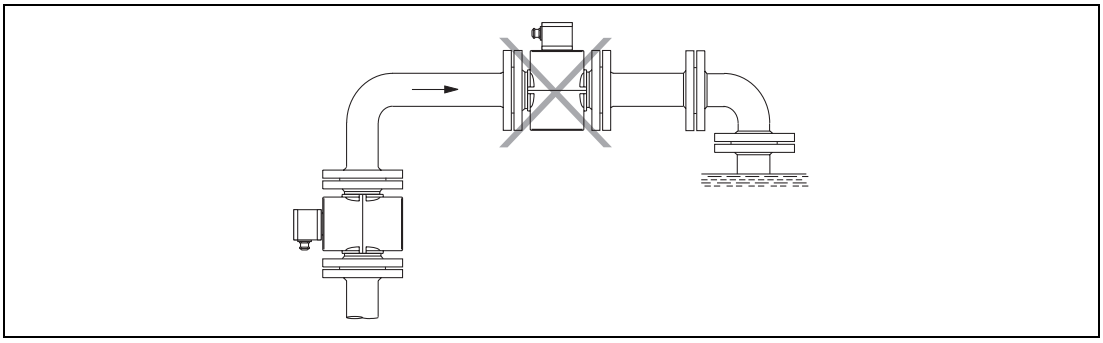


Fig. 9:

3.2.5 In- and Outlet Straight Sections

The measurement principle is independent of flow profile as long as standing eddies do not extend into the measurement region (e.g. after double elbows, tangential inflows or half open valves upstream of the flowmeter primary). In such situations measures to condition the flow are required. Experience indicates that in most cases a straight upstream section with a length of 3 x D and a downstream section of 2 x D length are sufficient (D = flowmeter primary size) Fig. 10. For calibration stands the reference conditions of EN 29104 require straight lengths of 10 x D upstream and 5 x D downstream.

Instruments for certified custody transfer applications special requirements apply (see Section 3.2.10).

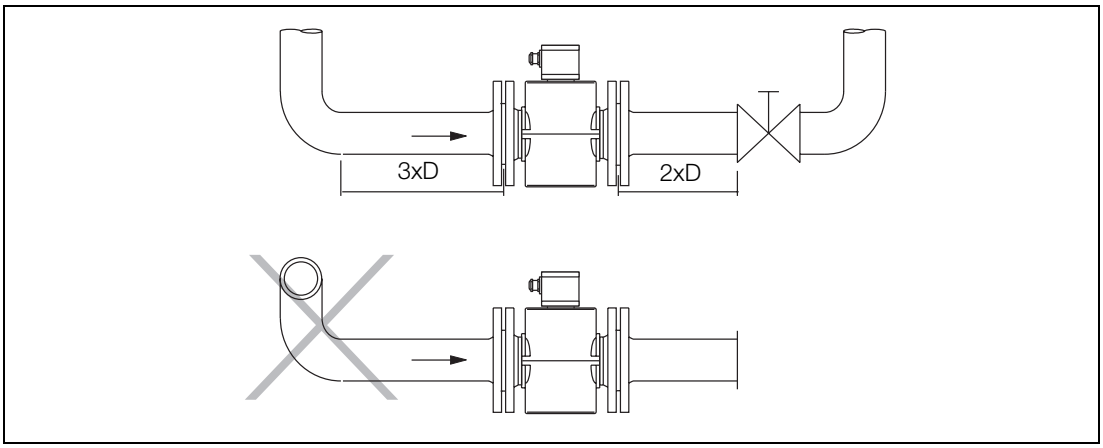


Fig. 10:

Wafer valves are to be installed in such a manner that the wafer, when open, does not extend into the flowmeter. Valves or other shut off devices should be installed downstream.

For highly contaminated fluids a bypass line Fig. 11, is recommended so that the during mechanical cleaning system operation need not be interrupted.

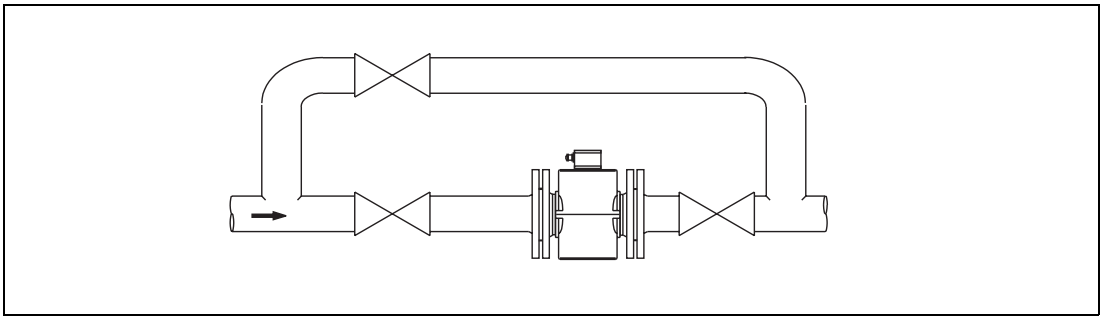


Fig. 11:

For flowmeter primaries which are to be installed in the vicinity of pumps or other vibration generating equipment, the utilization of mechanical snubbers is advantageous (Fig. 12).

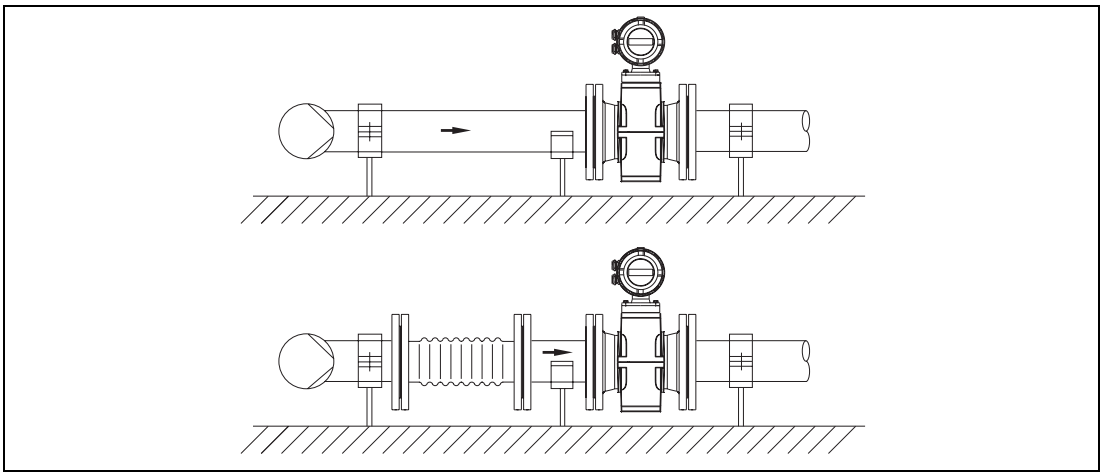


Fig. 12:

3.2.6 Installation of the Flowmeter Primary

The electromagnetic flowmeter can be installed at any arbitrary location in the pipeline as long as the installation requirements are satisfied (see 3.2.3).

When selecting the installation site consideration should be given to assure that moisture cannot enter into the electrical connection or converter areas. Make certain to carefully seat the gaskets and secure the covers after installation and start-up have been completed. Tighten the cable connectors.

The protective plugs in the cable connectors should only be removed when the cables are ready for installation.

The flowmeter primaries sizes DN 3 to DN 8 [1/10" to 5/16"] in the flanged design have a DN 10 [3/8"] connection flange. The diameter reduction to DN 3, 4, 6 or 8 [1/10", 5/32", 1/4" or 5/16"] is incorporated in the instrument.

As an option, flowmeter primaries sizes DN 3 to DN 8 [1/10" to 5/16"] are also available with a DN 15 [1/2"] connection flange.

Information!

Graphite may not be used for the flange or process connection gaskets because, it might be possible, that under certain conditions, an electrically conductive coating could form on the interior of the meter pipe. Vacuum shocks in the pipeline should be avoided to prevent possible damage to the liners (PTFE) and destruction of the instrument.

Gasket Surface on the Mating Flanges

In every installation it is essential that the material used for the gaskets for the parallel mating flanges is suitable for the fluid and the operating conditions. Only in this way will leaks be avoided. To assure optimum measurement results assure that the flowmeter primary gaskets are correctly centered on the flanges.

Protection Plates

The protection plates are designed to prevent damage to the liners. They should not be removed until the meter is ready to be installed in the pipeline. Care must be exercised to assure that the liner is not cut off or damaged during installation to avoid leaks.

Flange Bolt Tightening Torque

The mounting bolts are to be tightened equally in the usual manner without excessive one-sided tightening. We recommend that the bolts be greased prior to tightening and that they be tightened in a crisscross pattern as shown in Fig. 13. Tighten the bolts during the first pass to approx. 50 %, during the second pass to approx. 80 % and only during the third pass to 100 % of the max. torque value. The max. torque values should not be exceeded, see the table below.

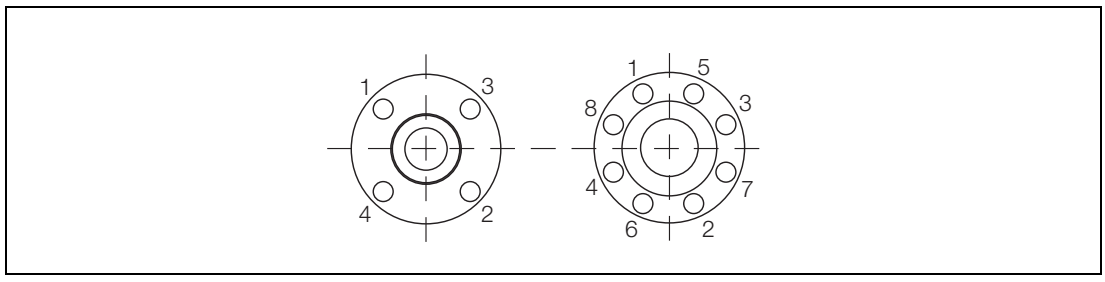


Fig. 13:

3.2.7 Torque Values

3.2.7.1 Torque Specifications for Flanged Instruments

Liner	Meter Size DN	Meter Size Inch	Process Connection	Bolts	Torque max. Nm	Press. Rating bar
PFA/PTFE/Hard rubber	3-10	1/10-3/8	Flange or	4 x M12	8	40
	15	1/2	Wafer Design	4 x M12	10	40
	20	3/4		4 x M12	16	40
	25	1		4 x M12	21	40
	32	1-1/4		4 x M16	34	40
	40	1-1/2		4 x M16	43	40
	50	2		4 x M16	56	40
	65	2-1/2		8 x M16	39	40
	80	3		8 x M16	49	40
	100	4		8 x M16	47	16
PTFE/Hard rubber	125	5	Flange	8 x M16	62	16
	150	6		8 x M20	83	16
	200	8		12 x M20	81	16
	250	10		12 x M24	120	16
	300	12		12 x M24	160	16
	350	14		16 x M24	185	16
	400	16		16 x M27	250	16
PTFE/Hard rubber	500	20	Flange	20 x M24	200	10
	600	24		20 x M27	260	10
	700	28		24 x M27	300	10
	800	32		24 x M30	390	10
	900	36		28 x M30	385	10
	1000	40		28 x M33	480	10

Table 1

3.2.7.2 Torque Specifications for Wafer Design Instruments and Variable Process Connections

Liner	Meter Size DN	Meter Size Inch	Bolts	Torque max. Nm	Press. Rating bar
PFA	3 - 8	1/10-5/16	4 x M12	2.3	40
PFA	10	3/8	4 x M12	7.0	40
	15	1/2	4 x M12	7.0	40
	20	3/4	4 x M12	11.0	40
	25	1	4 x M12	15.0	40
	32	1-1/4	4 x M16	26.0	40
	40	1-1/2	4 x M16	33.0	40
	50	1	4 x M16	46.0	40
	65	2-1/2	8 x M16	30.0	40
	80	3	8 x M16	40.0	40
	100	4	8 x M20	67.0	40

Table 2

3.2.8 Installations in Larger Size Pipelines

The flowmeter can readily be installed in larger size pipe lines by using of reducers. The pressure drop resulting from the reduction can be determined using the Nomograph Fig. 14 using the following procedure:

1. Calculate the diameter ratio d/D.

2. Calculate the flow velocity as a function of the meter size and the flowrate.
   The flow velocity can also be determined from the Flow Rate Nomograph (Fig. 15).

3. The pressure drop can be read on the -Y- axis at the intersection of the flow velocity curve and the "Diameter Ratio d/D" value on -X- axis in Fig. 14.

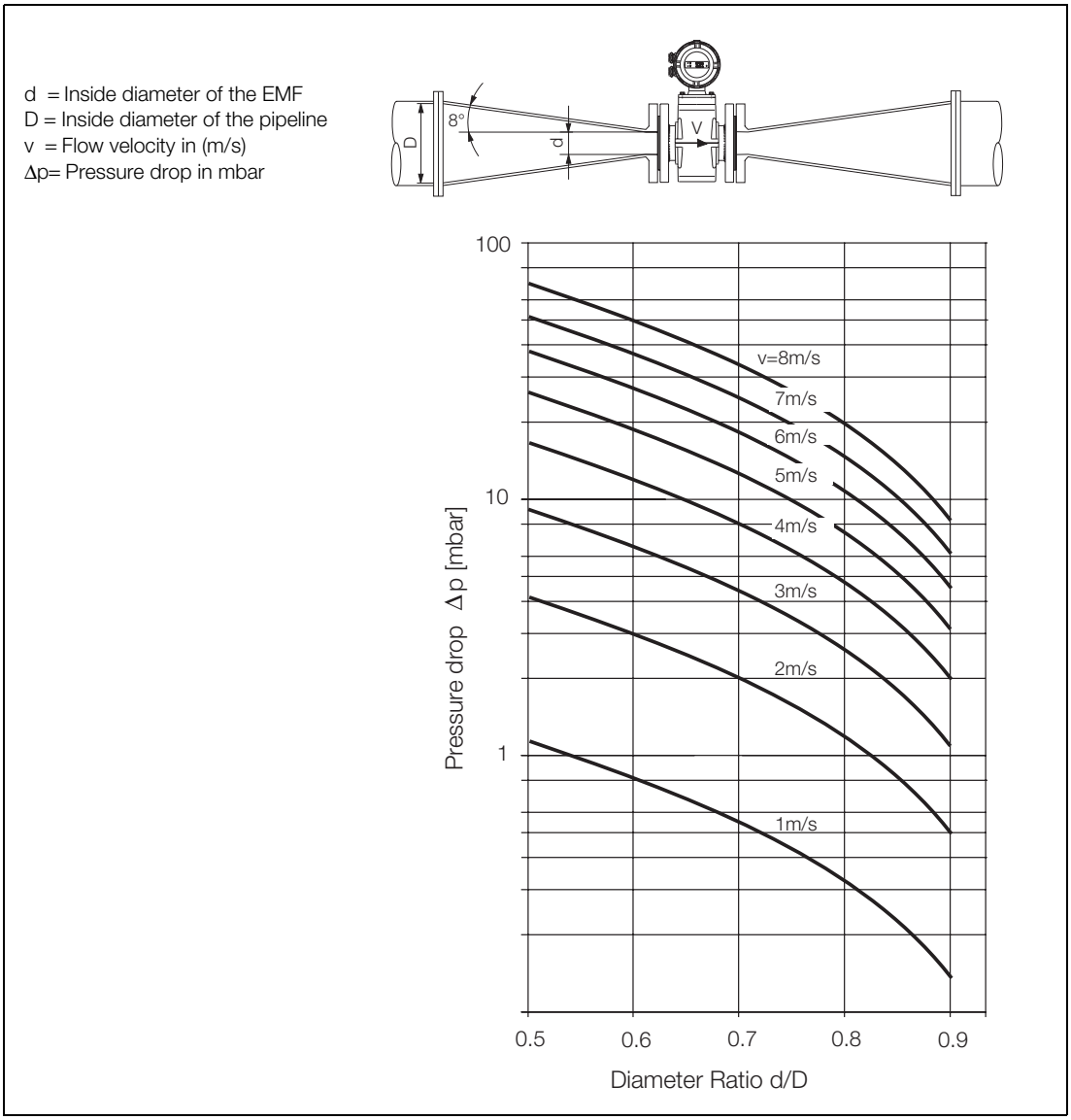


Fig. 14: Nomograph for Pressure Drop Determination for EMF with Flanged Reducers, a/2 = 8°

3.2.9 Meter Sizes, Pressure Ratings and Flow Ranges

Meter Size DN	Meter Size Inch	Std. Press. Rating PN	Min. Flow Range 0 to 0.5 m/s Flow Velocity	Max. Flow Range 0 to 10 m/s Flow Velocity
3	1/10	40	0 to 0.2 l/min	0 to 4 l/min
4	5/32	40	0 to 0.4 l/min	0 to 8 l/min
6	1/4	40	0 to 1 l/min	0 to 20 l/min
8	5/16	40	0 to 1.5 l/min	0 to 30 l/min
10	3/8	40	0 to 2.25 l/min	0 to 45 l/min
15	1/2	40	0 to 5.0 l/min	0 to 100 l/min
20	3/4	40	0 to 7.5 l/min	0 to 150 l/min
25	1	40	0 to 10 l/min	0 to 200 l/min
32	1-1/4	40	0 to 20 l/min	0 to 400 l/min
40	1-1/2	40	0 to 30 l/min	0 to 600 l/min
50	2	40	0 to 3 m^3/h	0 to 60 m^3/h
65	2-1/2	40	0 to 6 m^3/h	0 to 120 m^3/h
80	3	40	0 to 9 m^3/h	0 to 180 m^3/h
100	4	16	0 to 12 m^3/h	0 to 240 m^3/h
125	5	16	0 to 21 m^3/h	0 to 420 m^3/h
150	6	16	0 to 30 m^3/h	0 to 600 m^3/h
200	8	10/16	0 to 54 m^3/h	0 to 1080 m^3/h
250	10	10/16	0 to 90 m^3/h	0 to 1800 m^3/h
300	12	10/16	0 to 120 m^3/h	0 to 2400 m^3/h
350	14	10/16	0 to 165 m^3/h	0 to 3300 m^3/h
400	16	10/16	0 to 225 m^3/h	0 to 4500 m^3/h
450	18	10/16	0 to 300 m^3/h	0 to 6000 m^3/h
500	20	10	0 to 330 m^3/h	0 to 6600 m^3/h
600	24	10	0 to 480 m^3/h	0 to 9600 m^3/h
700	28	10	0 to 660 m^3/h	0 to 13200 m^3/h
800	32	10	0 to 900 m^3/h	0 to 18000 m^3/h
900	36	10	0 to 1200 m^3/h	0 to 24000 m^3/h
1000	40	10	0 to 1350 m^3/h	0 to 27000 m^3/h

Flowrate Nomograph

The flowrate is a function of the flow velocity of the fluid and the size of the flowmeter. The Flowrate Nomograph shows the flow ranges for each of the different flowmeter sizes as well as the flowmeter sizes suitable for a specific flow range.

Example:

Flowrate = 7 m^3/h (maximum flowrate = flow range end value). Suitable are flowmeter sizes DN 20 to DN 65 [3/4" to 2-1/2"] for flow velocities between 0.5 and 10 m/s.

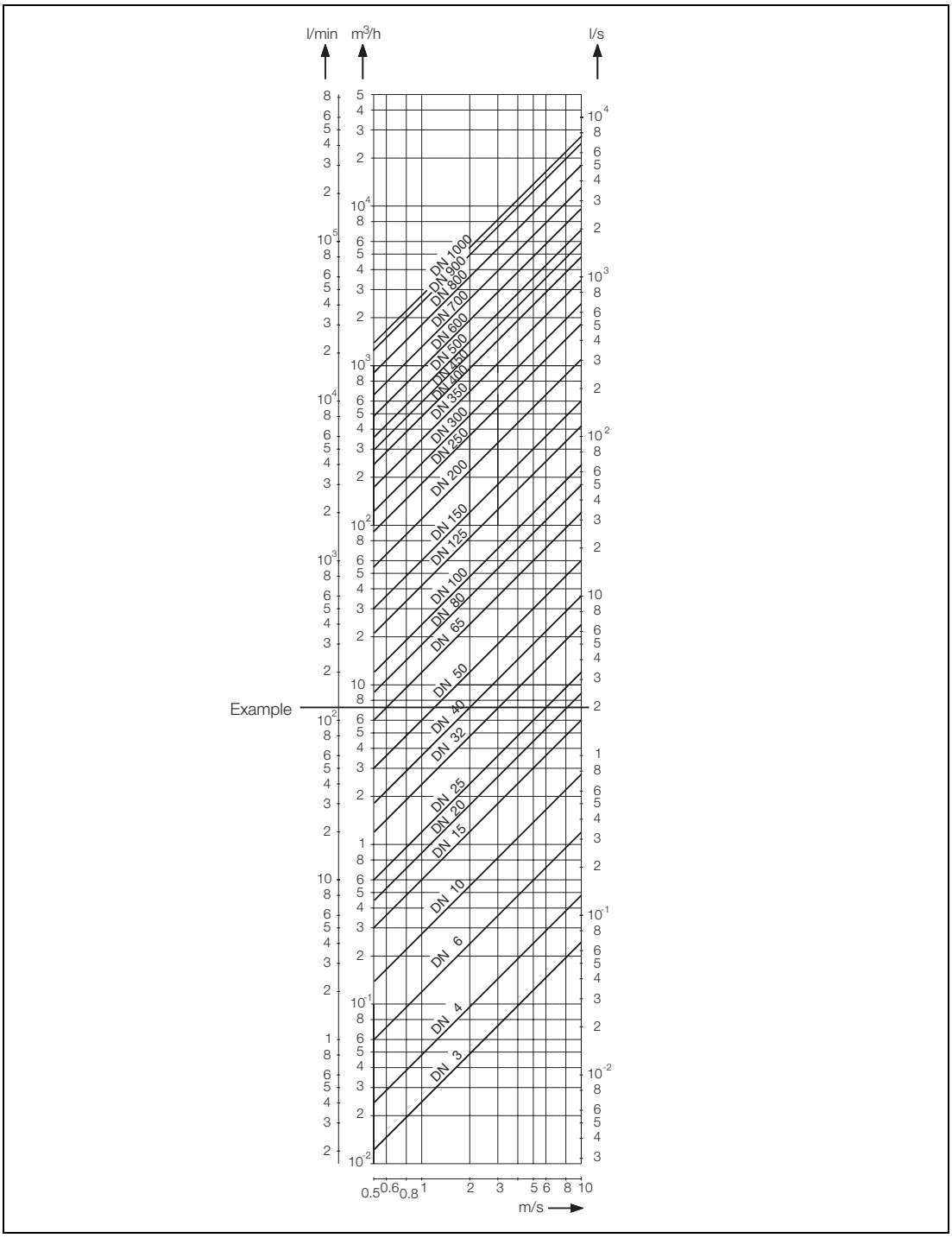


Fig. 15: Flowrate Nomograph DN 3 to DN 1000 [1/10" to 40"]

3.2.10 Agency Certified EMF

Approvals

The National institute for Technology and Science (PTB) in Braunschweig, Germany has approved the design of the measurement instrument “Electromagnetic Volume Flow Integrator with Electrical Counter” for interstate custody transfer certifications. The following approvals have been granted for the flowmeter primary and converter used as Volume Flow Integrators:

6.221 / 87.12 Electromagnetic Volume Flow Integrator with Electrical Counter in Class “B” for Cold Water and Waste Water

5.721 / 87.05 Electromagnetic Volume Flow Integrator with Electrical Counter for Liquids Other than Water

For the Electromagnetic Volume Flow Integrator with Electrical Counter the Annex (EO 6) and the Annex 5 (EO 5) of the Certification Regulation of 1988 apply.

Calibration

The calibration of the Electromagnetic Volume Flow Integrator with Electrical Counter is conducted on the flow test stands in Goettingen, Germany which have been approved for certified calibrations. Subsequent flow range changes require a new certified calibration on an agency approved flow test stand.

Approved Meter Sizes for “Cold Water and Waste Water”

Meter Size DN	Meter Size Inch	Smallest Allow. Range End Value (ca. 2 m/s)	Largest Allow. Range End Value (ca. 10 m/s)
25	1	0 to 2.4 m^3/h	0 to 12 m^3/h
32	1-1/4	0 to 5 m^3/h	0 to 25 m^3/h
40	1-1/2	0 to 9 m^3/h	0 to 45 m^3/h
50	2	0 to 14 m^3/h	0 to 70 m^3/h
65	2-1/2	0 to 24 m^3/h	0 to 120 m^3/h
80	3	0 to 36 m^3/h	0 to 180 m^3/h
100	4	0 to 56 m^3/h	0 to 280 m^3/h
125	5	0 to 84 m^3/h	0 to 420 m^3/h
150	6	0 to 128 m^3/h	0 to 640 m^3/h
200	8	0 to 220 m^3/h	0 to 1100 m^3/h
250	10	0 to 360 m^3/h	0 to 1800 m^3/h
300	12	0 to 500 m^3/h	0 to 2500 m^3/h
350	14	0 to 700 m^3/h	0 to 3500 m^3/h
400	16	0 to 900 m^3/h	0 to 4500 m^3/h
500	20	0 to 1420 m^3/h	0 to 7100 m^3/h
600	24	0 to 2000 m^3/h	0 to 10000 m^3/h
700	28	0 to 2800 m^3/h	0 to 14000 m^3/h
800	32	0 to 3600 m^3/h	0 to 18000 m^3/h
900	36	0 to 4600 m^3/h	0 to 23000 m^3/h
1000	40	0 to 5600 m^3/h	0 to 28000 m^3/h

Approved Meter Sizes for “Liquids Other than Water”

Meter Sizes and Largest Allowable Flowrate						
DN	Inch	Q_{max} Liter/min				
25	1	selectable from 60	to	200	in steps of	10
32	1-1/4	selectable from100	to	400	in steps of	10
40	1-1/2	selectable from150	to	750	in steps of	50
50	2	selectable from250	to	1000	in steps of	50
65	2-1/2	selectable from400	to	2000	in steps of	100
80	3	selectable from700	to	3000	in steps of	100
100	4	selectable from900	to	4500	in steps of	100
150	5	selectable from2000	to	10000	in steps of	500

Smallest Flowrate and Fluid			
DN	Inch	Smallest Flowrate l/min	Fluid
25	1	8	Beer, Milk, Syrup
32	1-1/4	5	Beer, Milk, Syrup
40	1-1/2	20	Beer, Milk
50	2	200	Beer, Wort
65	2-1/2	500	Milk, Wort, Beer
80	3	500	Milk, Wort, Beer
100	4	2000	Brine, Wort
150	5	2000	Brine

Min. flow range ca. 2.5 m/s.
Max. flow range ca. 10 m/s.

The flow ranges are as prescribed in the tables. Subsequent flow range changes require a new certified calibration on an agency approved flow test stand.

Installation Requirements for Volume Flow Integrators

The following installation requirements must be maintained:
For Cold Water and Waste Water a straight section with a length of at least 5 times the diameter of the flowmeter primary is required upstream and 2 times downstream. For Liquids other than Water (Milk, Beer, Wort, Brine) the values in the brackets in Fig. 16 apply.

For flow metering in both directions (forward and reverse) straight sections are required on both ends of the flowmeter primary with a length of 5 times the diameter of the flowmeter primary for “Cold Water and Waster Water” approvals and 10 times the diameter of the flowmeter primary for “Liquids Other than Water”. The piping system must always be completely filled. The signal cable length may not exceed 50 m.

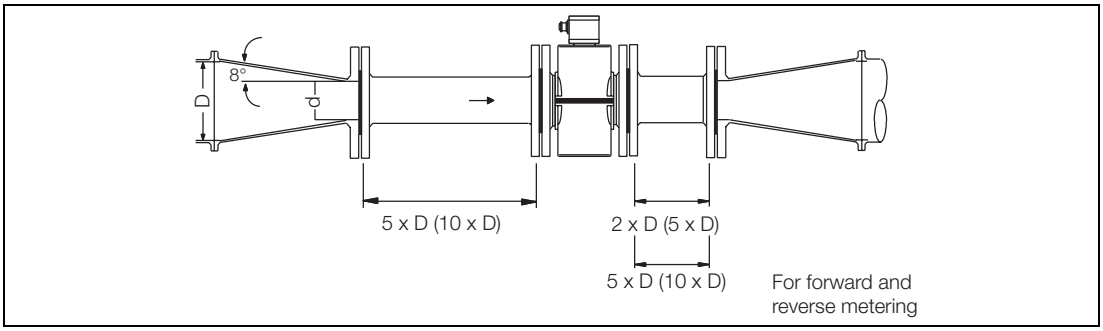


Fig. 16: Pipeline Installation, Reductions as Required

4 Electrical Connections, Grounding

4.1 Grounding the Flowmeter

The grounding procedure described in this manual must be observed. Corresponding to VDE 0100, Part 540 the grounding screws on the flowmeter primary (on the flange and on the converter housing) are to be connected to earth with a copper wire whose cross section is at least 2.5 mm^2. In order to comply with the EMC-Resistance/Low Voltage Regulations both the meter pipe of the flowmeter primary and the connection box or COPA-housing must be connected to earth. Please use the green/yellow cables included with the shipment for these connections. For measurement reasons the earth potential should be identical to the potential of the pipeline. An additional earth connection at the terminals in the connection box is not required.

For plastic pipelines or pipelines lined with insulating materials the fluid is grounded using grounding plates or grounding electrodes. When there are stray currents in the pipeline it is recommended that grounding plates be installed at both ends of the flowmeter primary.

In the following three different grounding schemes are described. In examples a) and b) the fluid is in electrical contact with the pipeline. In example c) the fluid is insulated from the pipeline.

a) Metal pipeline with fixed flanges

1. Drill blind holes in the flanges on the pipeline (18 mm deep)
2. Thread holes, (M6, 12 mm deep).
3. Attach the ground strap to the flange using a screw (M6), spring washer and flat washer and connect to the ground connection on the flowmeter primary.
4. Connect a 2.5 mm^2 CU wire between the ground connection on the flowmeter primary and a good earth.

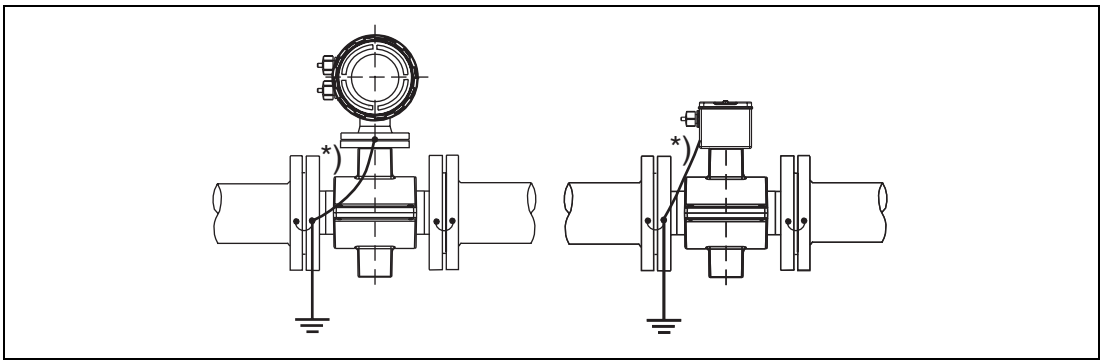


Fig. 17: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

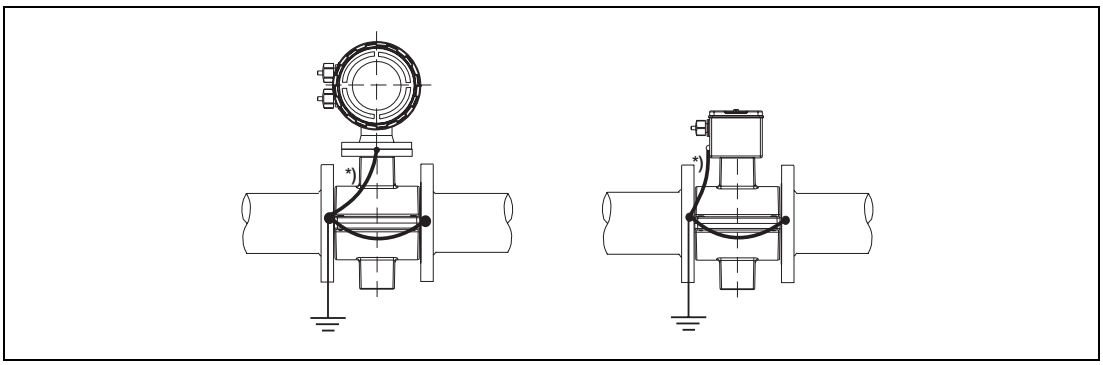


Fig. 18: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

*) Use the green/yellow cable included with the shipment for these connections.

b) Metal Pipeline with Loose Flanges

1. In order to assure a trouble free ground connection to the fluid and the flowmeter primary in a pipeline with loose flanges, 6 mm threaded studs should be welded to the pipeline.
2. Attach the ground strap using a nut, spring washer and flat washer and connect to the ground connection on the flowmeter primary.
3. Connect a 2.5 mm^2 CU wire between the ground connection on the flowmeter primary and a good earth.

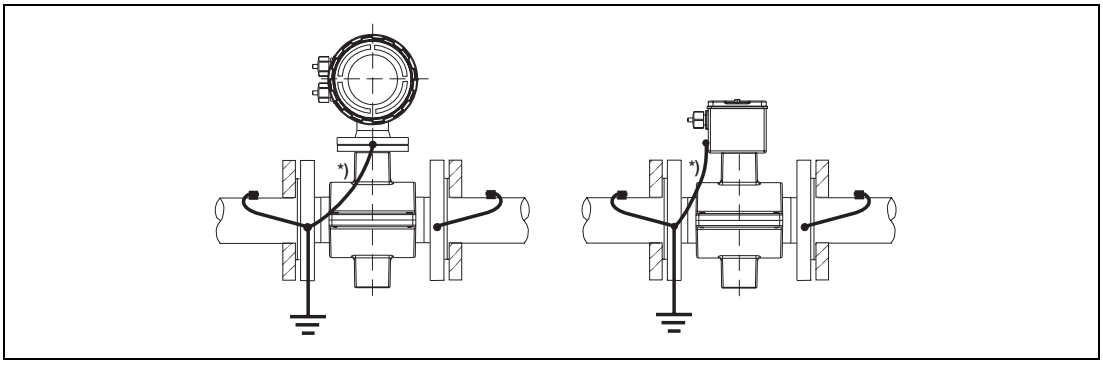


Fig. 19: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

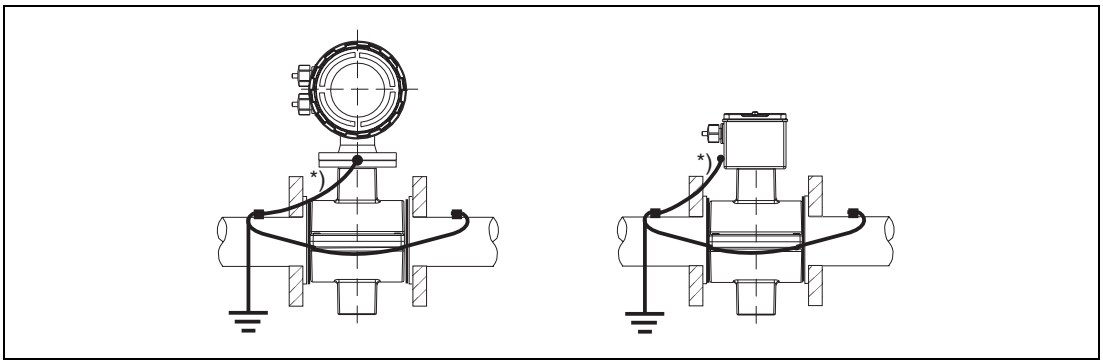


Fig. 20: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

*) Use the green/yellow cable included with the shipment for these connections.

c) Plastic, Concrete or Pipelines with Insulating Liners.

1. Install EMF in pipeline with a grounding plate.
2. Connect the connection tab on the grounding plate to the ground connection on the flowmeter primary with a ground strap.
3. Connect a 2.5 mm^2 CU wire between the ground connection on the flowmeter primary and a good earth.

For plastic pipelines or pipelines with insulating liners the fluid is grounded using the grounding plate as shown in Fig. 21 or using grounding electrodes, when installed in the flowmeter primary (option). If grounding electrodes are installed the grounding plates shown Fig. 21 are not required.

When there are stray currents in the pipeline it is recommended that, if grounding plates are to be used, to install one at both ends of the flowmeter primary.

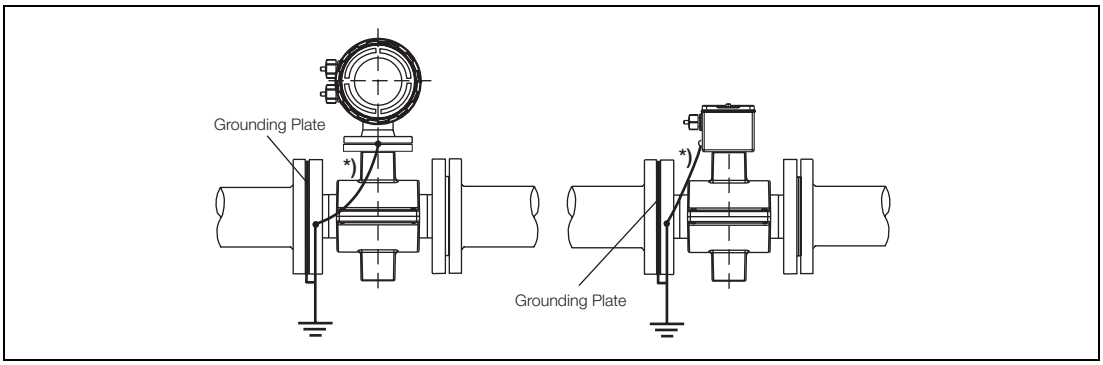


Fig. 21: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

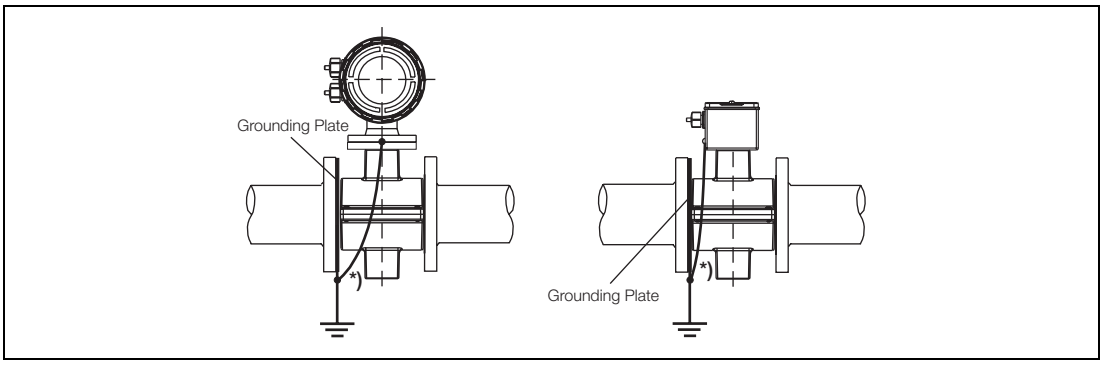


Fig. 22: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

*) Use the green/yellow cable included with the shipment for these connections.

4.1.1 Grounding Models FXE4000-DE21_ and FXE4000-DE23_

The ground connections are made as shown in Fig. 23. The fluid is grounded by the metal adapter pieces, so that an additional ground is not required.

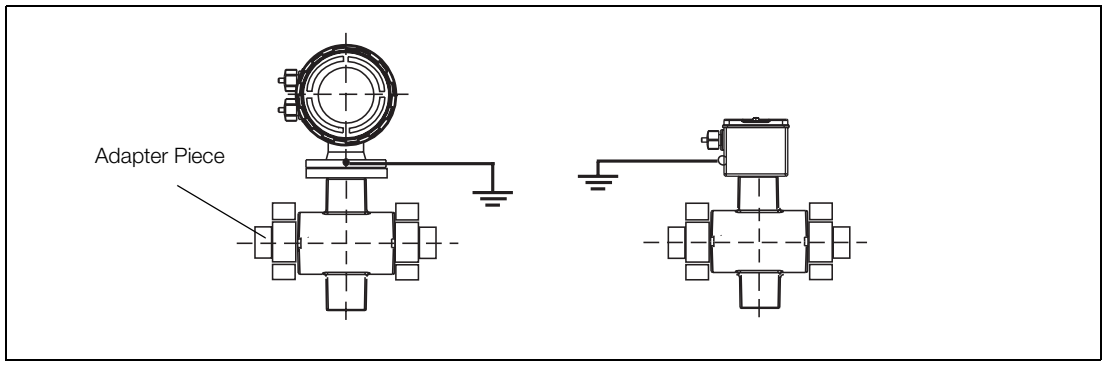


Fig. 23: Flowmeter Primary DN 3 - DN 100 [1/10" - 4"]

4.1.2 Grounding Instruments with Hard or Soft Rubber Liners

In these instruments, starting at meter size DN 125 [5"], an electrically conductive element is integrated in the liner. This element grounds the fluid.

4.1.3 Grounding for Instruments with Protection Plates

Fig. 24: {Protection Plates

The protection plates protect the edges of the liners, e.g. for abrasive fluids. In addition they also provide the same function as a grounding plate. Connect these protection plates in the same manner as the grounding plates when used with plastic pipelines or pipelines with electrically insulated liners.

4.1.4 Grounding with Conductive PTFE-Grounding Plates

As an option in the meter size range DN 10-100 [3/8" - 4"], grounding plates made of conductive PTFE are available. Install as shown in Fig. 25, and connect electrically as shown in Fig. 21.

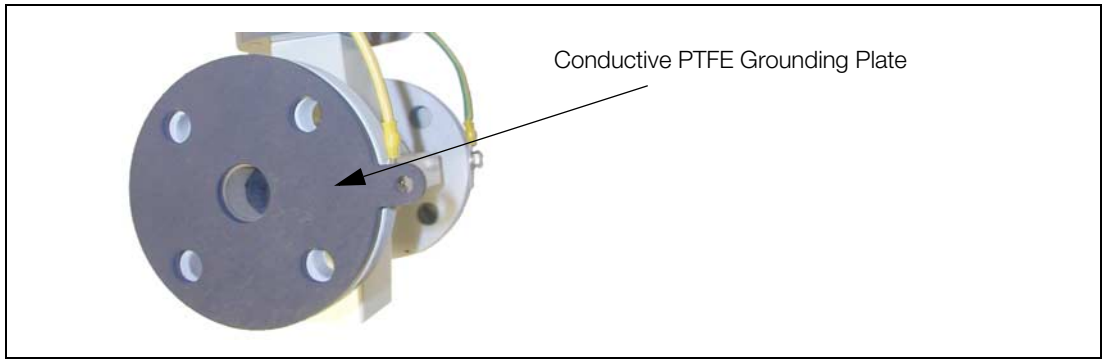


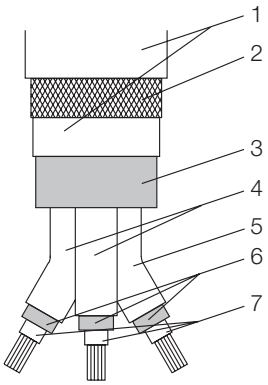
Fig. 25: Protection Plate / Grounding Plate Made of PTFE

4.2 Signal and Excitation Cable Connections for Model FXE4000 (MAG-XE), Special Requirements for Protection Class IP68

The electromagnetic flowmeter primary is connected to the converter by a signal/excitation cable. The magnet coils in the flowmeter primary are supplied from terminals M1/M2 in the converter with an excitation voltage. The signal/excitation cable is connected at the flowmeter primary to terminals 1, 2, M1, M2, 3, SE. The terminal assignments are described in Fig. 28. The shield 3 is at the common potential of the flowmeter primary and connected to earth. The ground connection on the exterior of the connection box of the flowmeter primary should also be connected to earth.

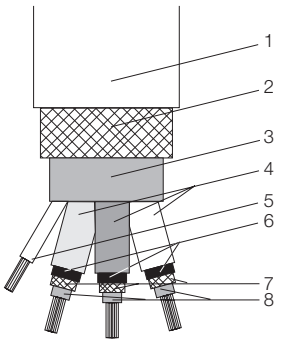
4.2.1 Signal and Excitation Cable Construction

The signal/excitation cable conducts signals of only a few millivolts and should therefore be routed in the shortest manner. The maximum allowable signal cable length is 50 m.



1 Jacket of PVC, white
2 Steel wire weave
3 Cu wire weave
4 Flow signal, jacket red and blue
5 Excitation, jacket white
6 Each 1x shielded, Cu wire weave
7 Polyethylene, natural

Fig. 26: Signal Cable Construction ABB No. D173D018U02



1 Jacket of PVC, white
2 Iron wire weave
3 Conductive jacket black, conductive
4 Electrode flow signal
Electrode 1 red, electrode 2 blue,
Excitation white
5 Common potential, yellow
6 Conductive jacket black, conductive
7 Shield, Cu wire weave
8 Polyolefin copolymer

Fig. 27: Signal Cable Construction ABB No. D173D025U01

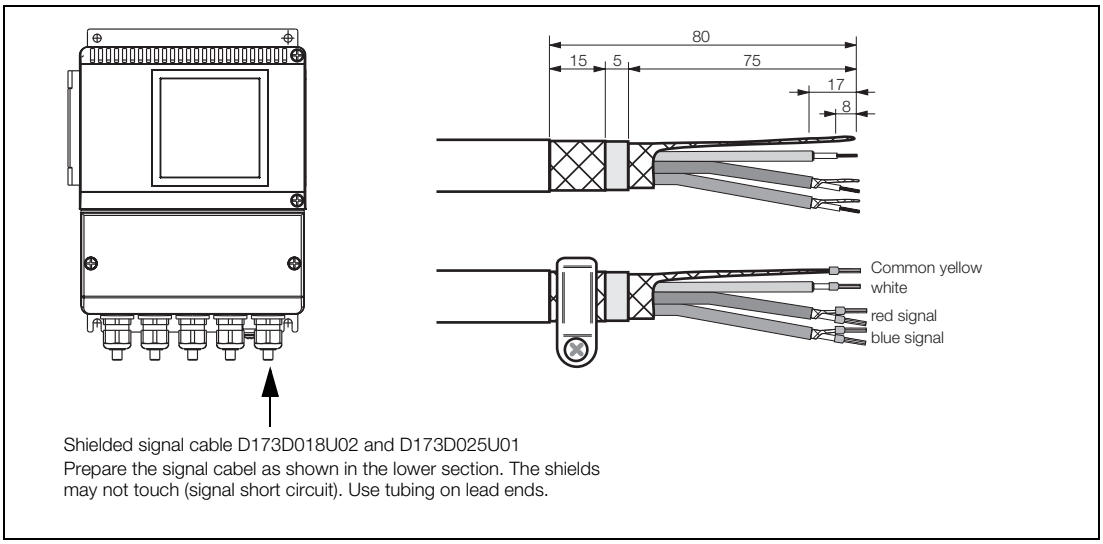


Fig. 28:

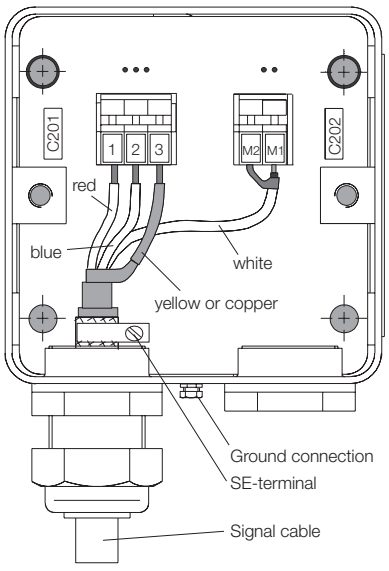
The cables should not be routed in the vicinity of large electrical machinery or switch gear equipment which could induce stray fields, pulses and voltages. All leads are to be surrounded by shields connected to earth. The signal cable should not be fed through branch fittings or terminals strips. A shielded excitation cable (white) is located parallel to the signal leads (red and blue) in the cable assembly so that only one cable is required between the flowmeter primary and the converter. To shield against magnetic pickup the cable incorporates an outer steel shield which is to be connected to the SE terminal.

Attention!

If plant conditions make it impossible to avoid proximity to electrical machinery or switch gear equipment, it is advisable to route the signal/excitation cable in metallic conduits which are connected to earth.

4.2.2 Connection Area Flowmeter Primary

The leads of the signal/excitation cable are to be routed in the shortest way to the connection terminals. Loops are to be avoided (see Fig. 29).



Terminal Assignments	Connection
1 + 2	Flow signal leads (red and blue)
3	Inner shield (copper) or additional inner lead (yellow) common
M1 + M2	Connections for magnet excitation
SE	Outer cable shield (steel)

Fig. 29: Flowmeter Primary Connection Area

4.2.2.1 Using the Spring Loaded Connection Terminals

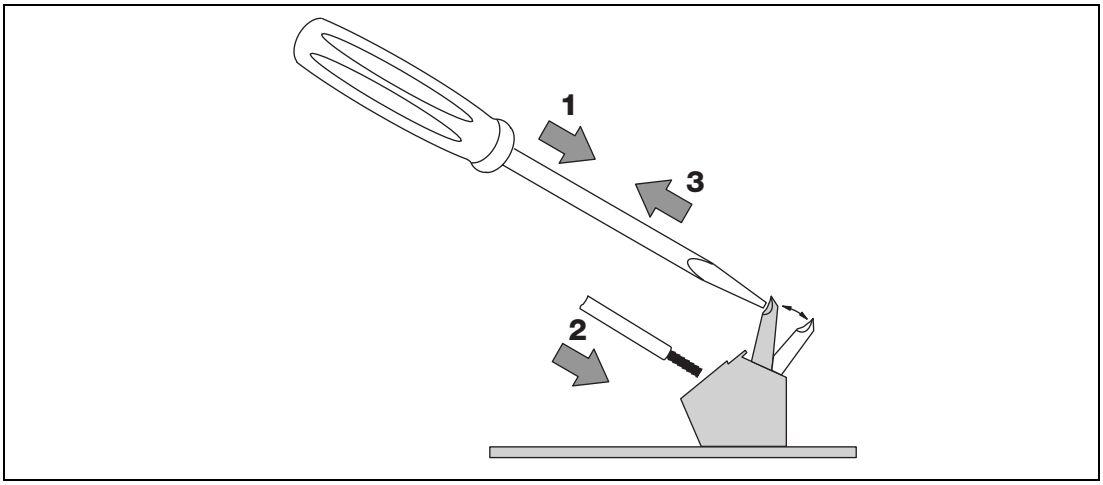


Fig. 30:

Information!

When installing the signal/excitation cable assure that a water trap is provided, (Fig. 31). For vertical installations the cable connectors should point downward.
When reinstalling and tightening the housing cover care should be exercised. Check to make sure that the gaskets are seated properly. Only then will the Protection Class be effective.

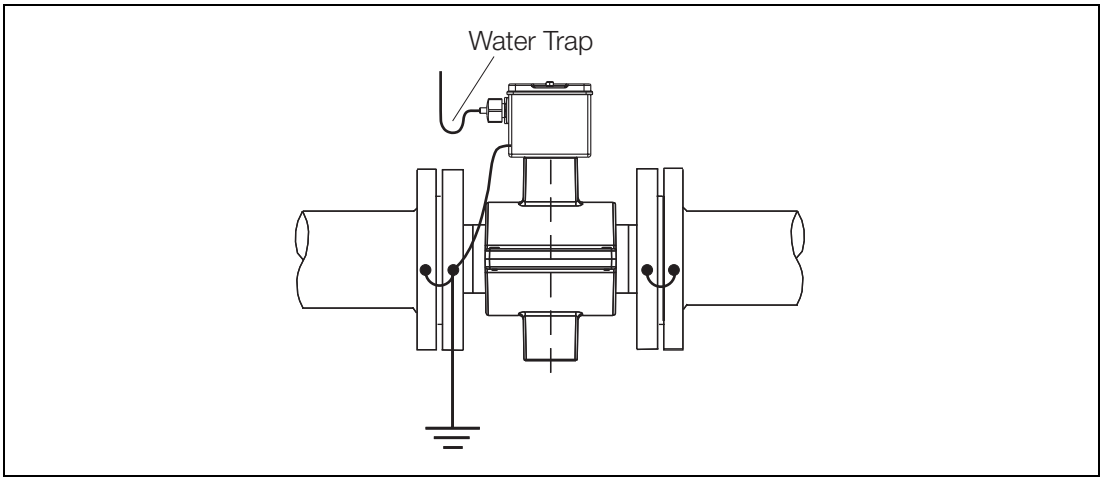


Fig. 31: Cable Routing

4.2.3 Assembly and Installation for Protection Class IP 68

There are 2 different designs available.

4.2.3.1 Design with Hose Connection

For flowmeter primaries for use in Protection Class IP68 areas the max. submergence depth is 5 m. In place of the cable connectors a connector surrounded by a hose is used. The signal/excitation cable must be routed through the 1/2" hose from the connection box to a point above the maximum submergence level (Fig. 32). Above the submergence level the water tight connector included with the shipment is installed on the cable. Then the hose is sealed to the hose connector with a threaded clamp. Finally, the connection box must be carefully closed.

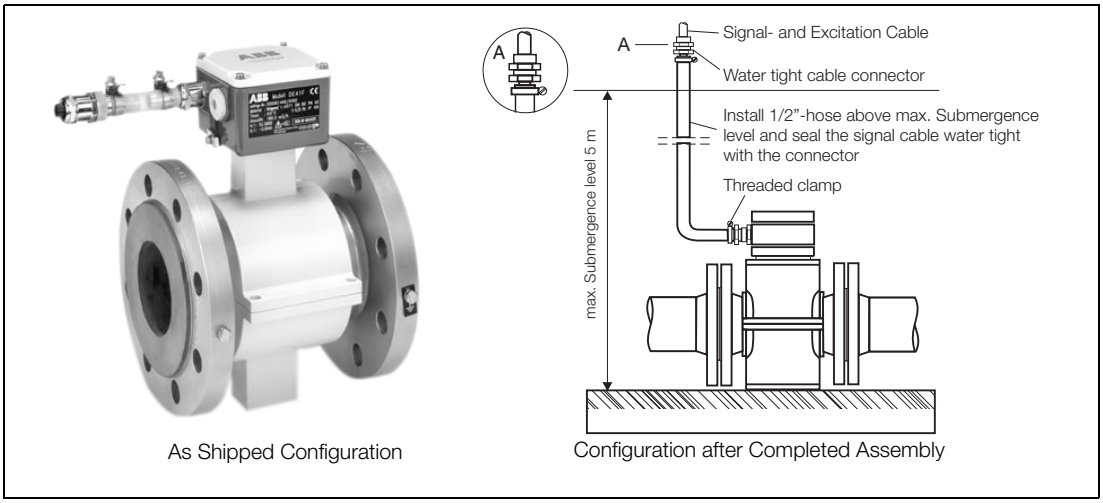


Fig. 32: Installation IP68 (Hose Connection)

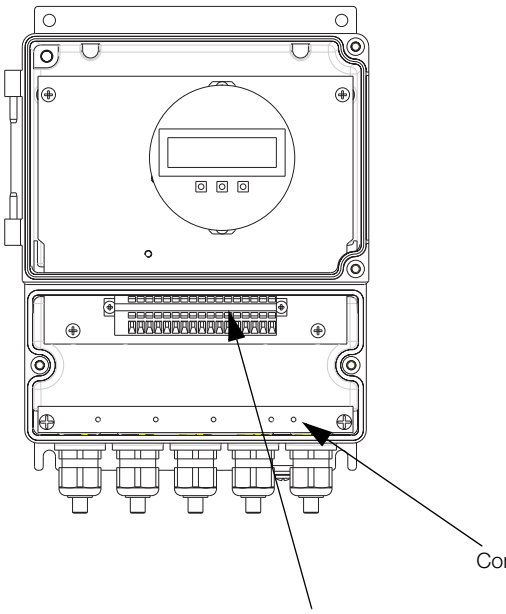
4.2.3.2 Design without Hose Connection

Signal cable D173D025U01 is to be used to connect the flowmeter primary and the converter. After the connections have been made, the cable connectors are to be tightened and the connection box carefully closed.

The jacket of the signal cable may not be damaged. Only then will Protection Class IP68 for the flowmeter primary be assured.

4.2.4 Electrical Connection Area in the Converter

4.2.4.1 FXE4000 (MAG-XE)



Terminal Assignments	Connection
L; N/1+; 2–	Supply voltage
+ –	20 mA output and HART
V8 V9	Pulse output
X1 G2	Contact input (G2 common)
P7 G2	Contact output (G2 common)
1 + 2	Leads for flow signal (red and blue)
1S + 2S	Cable shield for flow signal
M1 + M2	Connections for magnetic field excitation (white)
3	Inner cable shield (Copper) or yellow
⏚	Outer cable shield (steel)

Comments: For FOUNDATION Fieldbus and PROFIBUS PA the BUS terminals in the connection area are to be used exclusively.

Connection for the cable shield (steel)

L	N	PE	V9	V8	P7	G2	X1	+	-	M1	M2	3	1S	1	2	2S

Fig. 33: Connection Box Field Mount Housing

Attention!

The supply power connections must be made in agreement with the specifications on the type tag on the converter at terminals L (Phase) and N (Neutral) or 1+ and 2– through a main fuse and a main switch.

Using the Spring Loaded Connection Terminals FXE4000 (MAG-XE Converter)

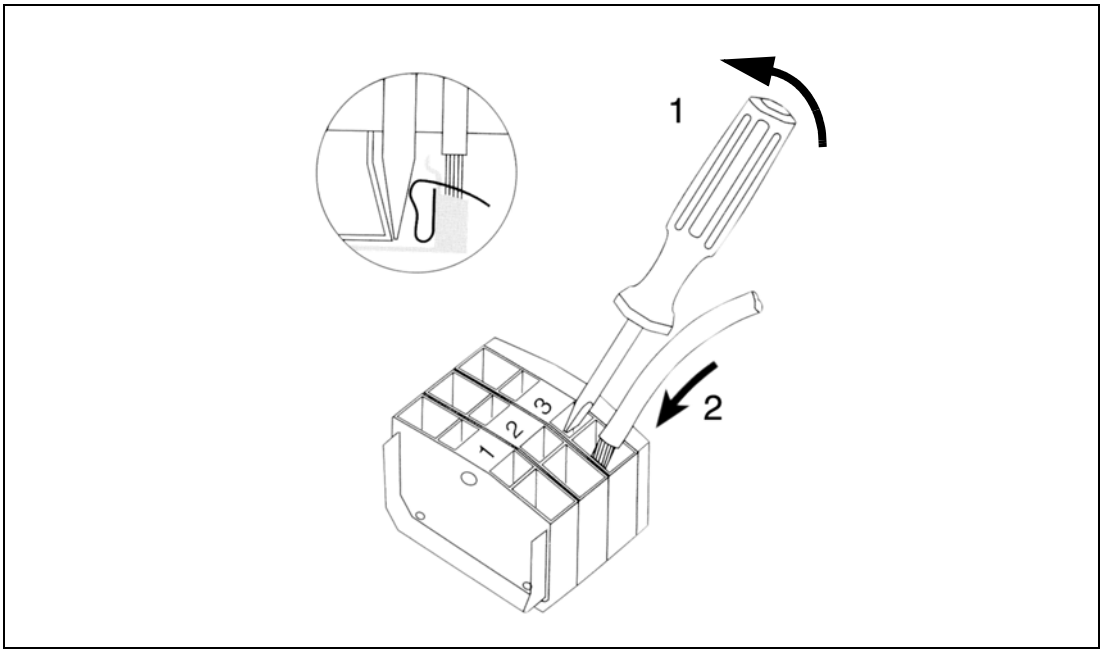
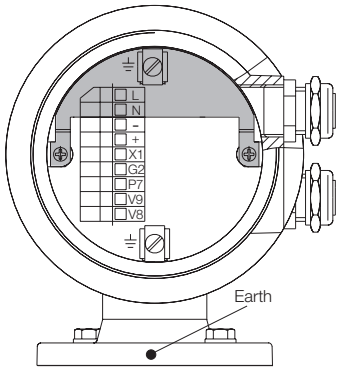


Fig. 34:

4.2.4.2 FXE4000 (COPA-XE)



Terminal Assignments	Connection
L; N/1+; 2–	Supply voltage
+ –	20 mA output + HART
V8 V9	Pulse output
X1 G2	Contact input (G2 common)
P7 G2	Contact output (G2 common)

Comments: For FOUNDATION Fieldbus and PROFIBUS PA the BUS terminals in the connection area are to be used exclusively.

Fig. 35: Connection Box

Using the Spring Loaded Connection Terminals FXE4000 (COPA-XE)

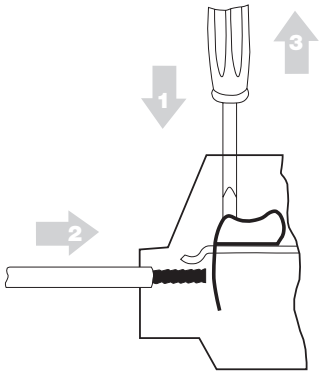
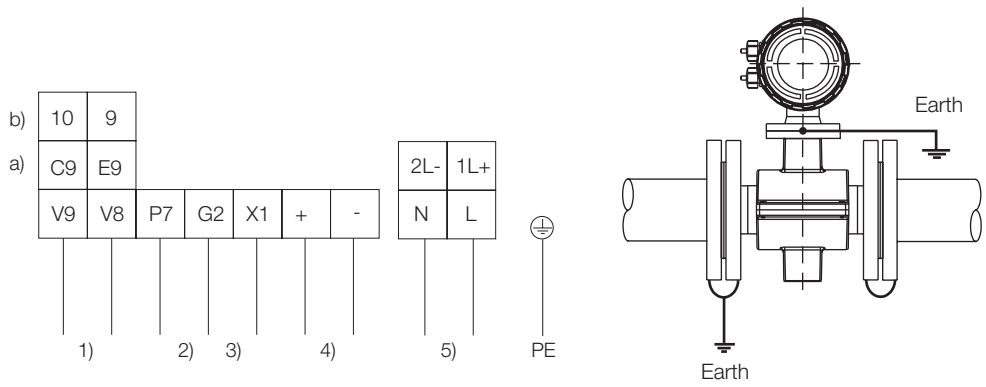


Fig. 36:

4.3 Interconnection Diagrams

4.3.1 Interconnection Diagram FXE4000 (COPA-XE), Connection Options for Analog Communication (incl. HART)



1) a) **Scaled pulse output, passive**, pulse width settable from 0.1 ms to 2000 ms,
Terminals: V8, V9, function E9, C9
Optocoupler specifications:
f_{max} 5 kHz
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$

b) **Scaled pulse output, active,** pulse width settable from 0.1 to 2000 ms, terminals V8, V9, function 9, 10
$20\ mA < I \le 150\ mA$; $f_{max} \le 4$ Hz, pulse width ≤ 50 ms, pulse $T_{16V} \le 25$ ms, $16\ V \le U \le 30\ V$;
On/off ratio 1:4 ($T_{on} : T_{off}$),
f_{max} 5 kHz, $2\ mA \le I \le 20\ mA$; $16\ V \le U \le 30\ V$

2) **Contact output**, function selectable in software as system monitor, empty pipe, Max.-Min.-Alarm or F/R signal*, terminals G2, P7
Optocoupler specifications:
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$;
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$

3) **Contact input**, function selectable in software as external zero return, external totalizer reset, external totalizer stop
Terminals: G2, X1
Optocoupler, $16\ V \le U \le 30\ V$, Ri = 2kΩ

4) **Current output** selectable, terminals: +/-, load ≤ 600 Ω for 0/4 to 20 mA,
Load ≤ 1200 Ω for 0/2 to 10 mA,
Load ≤ 2400 Ω for0 to 5 mA,
Option: **HART-Protocol**

5) **Supply power**, see Type Tag

*) When shipped the function forward direction signal was selected.

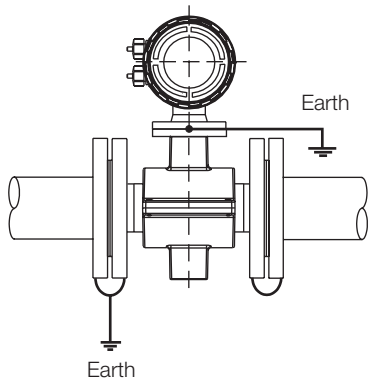
Fig. 37: Interconnection Diagram FXE4000 (COPA-XE), Connection Options for Analog Communication (incl. HART)

4.3.2 Interconnection Diagram FXE4000 (COPA-XE), Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

a) PROFIBUS PA (Profile 3.0)
b) RS485 (ASCII Protocol)
c) PROFIBUS DP
d) FOUNDATION Fieldbus

a)				PA+	PA-				
b)	Ux	V8	P7	A	B	+	-	2L-	1L+
c)	Ux	V8	P7	+VD	A	B	GND	N	L
d)				FF+	FF-				

PE



Design a)

Terminals PA+, PA-
Connection for PROFIBUS PA per IEC 61158-2 (Profile 3.0), (see also Page 76)
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Design b)

Terminals Ux, V8
Scaled pulse output, passive (optocoupler), pulse width settable from 0.1 ms to 2000 ms,
Optocoupler specifications:
f_{max} 5 kHz
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$;
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$

Terminals Ux, P7
Contact output, function selectable in software as system monitor, empty pipe,
Max.-Min.-Alarm or F/R signal
Optocoupler specifications:
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$;
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$

Terminals A, B
Serial data link RS485 for communication using ASCII-Protocol

Terminals +, -
Current output, terminals: +/-, load ≤ 600 Ω for 0/4 to 20 mA

Design c)

Same as design b), except

Terminals +VD, A, B, GND
Connection for PROFIBUS DP per EN 50170

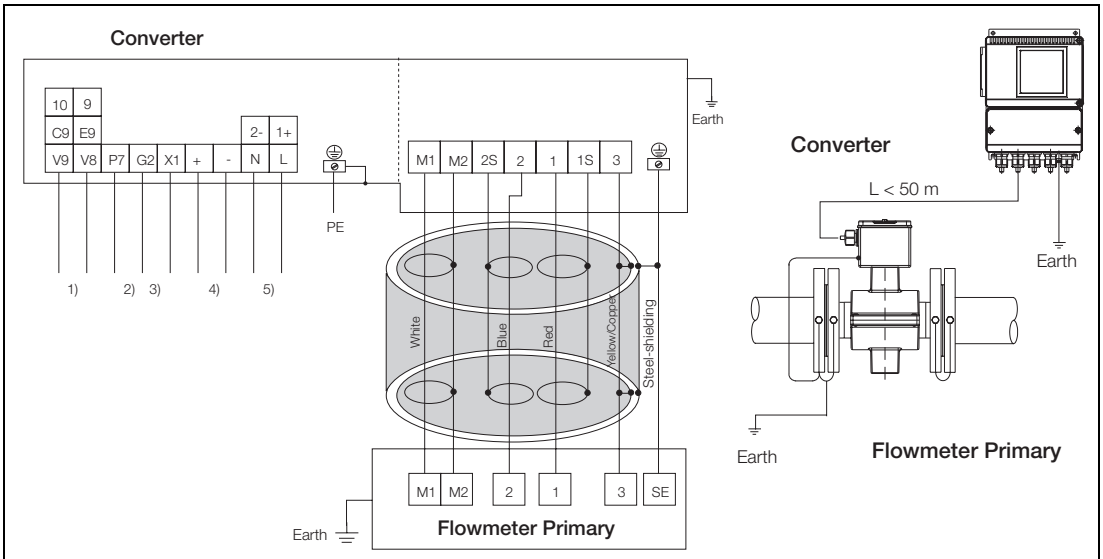
Design d)

Terminals FF+, FF-
Connection for FOUNDATION Fieldbus (H1) per IEC 61158-2, (see also Page 79)
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Supply power
see Type Tag

Fig. 38: Interconnection Diagram FXE4000 (COPA-XE), Connection Options for Digital Communication

4.3.3 Interconnection Diagram FXE4000 (MAG-XE), Connection Options for Analog Communication (incl. HART)

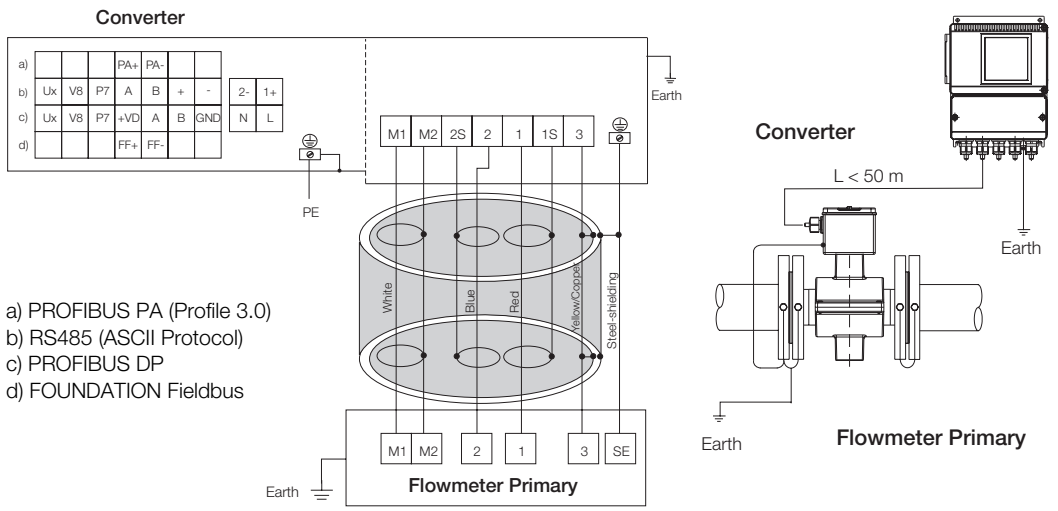


1) a) **Scaled pulse output, passive**, pulse width settable from 0.1 ms to 2000 ms,
Terminals: V8, V9, function E9, C9,
Optocoupler specifications: f_{max} 5 kHz
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$
b) **Scaled pulse output, active,** pulse width settable from 0.1 to 2000 ms, terminals V8, V9, function 9, 10
$20\ mA < I \le 150\ mA$; $f_{max} \le 4$ Hz, pulse width ≤ 50 ms, pulse $T_{16V} \le 25$ ms, $16\ V \le U \le 30\ V$
On/off ratio 1:4 ($T_{on} : T_{off}$), f_{max} 5 kHz, $2\ mA \le I \le 20\ mA$; $16\ V \le U \le 30\ V$
2) **Contact output**, function selectable in software as system monitor, empty pipe, Max.-Min.-Alarm or F/R signal*, terminals G2, P7
Optocoupler specifications:
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$;
$0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$
3) **Contact input**, function selectable in software as external zero return, external totalizer reset, external totalizer stop
Terminals: G2, X1
Optocoupler, $16\ V \le U \le 30\ V$, Ri = 2kΩ
4) **Current output** selectable, terminals: +/-, load ≤ 600 Ω for 0/4 to 20 mA,
Load ≤ 1200 Ω for 0/2 to mA, load ≤ 2400 Ω for 0 to 5 mA
Option: **HART-Protocol**
5) **Supply power**, see Type Tag

*) When shipped the function forward direction signal was selected.

Fig. 39: Interconnection Diagram FXE4000 (MAG-XE), Connection Options for Analog Communication (incl. HART)

4.3.4 Interconnection Diagram FXE4000 (MAG-XE), Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)



Design a)

Terminals PA+, PA-
Connection for PROFIBUS PA per IEC 61158-2 (Profile 3.0), (see Page 76)
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Design b)

Terminals Ux, V8
Scaled pulse output, passive (optocoupler), pulse width settable from 0.1 ms to 2000 ms,
Optocoupler specifications: f_{max} 5 kHz
$0 V \le U_{CEL} \le 2 V$, $16 V \le U_{CEH} \le 30 V$;
$0 mA \le I_{CEH} \le 0.2 mA$, $2 mA \le I_{CEL} \le 220 mA$

Terminals Ux, P7
Contact output, function selectable in software as system monitor, empty pipe,
Max.-Min.-Alarm or F/R signal
Optocoupler specifications:
$0 V \le U_{CEL} \le 2 V$, $16 V \le U_{CEH} \le 30 V$;
$0 mA \le I_{CEH} \le 0.2 mA$, $2 mA \le I_{CEL} \le 220 mA$

Terminals A, B
Serial data link RS485 for Communication using ASCII-Protocol

Terminals +, -
Current output, terminals: +/-, load ≤ 600 Ω for 0/4 to 20 mA

Design c)

Same as Design b), except

Terminals +VD, A, B, GND
Connection for PROFIBUS DP per EN 50170

Design d)

Terminals FF+, FF-
Connection for FOUNDATION Fieldbus (H1) per IEC 61158-2, (see Page 79)
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Supply power
see Type Tag

Fig. 40: Interconnection Diagram FXE4000 (MAG-XE), Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

4.3.5 Connection Examples for Peripherals for Analog Communication (incl. HART)

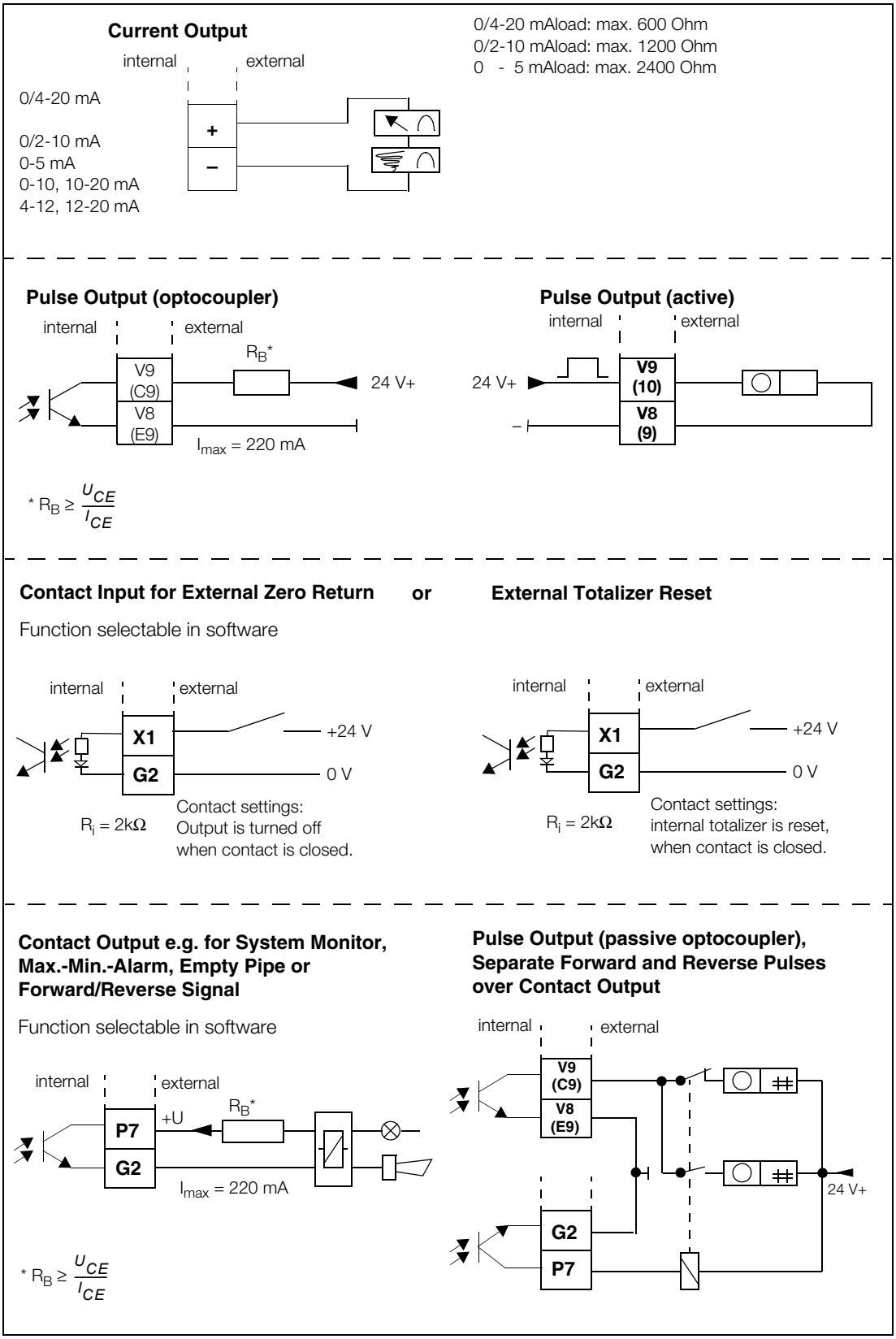
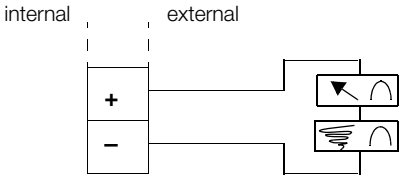


Fig. 41: Connection Examples for Peripherals for Analog Communication (incl. HART)

4.3.6 Interconnection Examples for Peripherals for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII-Protocol)

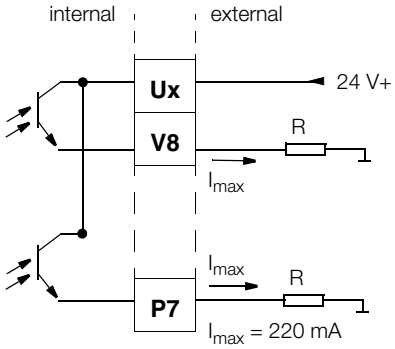
Current Output (only available for ASCII-Communication)

0/4-20 mA load: max. 600 Ohm



Pulse Output and Contact Output

(only available for PROFIBUS DP or ASCII Protocol)



Contact output Ux / P7
For system monitor, max.-min.-Alarm, empty pipe or forward /reverse signal, function selectable in software
Pulse output optocoupler Ux/V8

Circuit example for separate pulses for forward and reverse directions using the contact output

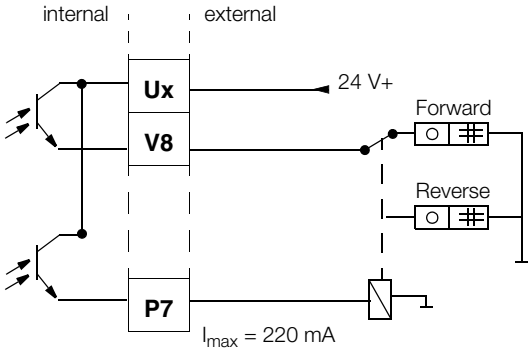
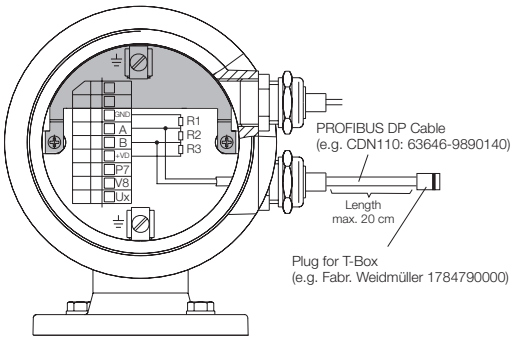
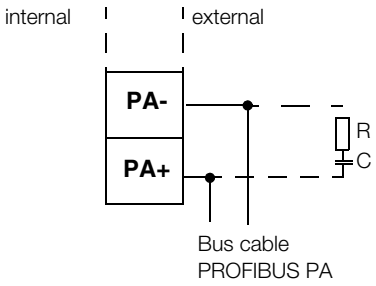


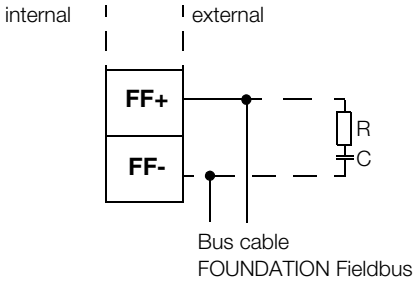
Fig. 42: Connection Examples for Peripherals for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)-Protocol

PROFIBUS DP
The resistors R1, R2, R3 are bus termination resistors. They are to be installed if the instrument is connected at the end of the bus cable.
R1 = 390 Ω; R2 = 220 Ω; R3 = 390 Ω

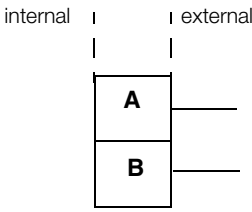


PROFIBUS PA / FOUNDATION Fieldbus
The resistor R and the capacitor C form the bus termination. They are to be installed if the instrument is connected at the end of the bus cable.
R = 100 Ω; C = 1 µF



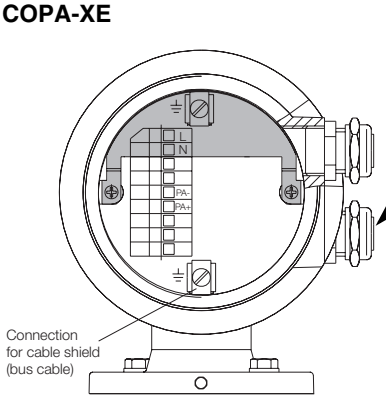


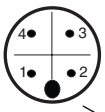
Data link RS485 (ASCII Protocol)
2-wire data link, half-duplex, max. cable length: 1200 m, max. 32 instruments in parallel on bus twisted pair cable.



Connection Example for PROFIBUS PA using M12 plug

COPA-XE

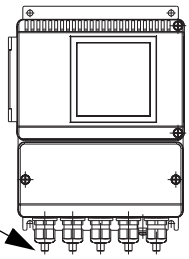




Pin assignments
(View from front onto the pin insert and pins)

PIN 1 = PA+
PIN 2 = nc
PIN 3 = PA-
PIN 4 = Shield

MAG-XE



The converter in a field mount housing is also available with a M12-plug (only for PROFIBUS PA).

Connection using M12 plug (only for PROFIBUS PA)
As an option, the bus connection can be made using a M12 plug instead of a cable connector (see Ordering Information for the instrument).
The instrument is then shipped completely wired. Suitable sockets (Type EPG300) as well as other accessories may be found in the List Sheet 10/63.6.44 DE.

Fig. 43: Connection Examples for Peripherals for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

5 Start-Up

5.1 Preliminary Checks/Starting Up the Flowmeter System

5.1.1 Flowmeter FXE4000 (COPA-XE)

The start-up procedure described below is to be used after the assembly and installation of the flowmeter have been completed.

The supply power is turned off.

- Check the grounds.
- Check that the temperature limits were not exceeded.
- Check connections based on the Interconnection Diagrams.
- Assure that the supply power values agree with those specified on the type tag.
- The connections for the supply power in the COPA-XE are located under the semicircular cover in the connection area!

Turn on supply power!

- After the supply power is turned on, the flowmeter primary data stored in the external EEPROM are compared to the values stored internally. If the data are not identical, an automatic exchange of the data in the converter is initiated (upload). The converter displays the message “Primary data are loaded”. The system is now operational.
- The display indicates the instantaneous flowrate value.
- In order to set up the system only a few entries or selections of parameters must be made. The flow range is automatically set to 10 m/s. Enter the desired flow range in the submenu „Range“. Hydraulically ideal range end values are equivalent to ca. 2-3 m/s. In the submenu „Current output” the required current range can be selected. For the pulse output the pulse factor (pulses per unit) and the pulse width should be entered in the submenu „Totalizer”. (see Section 7)
- The system zero value should be checked (see Section 5.2).
- To finish the start-up procedure, the menu “Store data in external EEPROM” should be called in order to store all the settings which were made during the start-up. If the converter was exchanged, then the EEPROM is to be removed from the old converter and plugged into the new one (see Section 5.4).

5.1.2 Flowmeter FXE4000 (MAG-XE)

The start-up procedures described below are to be used after the assembly and installation of the flowmeter primary and the converter.

The supply power is turned off.

- Assure that the supply power values agree with those specified on the type tag.
- Check if the converter is installed in an essentially vibration free location.
- Check that the ambient temperature limits for the converter are not exceeded (-20 °C and +60 °C).
- Check for proper coordination between the flowmeter primary and the converter. The end numbers of order number for the flowmeter primary are X1, X2 etc. on the factory tag while the converter end numbers are Y1, Y2 etc. on the type tag. End numbers X1 and Y1 are to be used together.
- Check that the EEPROM is plugged into the socket on the display board of the converter (see Fig. 43). There is a sticker on this EEPROM which has the same order and end numbers as those listed on the factory tag of the flowmeter primary. **Both must be identical!**

Turn on sup[ply power.

- After the supply power is turned on the flowmeter primary data stored in the external EEPROM are compared to the values stored internally. If the data are not identical, an automatic exchange of the data in the converter is initiated (upload). The converter displays the message “Primary data are loaded”. The system is now operational.
- The display indicates the instantaneous flowrate value.
- In order to set up the system only a few entries or selection of parameters must be made. The flow range is automatically set to 10 m/s. Enter the desired flow range in the submenu „Range“. Hydraulically ideal range end values are equivalent to ca. 2-3 m/s. In the submenu „Current output” the required cur-

rent range can be selected. For the pulse output the pulse factor (pulses per unit) and the pulse width should be entered in the submenu „Totalizer". (see Section 7)

- The system zero value should be checked (see Section 5.2).
- To finish the start-up procedure, the menu "Store data in external EEPROM" should be called, in order to store all the settings which were made during the start-up. If the converter was exchanged, then the EEPROM is to be removed from the old converter and plugged into the new one (see Section 5.4).

5.2 System Zero Adjustment

The System-Zero for the system is set in the converter. To check or adjust the zero the flow in the pipeline must be at absolute zero and the pipeline must be completely filled. Using the parameter "System Zero Adj." the adjustment can be made manually or automatically: Select parameter using ENTER, use the arrow keys to select „manual" or „automatic". For an „automatic" adjustment, initiate the procedure using ENTER. After the counter displayed in the 2nd line counts down from 255 to 0 the adjustment procedure is finished. The adjustment takes approx. 20 seconds, see also Section 8.6.

Start-up of PROFIBUS PA/DP Instruments

A detailed description of the data link communication may be found in the separate Operation Manuals.

For PROFIBUS PA: Part No. D184B093U11
For PROFIBUS DP: Part No. D184B093U09

These data link descriptions are included with the shipment of the PROFIBUS instrument including the GSD-File.

5.3 Detector "Empty Pipe"

At start-up the detector empty pipe must be adjusted for the existing operating conditions. For adjustment procedure see Section 7.

Attention!

After the start-up has been completed, assure that the housing cover has been tightly closed and can only be opened using the special tool.

5.4 Converter Exchange

The parameter settings are stored in an external EEPROM which is located on the display board. When an electronic module is exchanged, the original parameter settings can be transferred by installing the old EEPROM in the new converter. Converter specific data is automatically updated.

5.5 Socket Location for the Memory Module (external EEPROM)

The socket for the ext. EEPROM is located on the front of the display board.

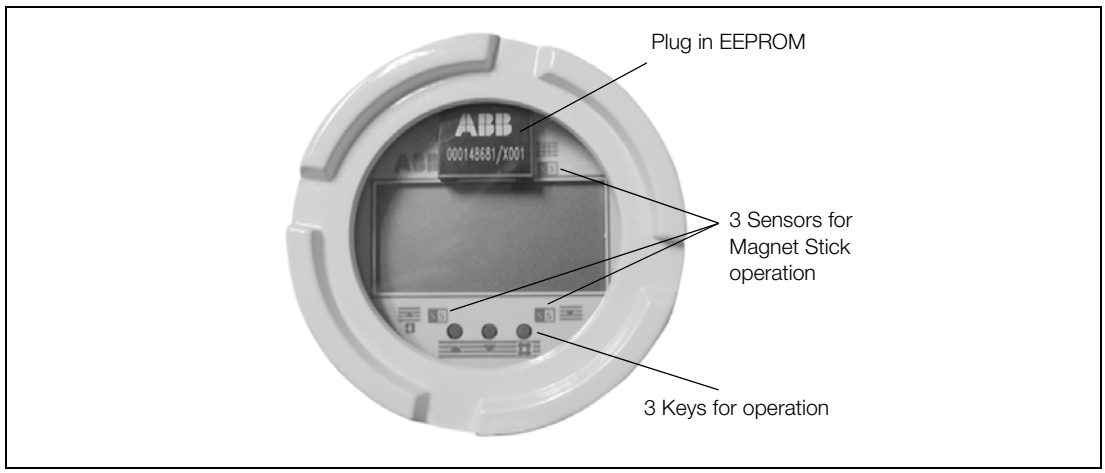


Fig. 44: Display Board

Attention!
Information for Opening the Housing

The following information must be observed when the housing for the converter is opened:

- All connections must be potential free.
- When the housing cover is removed, EMC and personnel protection are no longer provided.

5.6 Rotate Display / Rotate Housing

Warning!

Turn off the supply power!

Unscrew the housing cover. The display board is secured by 4 Phillips head screws.

After the screws are removed the display can be pulled off and rotated 90° to the left or 90° to the right. Carefully plug in the display again and reinstall the screws. Carefully reinstall the cover. Check that the gaskets are properly seated. Only then will Protection Class IP 67 be maintained.

The converter housing can be rotated 90° to the left after the two screws have been loosened.

Fig. 45:

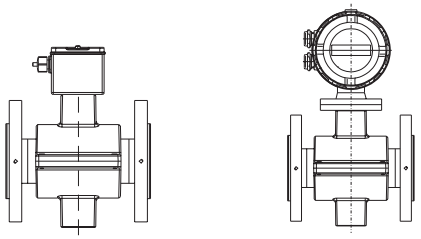
6 Specifications

6.1 Flanged Design Mod. FXE4000-DE41F / FXE4000-DE43F, Wafer Design. Mod. FXE4000-DE41W / FXE4000-DE43W

Attention!

The allowable fluid temperature (TS) and the allowable pressure (PS) are determined by the liner and flange materials of the instrument (see Factory and Type tags on the instrument).

6.1.1 Material Load Curves for Mod. FXE4000-DE41F / FXE4000-DE43F (Flanged Design)



FXE4000-DE41F FXE4000-DE43F

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner
Max. Temperature ≤ 130 °C for PTFE/PFA Liner

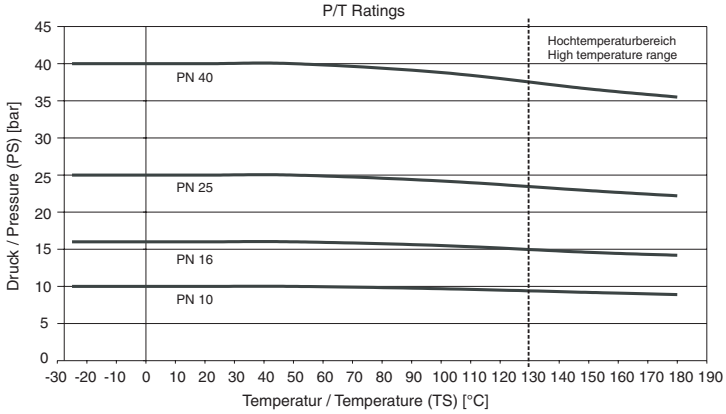


Fig. 46: DIN-Flanges SS No. 1.4571[316Ti] to DN 600

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner
Max. Temperature ≤ 130 °C for PTFE/PFA Liner

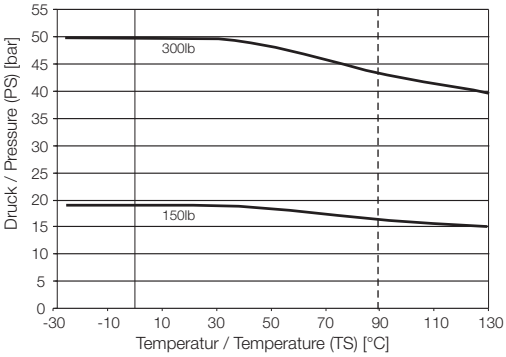


Fig. 47: ANSI-Flanges SS No. 1.4571[316Ti] to 12” (CL150/300) to 40”(CL150)

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner
Max. Temperature ≤ 130 °C for PTFE/PFA Liner

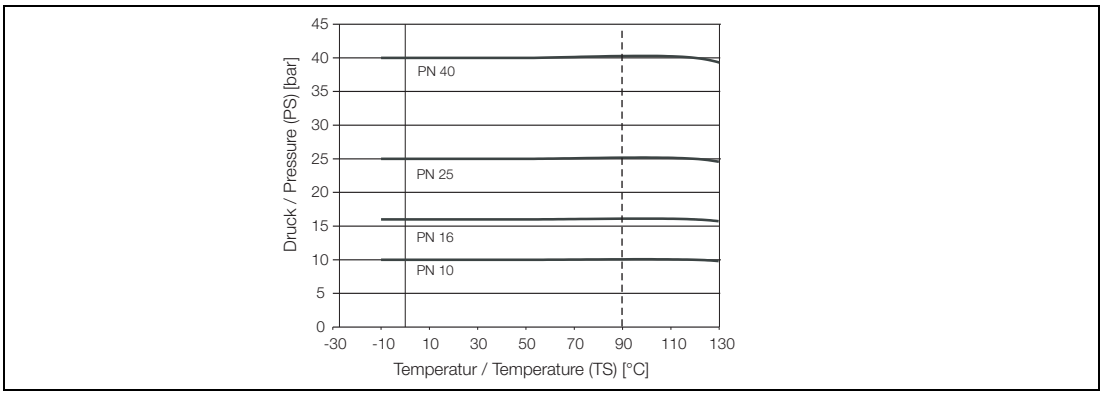


Fig. 48: DIN-Flanges Steel to DN 600[24"]

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner
Max. Temperature ≤ 130 °C for PTFE/PFA Liner

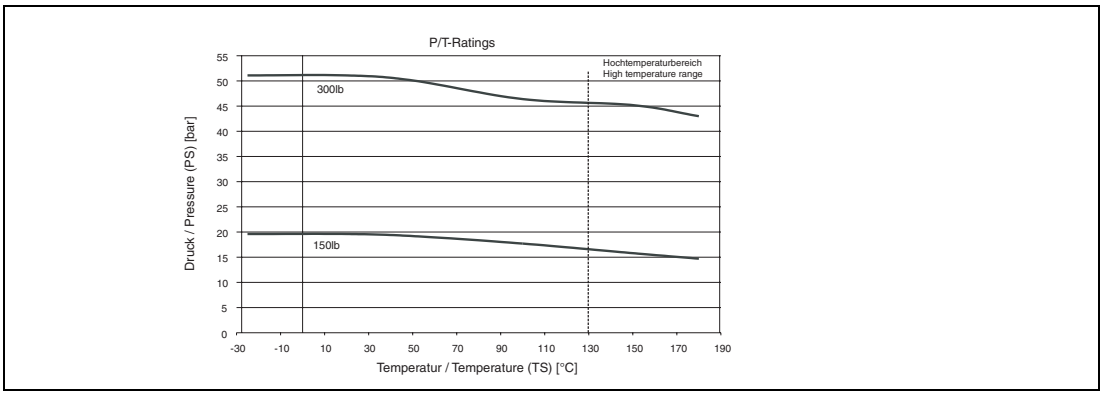


Fig. 49: ANSI-Flanges Steel to 12" (CL150/300) to 40" (CL150)

JIS 10K-B2210 Flanges SS No. 1.4571[316Ti] or Steel

Meter Size DN	Meter Size Inch	Material	PN	TS [°C]	PS [bar]
32–100	1–1/4-4	SS No. 1.4571[316Ti]	10	-25 to +130	10
32–100	1–1/4-4	Steel	10	-10 to +130	10

Liner: PTFE, Hard/Soft Rubber (limited to 90 °C)

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner

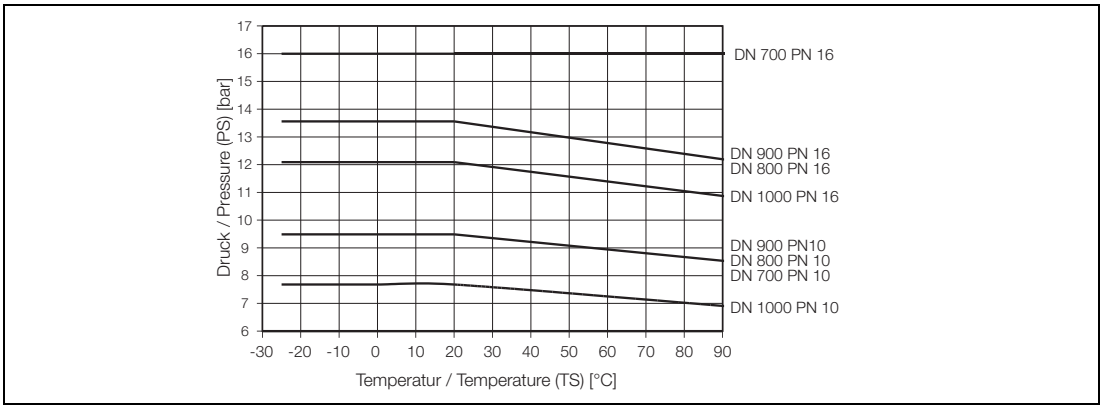


Fig. 50: DIN-Flanges SS No. 1.4571[316Ti] DN 700 – DN 1000

Max. Temperature ≤ 90 °C for Hard/Soft Rubber Liner

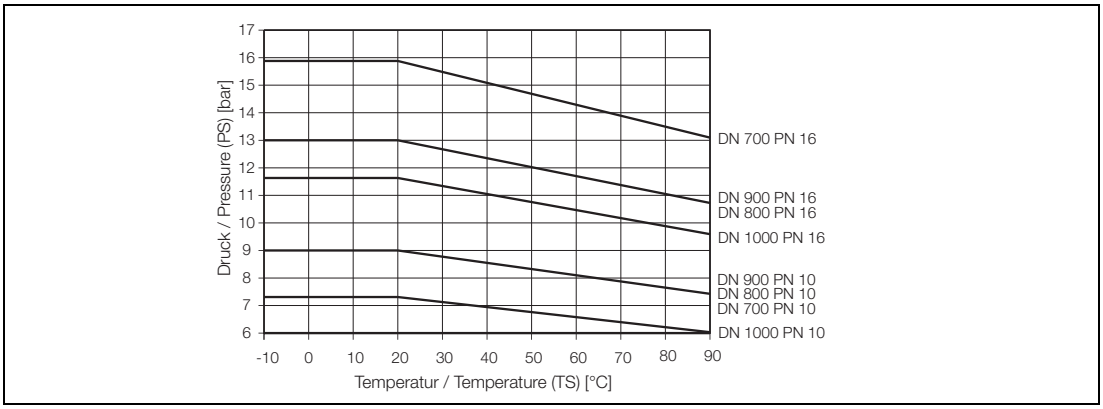
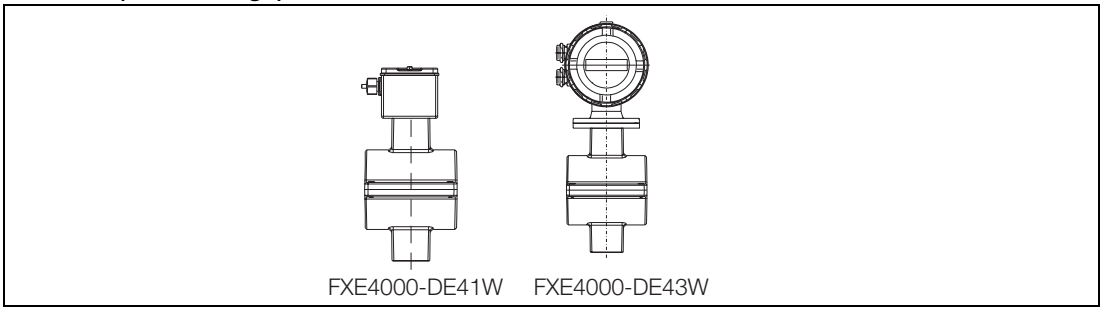


Fig. 51: DIN-Flanges Steel DN 700 – DN 1000

6.1.2 Material Load Curves for Models FXE4000-DE41W / FXE4000-DE43W (Wafer Design)



(PFA-Liner, Wafer design)

Meter Size DN	Meter Size Inch	TS_{max} [°C]	TS_{min} [°C]	PS_{max} [bar]
3 – 100	1/10 – 4	130	–10	16 (CL150)

6.1.3 General Specifications for Models FXE4000-DE41F/FXE4000-DE43F, FXE4000-DE41W/FXE4000-DE43W

Min. allow. Pressure as a Function of the Fluid Temperature

Liner	Meter Size DN	Meter Size Inch	$P_{Operate}$ mbar abs.	at	$T_{Operate}$ °C
Hard rubber	15 to 250	1/2 to 10	0		< 90
	300 to 1000	12 to 40	0		< 90
Soft rubber	50 to 250	2 to 10	0		< 90
	300 to 1000	12 to 40	0		< 90
PTFE	10 to 600	3/8 to 24	270		< 20
			500		< 130
PFA	3 to 100	1/10 to 4	0		< 130

Other meter sizes, pressure ratings, Temperature Classes upon request

Max. allow. Fluid Temperature as a Function of the Ambient Temperature for Instruments with Steel Flanges

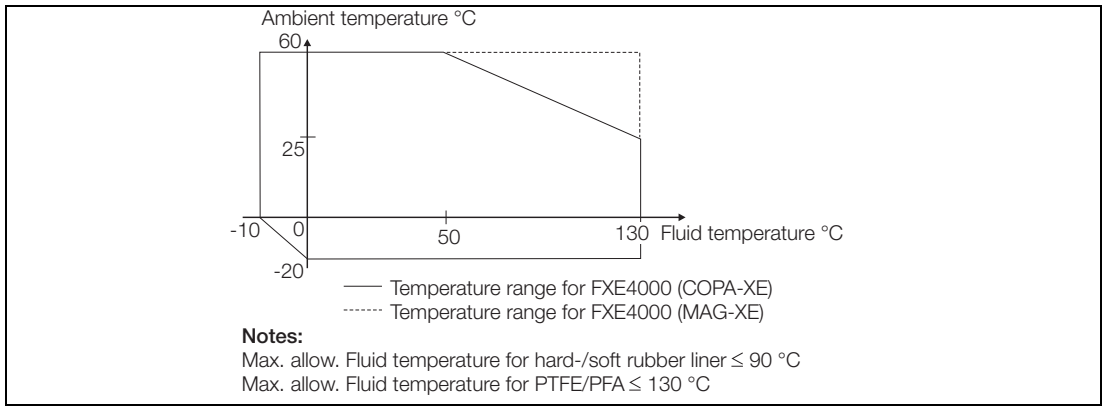


Fig. 52: Max.allow. Fluid Temperature as a Function of the Ambient Temperature for Instruments with Steel Flanges

Max. allow. Fluid Temperature as a Function of the Ambient Temperature for Instruments with Stainless Steel Flanges

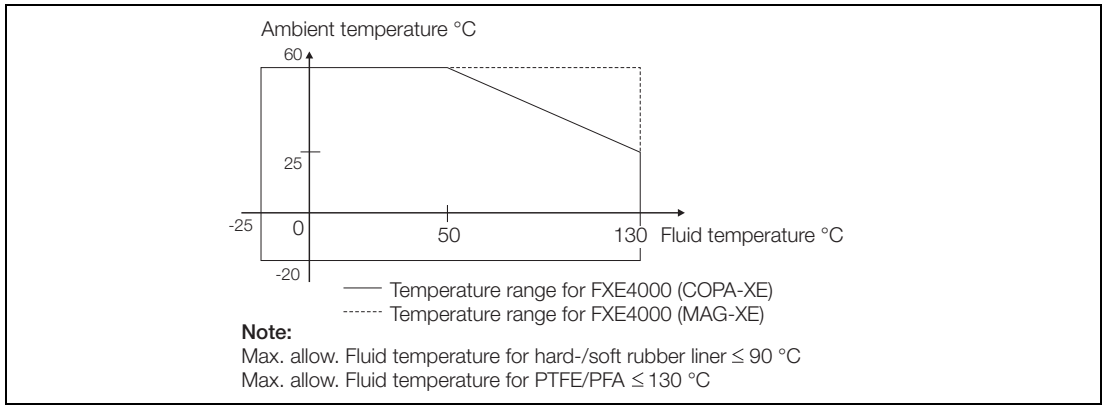


Fig. 53: Max. allow. Fluid Temperature as a Function of the Ambient Temperature for Instruments with Stainless Steel Flanges

Flowmeter Primary Materials

Part	Standard	Others
Liner	PTFE, PFA, Hard Rubber, Soft Rubber	–
Signal and grounding electrodes with – Hard rubber, Soft rubber	SS No. 1.4571 [316TI]	Hast. B-2 (2.4617), Hast. 2 C-4, Titanium, Tantalum, Platinum-Iridium
– PTFE PFA	Hast. C-4 (2.4610)	SS No. 1.4571 [316TI] Hast. B-2 (2.4617) Titanium, Tantalum Platinum-Iridium
Grounding plate for flanged and wafer design instruments	SS No. 1.4571 [316TI]	upon request
Protection plate	SS No. 1.4571 [316TI]	upon request

Process Connection Material

Part		Standard	Others
Flanges			
DN 3 - DN 15	1/10" - 1/2"	SS No.1.4571[316Ti] (Standard)	
DN 20 - DN 300	3/4" - 12"	Steel (galvanized)	SS No. 1.4571[316Ti]
DN 350 - DN 1000	14" - 40"	Steel (painted)	SS No. 1.4571[316Ti]

Part		Standard	Others
Housing DN 3 - DN 300	1/10" - 12:"	Two piece housing Cast Alum, painted, Paint coat, 60 µm thick RAL 9002	–
DN 350 - 1000	14" - 40"	Welded steel construction, painted Paint coat, 60 µm thick RAL 9002	
Connection box		Cast Alum, painted, 60 µm thick Frame: dark gray, RAL 7012 Cover: light gray, RAL 9002	–
Meter pipe		SS No. 1.4301[304]	–
Pg-Connector		Polyamide	–

Protection Class EN 60529

IP 67
IP 68 (only for FXE4000-DE21/FXE4000-DE41 flowmeter primary)

Pipeline Vibration in Based on EN 60068-2-6

For Compact Design instruments (COPA-XE):
In the range 10 - 55 Hz max. 0.15 mm amplitude
In the range 55 - 150 Hz max. 2 g acceleration

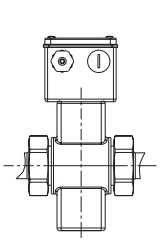
For Instruments with Remote Mounted Converters (MAG-XE):
In the range 10 - 55 Hz max. 0.15 mm amplitude

Designs

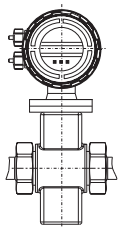
The installation lengths for the flanged designs correspond to those specified in VDI/VDE 2641, ISO 13359 or DVGW (Working Paper W420, Design WP, ISO 4064 short).

6.2 Specifications Stainless Steel Flowmeters

6.2.1 Material Load Curves for Model FXE4000-DE21_ or FXE4000-DE23_, (with variable process connections) DN 3 - DN 100 [1/10" - 4"]



FXE4000-DE21_

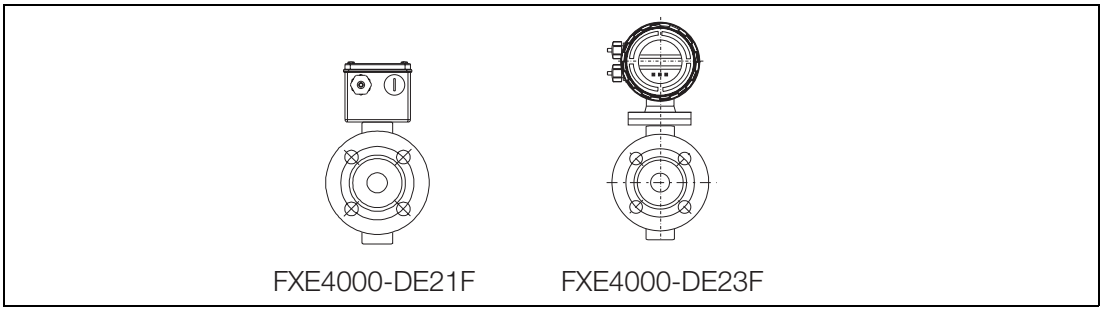


FXE4000-DE23_

Process Connection Liner PFA	Meter Size DN	 Inch	$PS_{max.}$ [bar]	$TS_{max.}$[°C]	$TS_{min.}$[°C]
Wafer design	3– 50	1/10–2	40 (CL 300)	130*	– 25
	65–100	2-1/2 –4	16 (CL 150)	130*	– 25
Weld stubs per ISO 2037	25–100	1–4	10	130*	– 25
Weld stubs per DIN 2463	10–100	3/8–4	10	130*	– 25
Weld stubs per DIN 11850	10 –100	3/8–4	10	130*	– 25
Food Ind. fitting per DN 11851	3–100	1/10–4	10	130	– 25
Tri-Clamp per DIN 32676	3–100	1/10–4	10	121	– 25
External threads ISO 228	3– 25	1/10–1	10	130*	– 25

*) Higher temperatures for CIP/SIP cleaning are permissible for limited time periods, see Table „Max. allow. Cleaning Temperature".

6.2.2 Material Load Curves for Flanged Instruments Models FXE4000-DE21F / FXE4000-DE23F



Liner: PFA

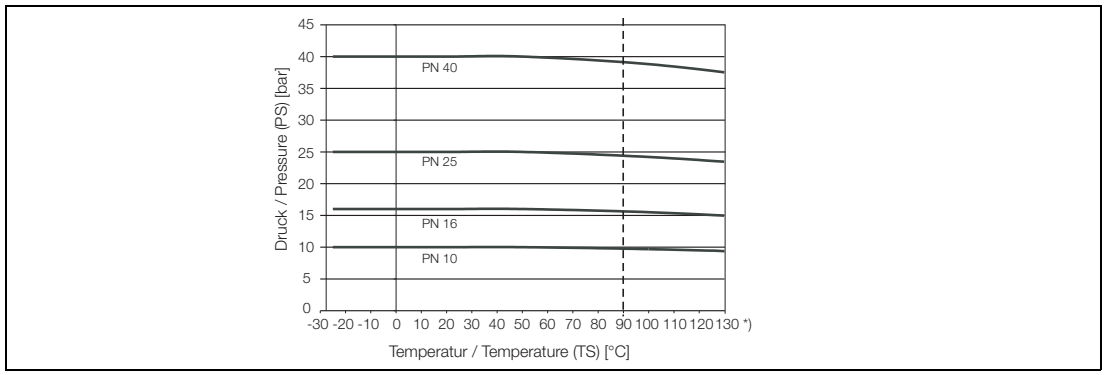


Fig. 54: DIN-Flanges SS No. 1.4571[316Ti] to DN 100

Liner: PFA

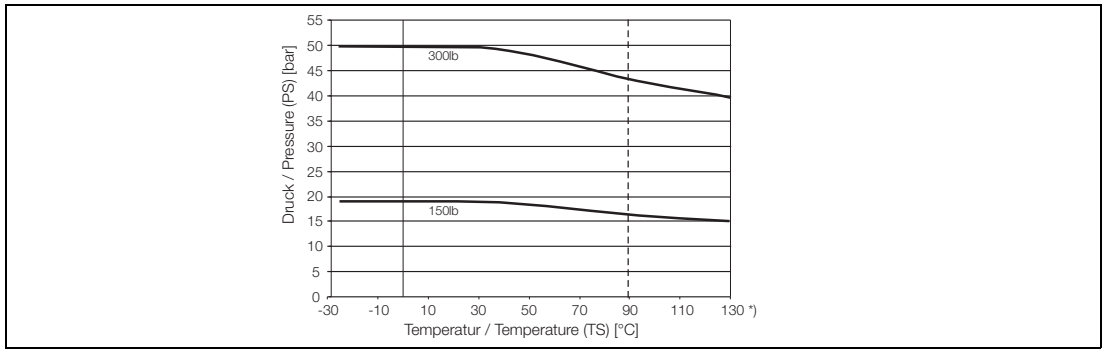
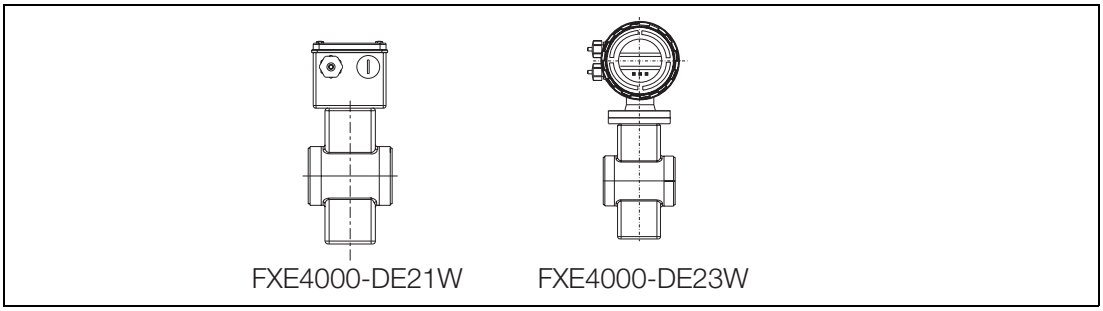


Fig. 55: ASME-Flanges SS No. 1.4571[316Ti] to 4”

JIS 10K-B2210 Flanges SS No. 1.4571 or Steel

Meter Size DN	Meter Size Inch	Material	PN	TS [°C]	PS [bar]
25 – 100	1 – 4	SS No. 1.4571[316Ti]	10	-25 to +130*	10
25 – 100	1 – 4	Steel	10	-10 to +130*	10

6.2.3 Material Load Curves for Wafer Design Instruments Models FXE4000-DE21W / FXE4000-DE23W



Liner: PFA

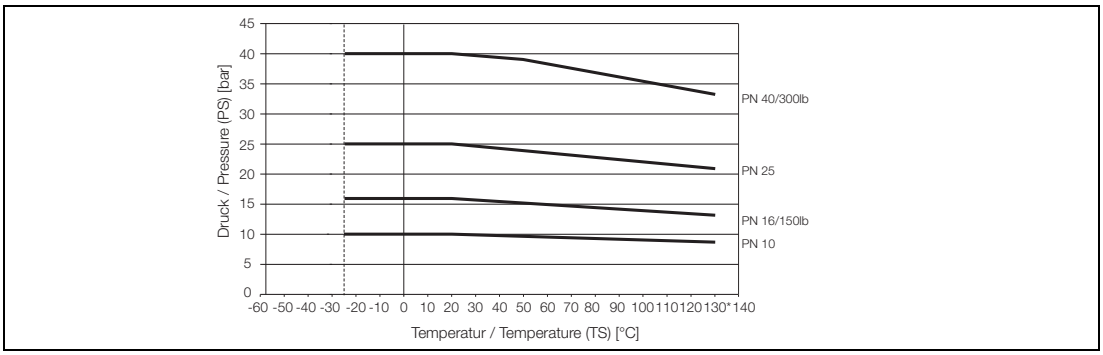


Fig. 56:

*) Higher temperatures for CIP/SIP cleaning are permissible for limited time periods, see Table „Max. allow. Cleaning Temperature“..

JIS 10K-B2210 Wafer design

Meter Size DN	Meter Size Inch	Material	PN	TS [°C]	PS [bar]
32 to 100	1-1/4 to 4	SS No. 1.4404[316L] SS No. 1.4435[316L] SS No. 1.4301[304]	10	–25 to +130	10

Minimum Allowable Absolute Pressure

Liner	Meter Size DN	Meter Size Inch	$P_{Operate}$ mbar abs	at	$T_{Operate}$ °C
PFA	3 to 100	1/10 to 4	0	≤	130*

Maximum Allowable Cleaning Temperature

CIP-Cleaning	Liner	T_{max} °C	T_{max} Minutes	T_{Amb} °C
Steam cleaning	PFA	150	60	25
Liquid cleaning	PFA	140	60	25

If the ambient temperature > 25 °C, then the difference is to be subtracted from the max. cleaning temperature. T_{max} - Δ °C, Δ °C = (T_{Anb} -25 °C).

Maximum Allowable Shock Temperature

Liner	Temp.-Shock max. Temp.-Diff. °C	Temp.-Gradient °C/min
PFA	any	any

Temperature Diagram

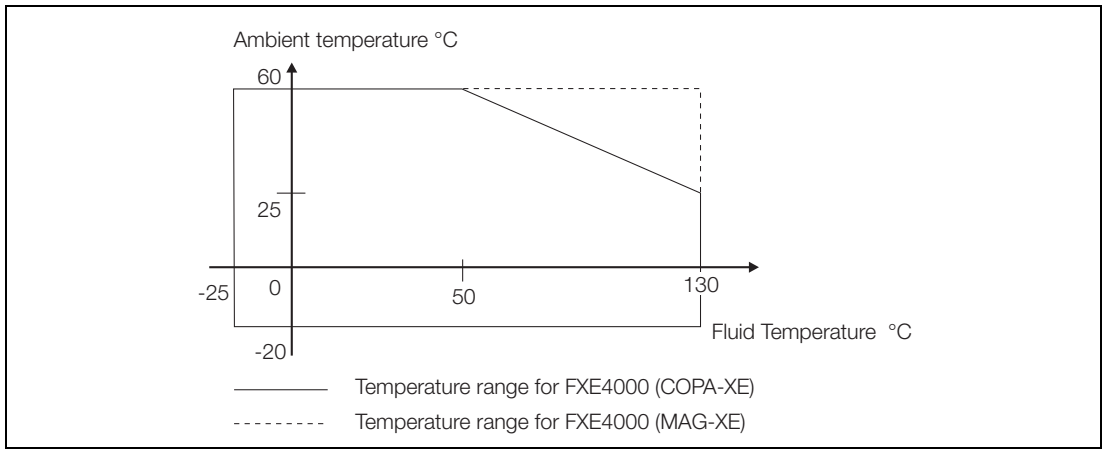


Fig. 57: Maximum Allowable Ambient temperature as a Function of the Fluid Temperature for Stainless Steel Process Connections and Wafer Designs

Fluid Temperature

-25 °C to +130 °C, CIP-capable, see Temperature Diagram and max. allowable cleaning temperature.

Storage Temperature

-20 °C to +70 °C

Materials Flowmeter Primary

Liner Material	Electrode Material		Electrode Design	
	Standard	Others	Standard	Others
PFA	Hast.-C4 (1.4539 for Food Ind. fittings & Tri-Clamp	Hast.-B2 SS No. 1.4539 SS No. 1.4571[316Ti] Tantalum, Titanium, Platinum-Iridium	Flat head	Pointed head ≥ DN10[3/8"]

Process Connection Material

	Standard
Flanges per DIN	SS No. 1.4571 [316Ti}
Wafer design	none
Weld stubs	SS No. 1.4404 [316L]
Food Ind. fitting per DIN 11851	SS No. 1.4404 [316L]
Tri-Clamp per DIN 32676	SS No. 1.4404 [316L]
External threads	SS No. 1.4404 [316L]

Connection Box	Standard	Option
COPA-XE	Cast Alum, painted, Colors Frame: dark gray, RAL 7012 Cover: light gray, RAL 9002	Converter housing made completely of SS No. 1.4301 [304]
MAG-XE	SS No. 1.4301 [304]	–
Meter Pipe	SS No. 1.4301 [304]	–
PG-Connector	Polyamide	–
Primary housing	Deep drawn SS No. 1.4301 [304]	

Gasket Material

Process Connection	Gasket Material
Wafer design	none
Weld stubs, Food Ind. fitting, Tri-Clamp, External threads	EPDM (Ethylene-Propylene) std. for FDA-Approval, Silicone with FDA-Approval (Option)
Housing flat gasket	Silicone

Protection Class per EN 60529

IP 67 Standard
IP 68 (only for FXE4000-DE21/FXE4000-DE41 flowmeter primary)

Pipeline Vibration in Based on EN 60068-2-6

For Compact Design instruments (COPA):
In the range 10 - 55 Hz max. 0.15 mm amplitude
In the range 55 - 150 Hz max. 2 g acceleration

For Instruments with Remote Mounted Converters (MAG):
In the range 10 - 55 Hz max. 0.15 mm amplitude

7 Programming the Converter

7.1 Available Display Formats

When the supply power is turned on the Model Number of the converter is displayed in the first line together with the software version and revision level in the second line. The process information for the flowmeter is then displayed.

In the first line the present flow direction (→ F for forward or ← R for reverse) and the instantaneous flowrate value in percent or direct reading engineering units is displayed. The totalizer value (7 digits) for the present flow direction is displayed with its units.

The totalizer value displayed is always the actual measured flow in its units regardless of the pulse factor value. This display format is called Process Information in the following text.

The totalizer value for the other flow direction can be displayed by pressing the STEP or DATA key.

→F	98.14 l/h
→**F**	12.30000 **m3**

1st line Instantaneous forward flowrate value
2nd line Forward totalizer value

→F	98.14 l/h
←**R**	516.0000 **m3**

1st line Instantaneous forward flowrate value
2nd line Reverse totalizer value (multiplex operation)

→F	70.01 l/s
→**F**	10230 m3

1st line Instantaneous forward flowrate value
2nd line Totalizer overflow. →F and m^3 blink

A totalizer overflow is always registered when the totalizer value reaches 10,000,000 units. When the totalizer value in a flow direction exceeds 9,999,999 units, the flow direction indicators (→F or ←R) and the totalizer units in the 2nd line blink. The software can record up to 250 totalizer overflows. The overflow message can be cleared independently for each flow direction using ENTER.

During an error condition an error message is displayed in the 1st line.

Flow	>130 %
→**F**	10.230 **m3**

The display alternates between a clear text message and the error code. During the clear text message display only the error with the highest priority is shown. In the alternate display the error codes for all the detected errors are shown.

Error Codes	Clear Text	Cause
0	Empty pipe	Pipeline not filled.
1	A/D saturated	A/D-Converter saturated.
2	Uref too small	Pos. or. neg. reference too small.
3	Flow >130 %	Flowrate greater than 130 %.
4	Ext. zero return	Ext. zero contact activated.
5	RAM invalid	Data in RAM invalid.
6	Totalizer	Totalizer value invalid.
7	Urefp too large	Positive reference too large
8	Urefn too large	Negative reference too large
9	Excit. frequency	Supply power frequency or driver/digital board error.
A	Max. Alarm	Flowrate above max. alarm limit.
B	Min. Alarm	Flowrate below min. alarm limit.
C	Primary data	Error in external EEPROM or module not installed.

Error Code Table Listed by Priority

In addition to displaying an error message the alarm output is activated over the optocoupler and the current output is set to its programmed alarm value (submenu „Iout at Alarm“) (does not apply to Error 6).

7.2 Data Entry

Data can be entered using the Magnet Stick without removing the housing cover. The Magnet Stick is positioned over appropriate **NS** Symbol.

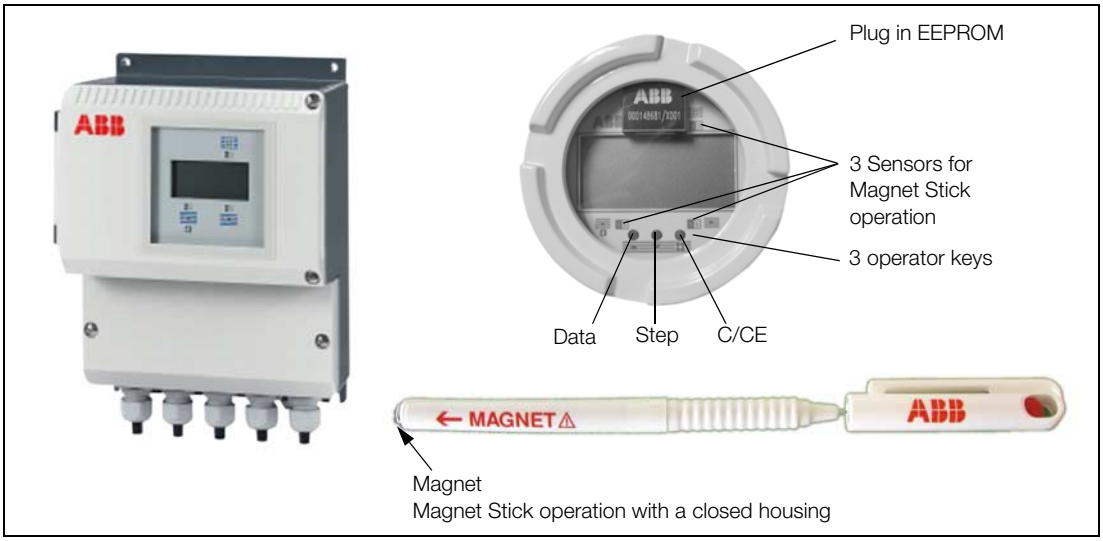


Fig. 58: Converter Keypad and Display

During data entry the converter remains on-line, the current and pulse outputs continue to indicate the actual operating values. The individual functions for the keys are described below:

C/CE	The C/CE key is used to toggle back and forth between the operating mode and the menus.
STEP ↓	The STEP-key is one of two arrow keys. STEP is used to scroll forward through the menus. All desired parameters can be accessed.
DATA ↑	The DATA-key is one of two arrow keys. DATA is used to scroll backward through the menus. All desired parameters can be accessed.
	The ENTER-Function is activated by pressing both arrow keys, STEP and DATA, simultaneously.
ENTER	ENTER is used to turn the program protection on and off. Additionally, ENTER is used to access the values in the parameter to be changed and to accept the new values or selections.
	The ENTER function is active for only 10 seconds. If no entries are made during this 10 second period the old value is redisplayed in the converter.

ENTER Function for Magnet Stick Operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for more than 3 seconds. The display blinks to indicate that the function is active.

Data entry is divided into two entry types:

- Direct numeric entries
- Selections from a predefined table.

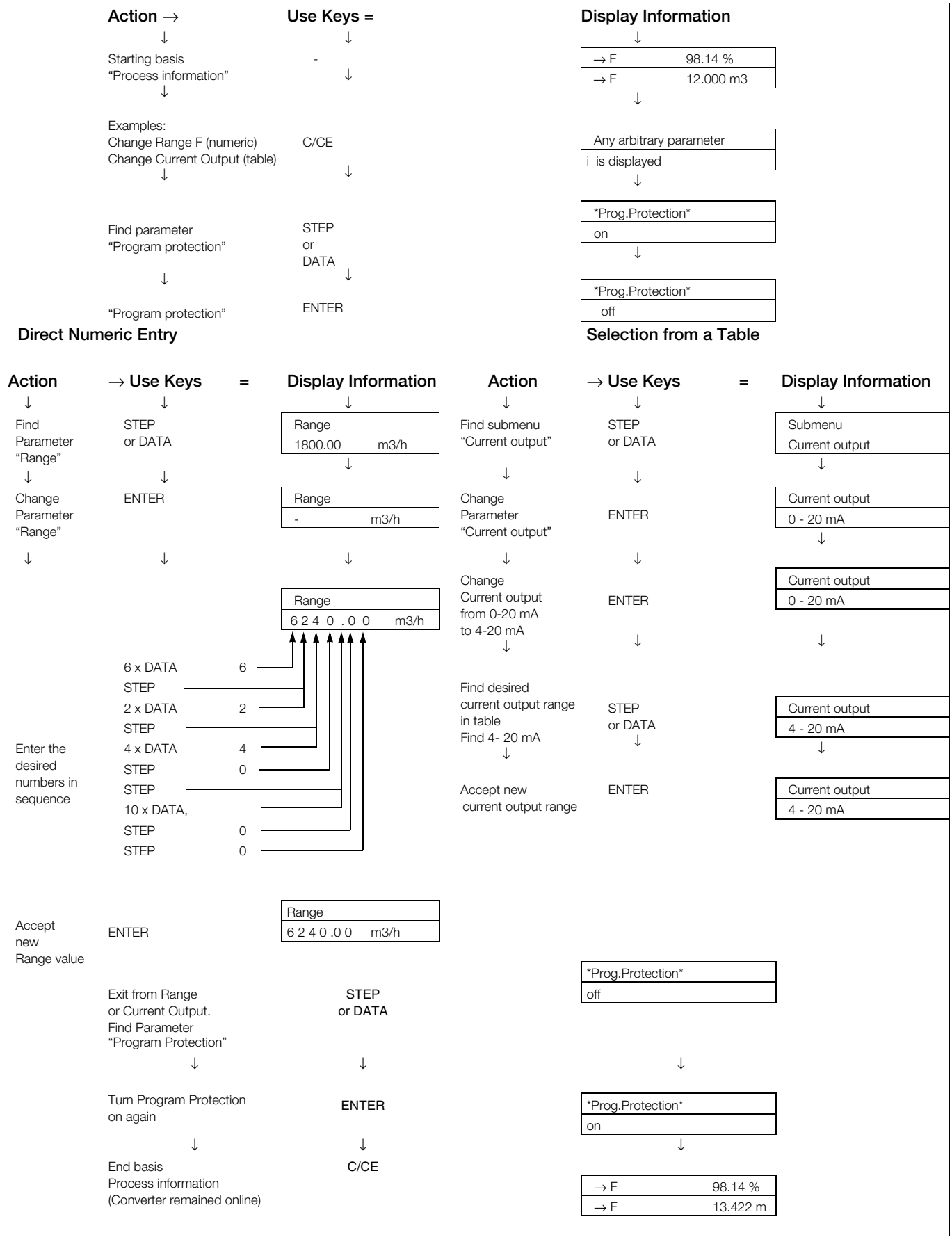
Information!

During data entry the values entered are checked for plausibility and if necessary, rejected with an appropriate message.

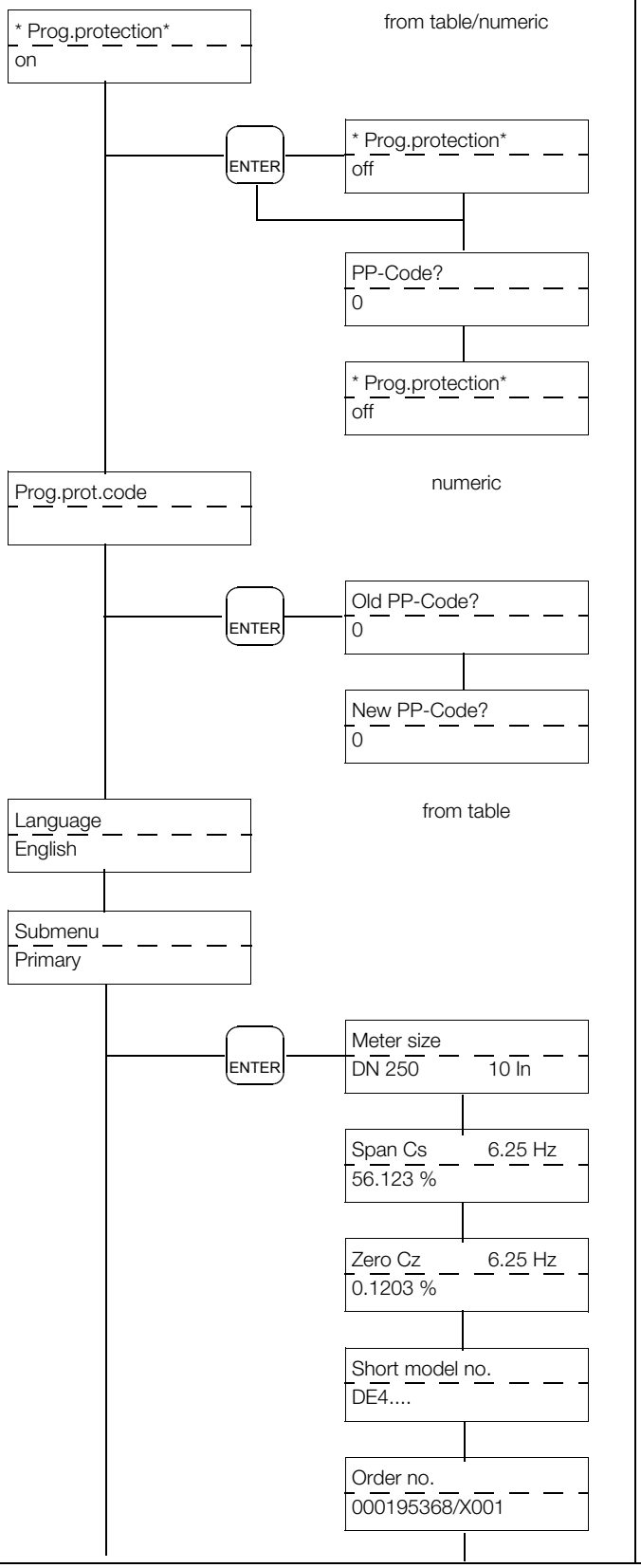
Warning!

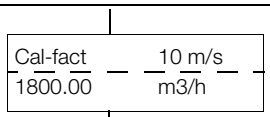
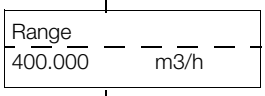
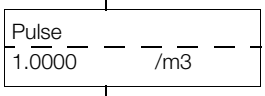
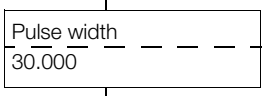
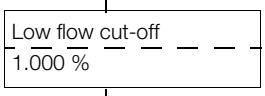
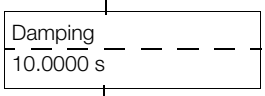
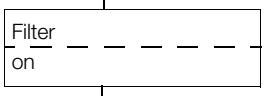
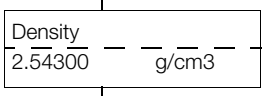
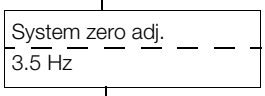
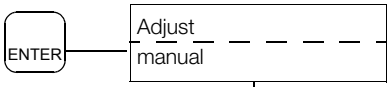
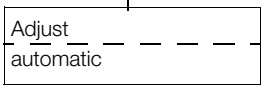
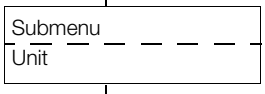
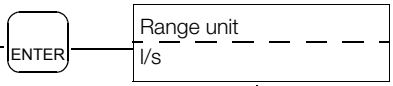
When the converter housing is opened, EMC and personnel contact protection are no longer provided.

7.3 Data Entry in „Condensed Form“

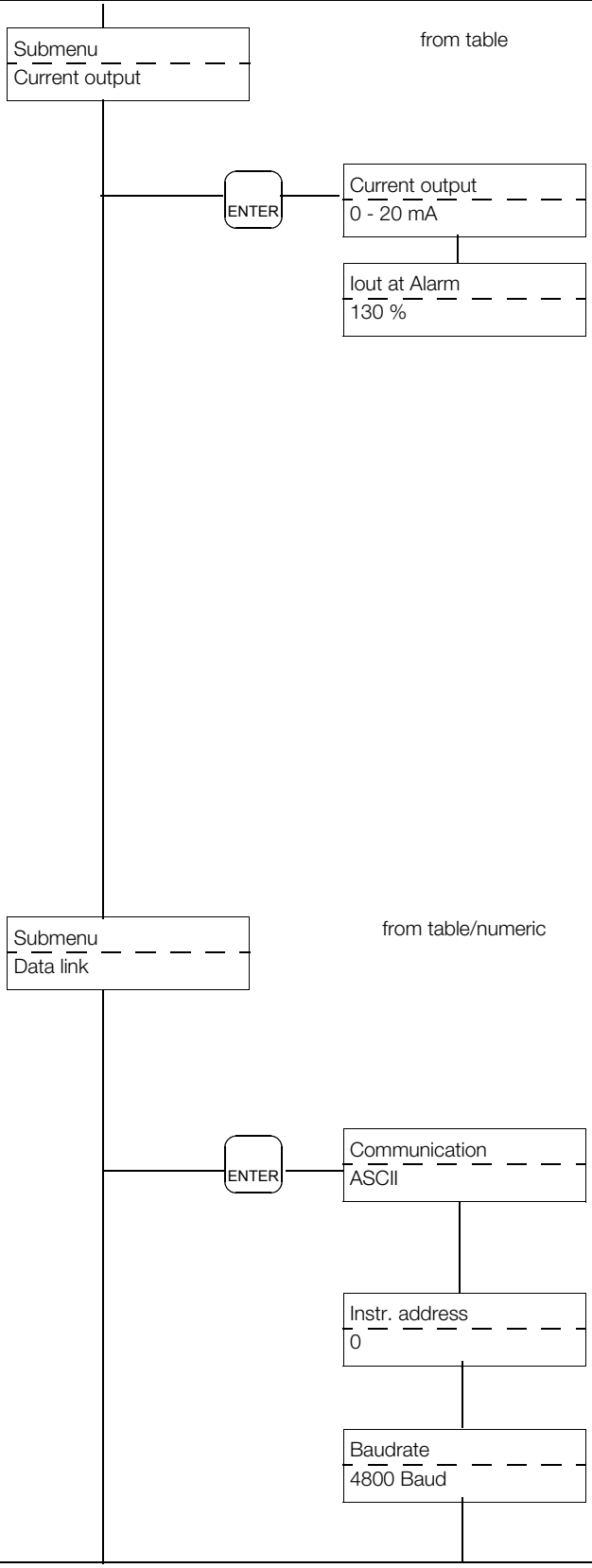


7.4 Parameter and Data Entry in "Condensed Form"



Submenu/Parameter	Entry Type	Comments
	numeric	Cal-factor is the flowrate value at 10 m/s flow velocity. The Cal-factor is automatically selected when the flowmeter size is selected.
		Flow range for the forward and reverse flow directions. Min. flow range setting is 0 - 0.5 m/s (0-0.05 Cal-fact) Max. flow range setting is 0 - 10 m/s (0-1 Cal-fact) The flow range end value can be entered anywhere between 0.5 and 10 m/s. The units are selected in the submenu Unit. (See also Section 8.7)
		For int. and ext. flow totalization, range 0.001 - 1000 pulse per selected unit, max. count frequency 5 kHz. The units are selected in the submenu Unit. (See also Section 8.2 and 8.8)
	numeric	For external pulse output, pulse width can be set between 0.1 and 2000 ms. For PROFIBUS PA and FOUNDATION Fieldbus this menu is not displayed. (See also Section 8.3)
	numeric	Range 0-10 % of the flow range set in „Range“. Applies to the values in the display and all outputs. When the flowrate is below the low flow cut-off value the flow is no longer measured. The current output is set to its zero value. The switching hysteresis for the flow cut-off is 1 %.
	numeric	The damping can be set between 0.5 and 99.9999 s. The value is the time for the indication to reach 99% of its final value for a flowrate step change. It applies to the instantaneous values in the display and the current output.
	numeric	On/off. (factory default setting = OFF). When the output signal is noisy, turn the filter on and enter a damping time > 2.4 s . (See also Section 8.4)
	numeric	If the totalizer values and flowrate display are to use mass units (g/kg/t/pound or uton), then a fixed density value must be entered for the calculations. Density values in the range between 0.01 and 5.0 g/cm^3 can be entered.
		Zero value adjustment (See also Section 8.6)
		Manual entry
		Valve must be closed. Pipeline must be completely full. Flowrate must be at zero. The auto. adjustment is initiated using ENTER.
	from table/numeric	 Exit the submenu (See also Section 8.7)
		lbs/s,lbs/min, lbs/h, uton/min, uton/h, uton/day, l/s, l/min,l/h, hl/s, hl/min, hl/h, m3/s, m3/min, m3/h, igps, igpm, igph, mgd, gpm, gph, bbl/s, bbl/min, bbl/h, bbl/day, bbl/min, bbl/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, kgal/s, kgal/min, kgal/h

Submenu/Parameter	Entry Type	Comments
Totalizer unit m3		ml, l, hl, m3, igal, gal, mgal, bbl, bls, kg, t, g, Ml, lb, uton, kgal
Unit factor 3785.41 Liter		If a desired unit is not included in the table, it is possible to program a user defined flow unit, based on Liters. The value of 3785.41 shown here is for the kgal unit kgal (factory default setting).
Unit name kgal /s /min /h		Four character name for the user programmed unit.
Prog.unit without Density		Programmed unit for mass (with density) or volume flowrate (without density)
Submenu Alarm	from table/numeric	C/CE Exit the submenu
Error log 0 ... 3 ...	ENTER	All detected errors (Error 0-9, A, B, C) are stored. Use ENTER to clear the Error Log. To display the clear text for all Error Codes press ENTER and then STEP.
Max alarm 130 %		The value of the desired MAX-Alarm limit can be set in 1%-steps from 0 to 130 % of the flow range entered in „Range“. This value applies to the forward and reverse flow directions. Selecting the MAX-Alarm function causes the contact across the terminals to be actuated when the flowrate exceeds the limit value entered. In addition, whenever the MAX-alarm is active an upward blinking arrow is displayed. →F 115.67 % →F 6789.12 l
Min alarm 10 %		Alarm, range 0-130 % of the flow range entered in „Range“. Set in 1% steps, switching hysteresis 1 % (see MAX-Alarm)
Submenu Prog.in/output	from table	This menu is not displayed for PROFIBUS PA and FOUNDATION Fieldbus. (See also Section 8.8)
Terminal P7/G2 General alarm	ENTER	Contact output terminals P7/G2 selections: General alarm[1)], empty pipe[1)], F/R-Signal, no function, MAX-Alarm[1)], MIN-Alarm[1)], MAX/MIN-Alarm[1)] 1) Contact can be configured as normally open or closed.
Terminal X1/G2 Ext. zero return		Contact input terminals X1/G2 selections: External zero return, totalizer reset, external totalizer stop, no function. For HART-Protocol the external totalizer stop is not available. For PROFIBUS the contact input is not available. (See also Section 8.8)



Submenu/Parameter | **Entry Type** | **Comments**

This menu is not displayed for PROFIBUS PA and FOUNDATION Fieldbus.
For instruments without HART-Protocol the menu structure in the „Current output“ menu is as follows:

Selections: 0-20 mA/4-20 mA, 0-10 mA/2-10 mA, 0-5 mA/9-10 mA, 10-20 mA/4-12 mA, 12-20 mA

Current output
4 - 20 mA

Iout at Alarm
130 %

During an error condition the contact output can be activated by the converter, an error message displayed and the current output set to a fixed value. The selections are: 3.8 mA or 0 or 130 % of the selected current output range. For Error 3 Flow > 130 % the current output is set to 130 % of the selected current output maximum value.
If „HART Communication“ was selected in the submenu Data Link (only available when this option was ordered), then the menu structure in the „Current output“ menu is as follows:
Attention:
For HART Protocol the current output is fixed at 4-20 mA . The value to which the current is set during an alarm condition can be set as described in the following menus (for instruments with HART Protocol).

Iout at Alarm
Low

Current output during an error condition selections: „Low“ or „High“. The „Low“ or „High“ value is set in the following menus.

Low Alarm
4.000 mA

User selectable value for the „Low“ status between 3.000 and 4.000 mA

High Alarm
24.8 mA

User selectable value for the „High“ status between 20.000 and 26.000 mA

C/CE

Exit the submenu

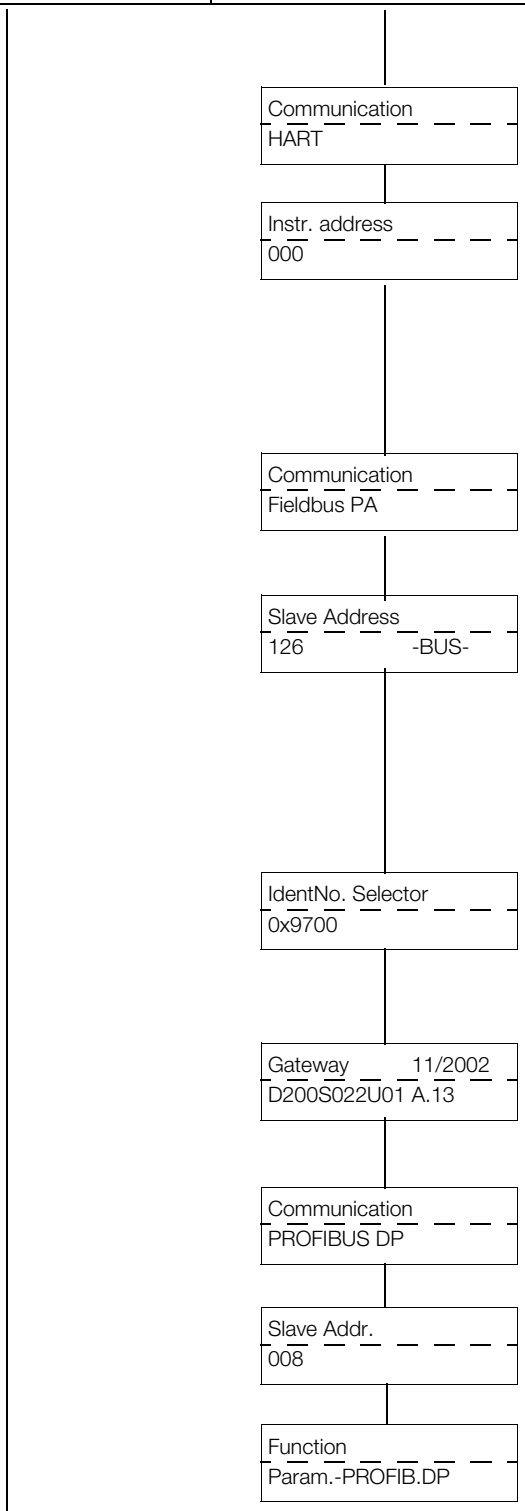
The submenu Data Link is only displayed when this option was ordered and a data link is recognized by the converter. Details for ASCII, HART, PROFIBUS PA or FOUNDATION Fieldbus communication may be found in the appropriate supplementary Operation Manuals.

1.) Communication ASCII

For this option the menu structure in the submenu Data Link is shown to the left:
Selections: ASCII or ASCII2w. ASCII2w indicates ASCII-Communication on a 2-wire line. The communication is then half-duplex.
Default setting: ASCII

If multiple instruments are connected to a single bus (RS485 with ASCII Protocol), each instrument must have a unique address. In the submenu „Instrument Address“ an address between 0 and 99 can be entered.
Default value: 0

In this submenu the transmission speed for the ASCII communication can be set between 110 and 28800 Baud.

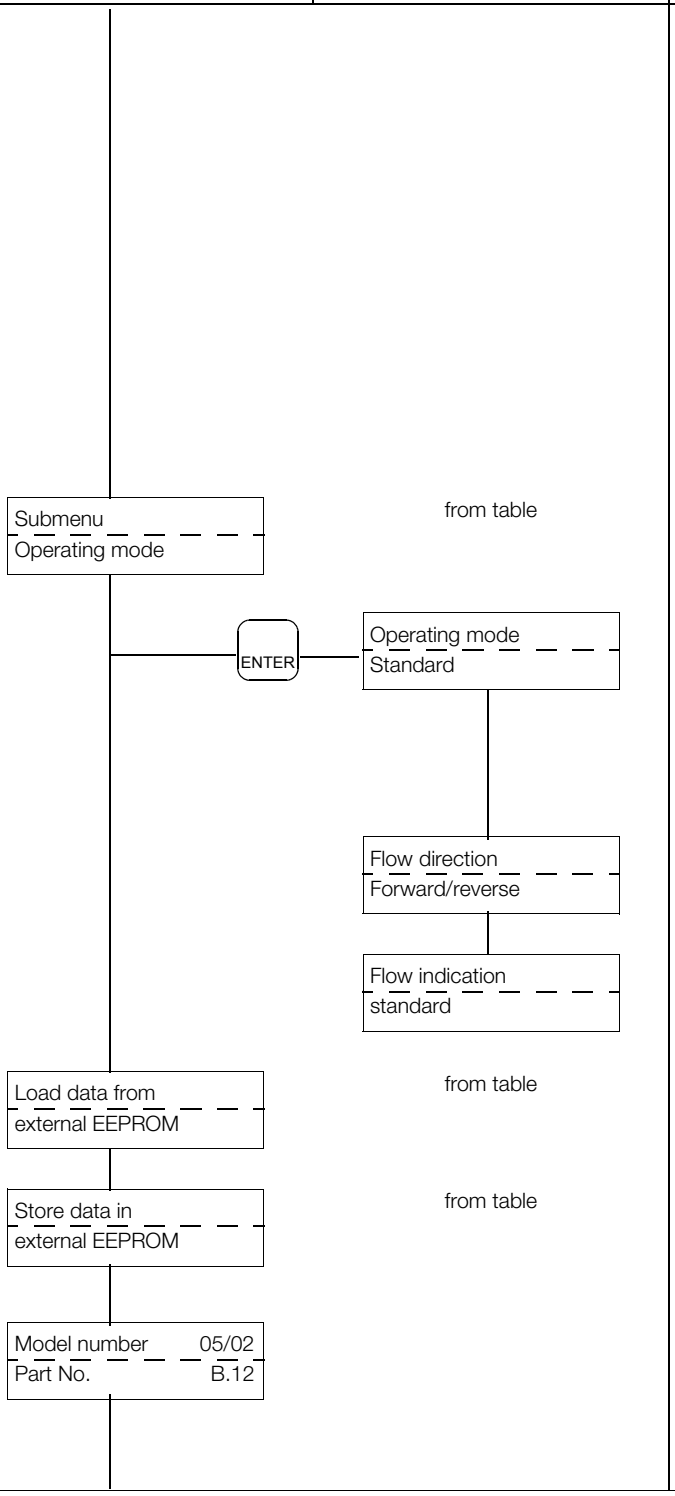
Submenu/Parameter	Entry Type	Comments
		**2. Communication HART** (Only available when this option was ordered). For this option the menu structure in the submenu Data Link is shown to the left: Read only display, no changes possible. For **HART-Protocol** the instrument address can also be set. HART-Protocol allows a bus with up to 15 instruments (1-15). **Attention:** If for HART-Protocol an address greater than 0 is entered, then the instrument operates in the Multidrop-Mode, i.e. the current output is fixed at 4 mA and only digital information it transmitted on the leads. **3. Communication PROFIBUS PA 3.0** (Only available when this option was ordered). See also Section 9.1. For this option the menu structure in the submenu Data Link is shown to the left: Only for display of the Communication Protocol: no changes can be made. Only for Communication PROFIBUS PA (no function for FF) Display of the Slave Address. Factory default setting: 126 Information for the DIP-Switch settings (see also Section 9.1) DIP-Switches 1 to 7 define the PROFIBUS Address DIP-Switch 8 defines the Address mode: **DIP-Switch 8 = Off** = Address over the bus or using the converter keypad and menus. The display indicates „-BUS-“ **DIP-Switch 8 = On** = Address using DIP-Switches 1-7. The display indicates „-switch-“ Factory default setting for DIP-Switch 8: Off Only for Communication PROFIBUS PA (no function for FF) Setting the Ident-Number-Selectors. selections: 0x9700; 0x9740: 0x0691, 6668 Factory default setting: 0x0691. Changes cannot be made during cyclical operation, only when the status is STOP. The Ident-Number 0x6668 assures backward compatibility with Profile 2.0 Display of the Gateway software version Read only display, no changes possible. If the instrument is not connected to the bus, the display indicates „No Gateway“ **4. Communication PROFIBUS DP** (Only available when this option was ordered). For this option the menu structure in the submenu Data Link is shown to the left: PROFIBUS DP can be selected The instrument address for PROFIBUS DP can be entered in this menu or over the bus. The instrument address is to be entered as a 3 digit number. Entry range 0-125; default value: 126 Read only display, no changes possible A detailed description may be found in the separate document Data Link Description for PROFIBUS DP Instruments.

Submenu/Parameter	Entry Type	Comments
Submenu Function test	from table/numeric	
ENTER → Function test Iout		This menu is not displayed for PROFIBUS DP/PA, FOUNDATION Fieldbus Function test current output, enter value in mA. For additional information see Section 8.9
Function test RAM (ASIC)		Function test int. modules. Auto. Test: RAM (ASIC), NVRAM, EPROM (Program), EEPROM, ext. EEPROM. Additional test functions: terminals P7/G2, switch S201, display, terminals X1/G2, HART-Command, Simulation and Test Mode. For additional information see Section 8.9
Submenu Detector e.pipe	from table/numeric	A full pipeline is essential for accurate measurements. If this condition cannot be maintained continually, the function „Detector empty pipe“ can be utilized to automatically turn off all output signals when the pipeline empties.
ENTER → Detector e.pipe on		Use ENTER and then STEP, to turn the detector on and off. off = Detector not active on = When the pipeline is empty, message in the display. The following menus are only displayed when the detector empty pipe is turned „on“.
Iout at e.pipe 130 %		Current output status when pipeline is empty: When the pipe is empty and the detector and the alarms are turned on, the following selections for the current output value are available: For 0-20 mA 0 % = 0 mA or 130 % = 26 mA For 4-20 mA 0 % = 3.6 mA or 130 % = 26 mA For Error 3 (Flow >130 %) the output is always set to 130 % = 26 mA. For HART-Protocol the display for Iout at empty pipe is „Low“ or „High“. The „Low“ or „High“ state is defined in the menu „Current output“. The alarm output is activated and the message „Empty pipe“ and „Error 0“ are displayed. This menu is not available for PROFIBUS PA or FOUNDATION Fieldbus.
Alarm e.pipe on		On = when the pipeline is empty, signal over contact P7, G2 or Ux, P7 Off = when the pipeline is empty, no signal over the contact This menu is not available for PROFIBUS PA or FOUNDATION Fieldbus.
Threshold 2300 Hz		Threshold 2300 Hz for activating the empty pipe alarm
Adjust Detector e.pipe		The pipeline must be full. After ENTER the following message is displayed (as an example) Adjust 18750 196 Use STEP or DATA keys to adjust the 18750 value to 2000 ± 25 Hz. Use ENTER to accept this value. Then empty the pipeline. The adjustment value in the display must increase above the value set in the menu „Threshold“. The detector empty pipe is adjusted.

Submenu/Parameter	Entry Type	Comments
Submenu Totalizer	from table/numeric	C/CE Exit the submenu
ENTER Totalizer →F reset		The totalizer values and overflow messages can be reset independently for the forward and reverse flow directions with ENTER. First the overflow counter value (if any) is reset and using ENTER again the totalizer value. When an overflow has occurred, the forward or reverse direction indicators and the units blink in the process display. The software can record up to 250 totalizer overflows. When an overflow occurs (totalizer value >9/999/999 units) the totalizer is reset and the overflow counter incremented by 1. If more that 250 overflows occur, the message „Overflows >250“ is displayed. The forward totalizer is reset using ENTER. If overflow >0, then only the overflow counter value is displayed. This function is not available for certified instruments.
Totalizer →F 4697.00 m3		The totalizer value for the „Forward“ and „Reverse“ flow directions can be manually preset to any value. This feature could be used to transfer the totalizer value from an old converter to a new converter after an exchange. Use STEP or DATA to access the parameter, the present totalizer value is displayed in the 2nd line; after using ENTER a new value can be entered and accepted using ENTER again. Preset totalizer (totalizer value settable) 2nd display line = present value
Overflow →F 250		This function is not available for certified instruments. Overflow counter max. 250, 1 Overflow = totalizer value 10,000,000 units (display indication reset and overflow counter increment by 1.
Totalizer ←R reset		See Forward Totalizer
Totalizer ←R 625.000 m3		See Forward Totalizer
Overflow ←R 004		See Forward Overflow
Totalizer funct. Standard		Selections: „Standard“ or „Difference“ The selection is made using STEP and DATA and closed using ENTER. In the „Totalizer function Standard“ the count pulses for the forward and reverse flow direction totalizers and integrated on two separate totalizers. If in menu „Operating mode“ the flow direction is selected as „Forward“ only, then only the forward totalizer counts. For the „Difference“ selection the flows in both directions are integrated in a single totalizer. In the forward direction the pulses are added while in the reverse direction they are subtracted from the totalizer value. The pulse output is not affected by these selections.
Mains interrupt reset		If a blinking asterisk is displayed in the first line, a power outage has occurred, it can be reset using ENTER. This function is only available for instruments with HART-Protocol.

Submenu/Parameter	Entry Type	Comments
Submenu Display	from table	C/CE Exit the submenu
ENTER → 1st line Q [%]		Selections for display in the 1st line: flowrate in %, in direct reading engineering units, totalizer, totalizer forward, totalizer reverse, TAG-Number or Bargraph
2nd line Totalizer		See 1st line
1st line multipl. Q [Bargraph]		In addition to the display selections for the 1st line it is possible to display an additional value in multiplex operation: flowrate in %, in direct reading engineering units, totalizer, totalizer forward, totalizer reverse, TAG-Number or Bargraph or a blank line
2nd line multipl. off		The display automatically alternates every 10 seconds See 1st line multiplex
		For instruments with PROFIBUS PA or FOUNDATION Fieldbus in addition to the standard display selections: flowrate in % or direct reading engineering units, totalizer, totalizer forward, totalizer reverse, TAG-Number or Bargraph, additional selections are available: Slaveaddress, Protection and Status; Channel, Mode, Status **Example for display of "Slave address, Protection and Status" in 1st line** 1st line: SlAdd Prot Stat — This is how the values are displayed: Add: 46 BUS Stop / 1353 m3 The 1st line displays the actual Bus-Address (Add: 46) followed by the Address mode "Prot" (BUS; i.e. the address settings are defined over the bus and not by the DIP-Switch settings on the instrument). (See Section 9.1) If the DIP-Switch 8 is "ON", then the BUS-Address is defined by the DIP-Switch settings 1-7and “switch” is displayed instead of “Bus” The communication status is also displayed (Stop). Options are: Operate, Clear or Stop for cyclical communication Stop is displayed if there is no cyclical communication. The 2nd line in the above example displays the totalizer value **Example for display of "Channel, Mode and Status" in 1st line** 1st line: Chan Mode Stat — This is how the values are displayed: A1 Auto Go.Cas / 1353 m3 The 1st line displays the block A1 corresponds to the AI-Block A2 corresponds to the totalizer Block Tot 1 A3 corresponds to the totalizer Block Tot 2 In addition the Mode of the selected Block is displayed (Auto, Manual or OOS - out of service) with the Status (Go.Not = Good not cascade, Go.Cas=Good cascade, Bad, unc=uncertain) The display shows in sequence the 3 Channels (A1, A2, A3) with their Mode and Status.

Submenu/Parameter	Entry Type	Comments



Example for display of "A1, Value and Unit" in 1st line

1st line		
A1	Value	Unit

This is how the values are displayed

A1	149.501	l
1353 m3		

First the block is shown from which the values and units originate
A1 corresponds to the AI-Block
A2 corresponds to the totalizer Block Tot 1
A3 corresponds to the totalizer Block Tot 2
Then its value is displayed (149.501) with units ("l" = Liter)
The display shows in sequence the 3 Blocks (A1, A2, A3) with their value and units.

Information:
If when turning the power to the instrument on, the bus is not connected then the message "No Gateway" is displayed

C/CE — Exit the submenu

Standard/Fast
Standard: continuous flow metering
Fast: accelerated measurement signal processing (short time batches >3 s or pulsating flow)
The converter must be equipped with a higher excitation frequency. In this operating mode a better reproducibility for short measurement times or piston pump operation is achieved through use of accelerated signal measurements.

Defining the flow direction for metering „Forward/Reverse“ or only „Forward“.
For „Forward“ the instrument only meters in the forward flow direction. No measurement or totalization is made in the reverse flow direction.

„Standard“ or „Opposite“
Here the flow direction indicators in the display can be reversed. I.e. the forward flow direction can be defined as the reverse flow direction. Select „Flow indication opposite“

When a converter is replaced the data stored in the external EEPROM are automatically uploaded when the supply power is turned on. It is also possible to upload the data from the external EEPROM on command.

INformation!

After the start-up has been completed the actual settings must be stored in the external EEPROM. The same applies after any settings are changed.

Identifies the installed software version.
05/02 = Date of the release
B.12 = Revision level

Submenu/Parameter	Entry Type	Comments
TAG Number		A max. 16-character, alphanumeric TAG-Number to identify the meter location with upper and lower case letters and numbers can be entered. For instruments with HART-Protocol or PROFIBUS PA or FOUNDATION Fieldbus the following menu is displayed: Communication TAG — An alphanumeric meter location identifier can be entered (8 characters) Customer TAG — An alphanumeric meter location identifier can be entered (16 characters). Can only be set over the bus using, e.g. SMART VISION Message — An alphanumeric meter location identifier can be entered (32 characters). Can only be set over the bus using, e.g. SMART VISION
Code number		Only for ABB Service

8 Parameter Entries

8.1	Range / numeric entry
8.2	Pulse factor forward and reverse / numeric entry
8.3	Pulse width / numeric entry
8.4	Filter (noise reduction) / entry from table
8.5	Density / numeric entry
8.6	System zero adj. / numeric entry
8.7	Submenu Unit
8.7.1	Range unit / entry from table
8.7.2	Unit totalizer / entry from table
8.7.3	User configurable unit
8.7.3.1	Unit factor / numeric entry
8.7.3.2	Unit name / entry from table
8.7.3.3	Prog. Unit / entry from table
8.8	Submenu "Prog. in/output" / entry from table
8.8.1	Function terminal P7, G2 (Ux, P7 for PROFIBUS DP)
8.8.1.1	General alarm (Error 0 to 9, A, B) / entry from table
8.8.1.2	Empty pipe / entry from table
8.8.1.3	F/R-Signal / entry from table
8.8.1.4	No function
8.8.1.5	MAX-Alarm / entry from table
8.8.1.6	MIN-Alarm / entry from table
8.8.1.7	MAX/MIN-Alarm / entry from table
8.8.2	Terminals X1/G2 (not available with PROFIBUS PA/DP and FOUNDATION Fieldbus)
8.8.2.1	External zero return / entry from table
8.8.2.2	External totalizer reset / entry from table
8.8.2.3	External totalizer stop
8.8.2.4	No function / entry from table
8.9	Submenu Function test / numeric entry only for I_{out}

8.1 Range / Numeric Entry

The flow range end value „Range" applies to both flow directions. The flow range can be set between 0.05 Cal-fact and 1.0 Cal-fact.

Range	
20.000	m3/min

The selection can be made using the STEP and DATA keys. The units are selected in the Submenu „Unit".

The selected values for the totalizer functions are checked by the converter based upon the selections for the pulse factor (0.01 to 1000 pulses/unit), the pulse width (0.1 ms to 2000 ms), the totalizer units (e.g. ml. l. m3) or mass units (e.g. g. kg. t) together with the density correction factor. If any of these parameters are changed the resultant pulse width cannot exceed 50 % of the period of the output frequency at 100% flowrate (on/off ratio 1:1). If the pulse width is greater, it is automatically reduced to 50 % of the period and a warning message is displayed.

ATTENTION! New
pulse width

If the output frequency is too low an error message is displayed:

Error -41
Freq. <0.00016 Hz

If the output frequency is too high an Error message is displayed:

Error -40
Freq. >5 kHz

8.2 Pulse Factor Forward and Reverse Flow Directions / numeric entry

Pulse	
1.0000	/m3

The pulse factor is equivalent to the number of pulses for one measured flow unit transmitted to the pulse output (Terminals V8/V9) and for the internal flow totalizer. For instruments with the PROFIBUS PA or FOUNDATION Fieldbus options the totalizer display format is configured using their settings.

If the pulse factor value is changed, the totalizer value is maintained in the selected units. The pulse factor can be set in the range from 0.001 to 1000 pulses/unit.

The selected pulse factor value is checked by the converter based upon the selections for the range, the pulse width (0.1 ms to 2000 ms), the totalizer units (e.g. ml. l. m3) or mass units (e.g. g. kg. t) together with the density correction factor. If any of these parameters are changed the resultant pulse width cannot exceed 50 % of the period of the output frequency at 100 % flowrate (on/off ratio 1:1). If the pulse width is greater, it is automatically reduced to 50 % of the period and a warning message is displayed.

Error -41
Freq. < 0.00016 Hz

If the resultant output frequency is too low, an error message is displayed.

8.3 Pulse Width / numeric entry

The pulse width (duration of the pulses) of the scaled pulse output can be set in the range from 0.1 ms to 2000 ms. For technical reasons the pulse width is always a multiple of 0.032 ms. On the one hand the pulse width must small enough so that at the max. output frequency (flowrate max. 130 % = 5 kHz) pulse overlaps do not occur. On the other hand, it must be large enough so that any connected instrumentation can respond to the pulses.

Example:

Flow range = 100 l/min (Q_{max} = 100 % - flow range end value)
Pulse factor = 1 pulse/l

$$f = \frac{100 \text{ pulses/min}}{60 \text{ s}} = 1{,}666 Hz$$

When flow range is exceeded by 30 %

$f = 1.666 Hz \cdot 1.3 = 2.166 Hz$ (l/s) on/off ratio 1:1 (pulse width = pause width)

$$t_p = \frac{1}{2{,}166} \cdot 0{,}5 = 230 ms$$

In this example any value < 230 ms can be set. Mechanical counters usually require a pulse width ≥ 30 ms.

Pulse width
230 ms

The converter automatically checks the pulse width setting. Its max. value cannot exceed 80 % of the period at an output frequency at 130 % flowrate. If this limit is exceeded, the new value is not accepted and an error message is displayed.

Error 46
Entry too large

For instruments with the PROFIBUS PA or FOUNDATION Fieldbus option the Menu „Pulse width“ is not available.

Additional information for active pulse output

When an active or passive counter is connected the allowable current and pulse frequency values must be considered.

Example for an active pulse output:

For an output frequency of up to 4 Hz (4 pulses per second) the following applies: The current of the pulse output may be between 20 mA and 150 mA due to the resistance of the counter.

The ratio of pulse/pause may not be less than 1:4. The the value of the 24 V pulse drops exponentially as the load increases (see Fig. 59).

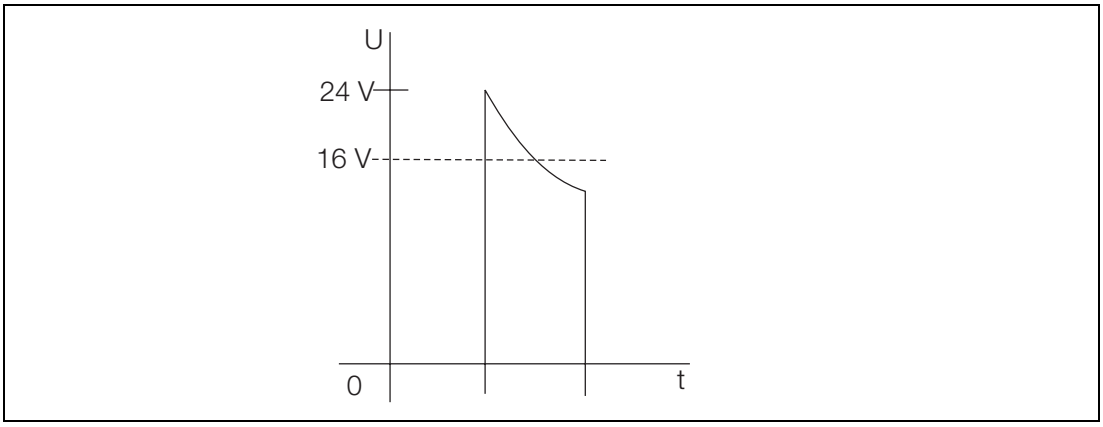


Fig. 59:

Example for a passive pulse output:

A passive 24 V counter or a SPC is connected: The max. output frequency from the flowmeter is 5 kHz (5000 pulses per second).
The optocoupler specifications must be considered (internal in the converter):

Optocoupler specifications:
f_{max} 5 kHz
0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA

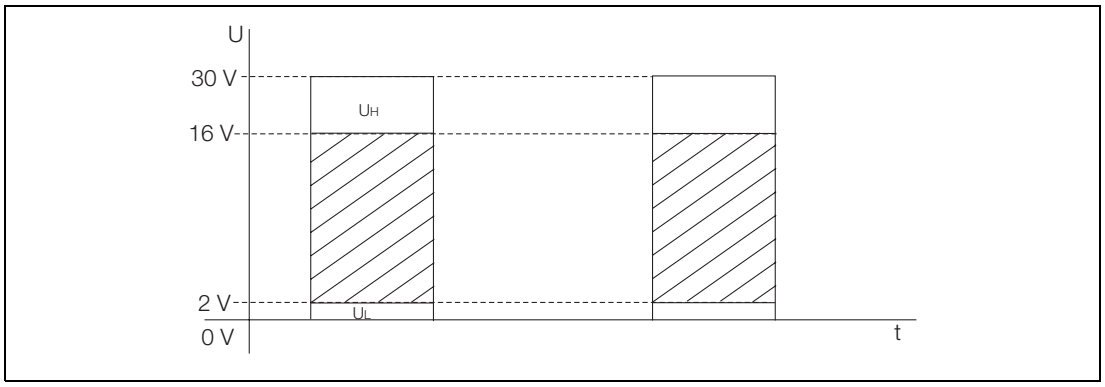


Fig. 60:

8.4 Filter (Noise Reduction) / entry from table

A digital filter is incorporated in the converter particularly for pulsating flows or very noisy flow signals. The filter quiets the values in the flowrate display and smooths the current output. The damping can be reduced when the filter is turned on. The response time of the converter is not affected.

The „Filter“ is turned „on“ using the STEP or DATA keys and then pressing ENTER. The filter is active if the damping time is set > 2.4 s.

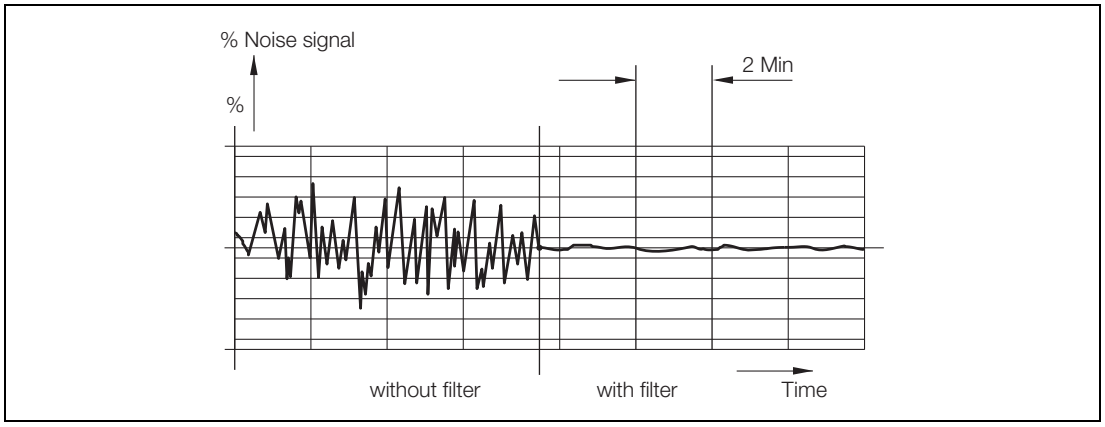


Fig. 61:

The output signal from the converter with and without a filter.

8.5 Density / numeric entry

Density	
2.54300	g/m3

When the flowrate indications and the totalization are to be in mass units, g., kg., t, pounds or uton, a fixed density value can be entered for the calculations. The density used for the conversion to mass flowrate can be set in the range from 0.01 to 5.00000 g/cm^3.

8.6 System Zero Adj. / numeric entry

After the installation has been completed the zero should be adjusted at the converter. The flowrate is to be reduced to absolute zero. The adjustment can be made automatically by the converter. A manual value can also be entered. The zero value can be set to 0 Hz by pressing the C/CE key. A measured output frequency value can be entered for the correction value.

Select parameter "System zero adj." and press ENTER.

System zero adj.
3.5 Hz

For security, a confirmation message is displayed:

The choice between “manual” and “automatic” can be made with the STEP or DATA keys.
Select „automatic“.

Pressing ENTER initiates the automatic adjustment procedure in the converter. The values in the display count down from 255 to 0. The procedure is repeated 4 times. The final zero value must be within the limits set in the converter of ± 50 Hz. If the value is outside of the limits the zero value is rejected. The value determined by the converter is displayed in the 2nd line.

8.7 Submenu Unit

The following functions and parameters are included in the submenu:

- Direct reading engineering **Range units**
- Direct reading engineering **Totalizer units**
- Direct reading engineering units with a user programmable **Unit Factor**
- User programmable **Units Name** and
- User **Prog. Units** with/without a density correction.

Submenu
Unit

The last three entry parameters are required for any user desired units which are not included in the program or in the table on Page 73. When this function is utilized, the factory set unit "kgal" is no longer available.

8.7.1 Range Unit / entry from table

The units listed in the following table can be selected using the STEP and DATA keys and accepted using ENTER.

Unit	Range
l/s	

Units	Standard	HART/PROFIBUS/FOUNDATION Fieldbus
Liter	l/s	l/s
	l/min	l/min
	l/h	l/h
Hectoliter	hl/s	
	hl/min	
	hl/h	
Cubic meter	m^3/s	m^3/s
	m^3/min	m^3/min
	m^3/h	m^3/h
Imperial-gallon per	ipgs	ipgs
	igpm	igpm
	igph	igph
U.S-mill-gallon per day	mgd	mgd
U.S.gallon per	gpm	gpm
	gph	gph
Barrel-Beer	bbl/s	bbl/s
	bbl/min	bbl/min
	bbl/h	bbl/h
Barrel-Petrochemical	bls/day	
	bls/min	
	bls/h	
Kilogram	kg/s	kg/s
	kg/min	kg/min
	kg/h	kg/h
Ton	t/s	
	t/min	t/min
	t/h	t/h
Gram	g/s	g/s
	g/min	g/min
	g/h	g/h
Milliliter	ml/s	
	ml/min	
	ml/h	
Megaliter	Ml/min	
	Ml/h	
	Ml/day	
Pound (454 g)	lb/s	lb/s
	lb/min	lb/min
	lb/h	lb/h
US-Ton	uton/min	
	uton/h	
	Uton/day	
	kgal/s	kgal/s
	kgal/min	kgal/min
	kgal/h	kgal/h

The units selected apply to Cal-fact, Range and the flowrate values in the display when a display is selected with direct reading engineering units.

8.7.2 Units Totalizer / entry from table

The units listed below apply to the totalizer values in the 2nd display line can be selected using the DATA and STEP keys. They may be different than the flowrate units. The engineering units selection is accepted by pressing ENTER.

Unit totalizer
m3

Unit: ml, Ml, lb, uton, kgal, l, hl, m3, igal, gal, mgal, bbl, lbs, kg, t, g.

The engineering units selected for the totalizer values are checked by the converter as a function of the flow range, the pulse factor (0.01 to 1000 pulses/unit), the pulse width (0.1 ms to 2000 ms) and the density correction factor when mass units (g, kg, t) have been selected. If any of these parameters are changed, the pulse width may not exceed 50 % of the period of the output frequency at 100% flowrate (on/off ratio 1:1). If the pulse width is greater it is automatically reduced to 50 % of the period and a message is displayed:

ATTENTION! New
pulse width

Error -40
Frequency > 5 kHz

If the resultant output frequency is too high an error message is displayed:

Error -41
Frequency <0.00016 Hz

If the resultant output frequency is too low an error message is displayed:

8.7.3 User Programmable Units

With this function it is possible to program any desired engineering units in the converter. The following three parameters are included in the this function:

a) Unit factor

b) Unit name

c) Prog. Unit with/without density

Entering data in the parameters a), b) and c) is only necessary if the desired direct reading engineering units are not listed in the table integrated in the converter.

8.7.3.1 Unit Factor / numeric entry

The value entered in this parameter is equivalent to the number of liters in the new unit. Shown is kgal = 3785.41 Liter.

8.7.3.2 Unit Name / entry from table

The name selection is made using the STEP and DATA keys. Scroll through the alphabet forward with DATA. The lower case letters appear first followed by the upper case letters. Pressing the STEP key shifts the entry location. A maximum of four letters can be entered.

Unit factor
kgal /s /min /h

The time units /s, /min and /h can be assigned to the entered programmed units.

8.7.3.3 Programmable Unit / entry from table

This function is utilized to indicate whether the programmed units are mass units (with density) or volumetric units (without density).

Prog. Unit
without Density

8.8 Submenu "Programmable In/Output" / entry from table

In this submenu a number of different in- and output functions can be assigned to the contact output terminals P7/G2 or X1/G2.

Output function:	terminals P7/G2 or Ux/V8
Input function :	terminals X1/G2

For instruments with the PROFIBUS PA or FOUNDATION Fieldbus option these terminals are not available. For instruments with the PROFIBUS DP option the input functions (terminal X1/G2) are not available and the output function is assigned to terminals Ux/P7.

8.8.1 Function Terminals P7, G2 (Ux, P7 for PROFIBUS DP)

One of the following functions can be assigned to the contact output P7, G2.

General alarm (Error 0-9, A, B)	(8.8.1.1)*	
Empty pipe	(8.8.1.2)*	(can only be selected when the detector empty pipe is turned on)
F/R-Signal	(8.8.1.3)	
No function	(8.8.1.4)	
MAX-Alarm	(8.8.1.5)*	
MIN-Alarm	(8.8.1.6)*	
MAX/MIN-Alarm	(8.8.1.7)*	

* Can be configured as normally open or normally closed. The desired configuration can be selected using the STEP/DATA keys.


Normally closed configuration, i.e. the contact opens when the signal is applied.


Normally open configuration, i.e. the contact closes when the signal is applied.

8.8.1.1 General Alarm (Error 0 to 9, A, B) / entry from table

Terminals P7/G2
General alarm 

All detected errors (Error 0 to 9, A, B) are signalled over the terminals. During an error condition, the contact at terminals P7, G2 is opened in the example shown.

8.8.1.2 Empty pipe / entry from table

If the function "Detector empty pipe" is turned on, the current output is set to its programmed value and the pulse totalization is interrupted. The alarm empty pipe is activated. In this example the contact opens, and the message "Empty pipe" and "Error 0" are displayed

Terminals P7/G2
Empty pipe 

8.8.1.3 F/R-Signal / entry from table

Terminals P7/G2
F/R-Signal

The present flow direction is indicated in the display by the direction arrows and signalled over the contact output P7, G2.

8.8.1.4 No Function

Terminals P7/G2
No function

No signal is transmitted over terminal P7, G2 when “No Function” is selected.

8.8.1.5 MAX-Alarm / entry from table

Terminals P7/G2
MAX-Alarm 

When the MAX-Alarm function is selected an alarm is signalled when the flowrate exceeds the limit value set, in this example the contact opens.

8.8.1.6 MIN-Alarm / entry from table

Terminals P7/G2
MIN-Alarm 

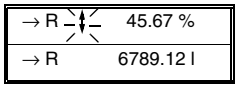
When the MIN-alarm function is selected an alarm is signalled when the flowrate is below the limit value set, in this example the contact opens.

8.8.1.7 MAX/MIN-Alarm / entry from table

When the MAX/MIN-Alarm is selected an alarm is signalled over the terminals when the flowrate is above or below the range between the MAX-Alarm and the MIN-Alarm values, i.e., when the flowrate is more than the MAX-Alarm value or less than the MIN-Alarm value.

Terminals P7/G2
MAX/MIN-Alarm

It is also possible in this alarm mode to activate an alarm signal when the flowrate is between MIN- and MAX-Alarm values. In this case the MAX-Alarm value setting should be less that the MIN-Alarm value. If the flowrate is within this range, then a alarm is signalled in the display and over terminals P7/G2.



Example:

MAX-Alarm = 20 %
MIN-Alarm = 80 %
Blinking double arrow indicates that the flowrate is between 20 and 80 %.

8.8.2 Terminals X1/G2 (not available with PROFIBUS PA/DP and FOUNDATION Fieldbus)

One of the following functions can be assigned to the contact input using the STEP/DATA keys:

- External zero return
- External totalizer reset
- External totalizer stop (not with HART-Protocol)
- No function

8.8.2.1 External Zero Return / entry from table

This input function can be assigned to terminals X1/G2, in order, e.g., to turn off the outputs (current and pulse) during a cleaning cycle (CIP).

Terminals X1/G2
Ext. zero return

When the external zero return is activated the actual flowrate will continue to be displayed.

8.8.2.2 External Totalizer Reset / entry from table

The contact input can be utilized to reset the internal totalizers for the forward and reverse flow directions and the overflow counters.

Terminals X1/G2
Totalizer reset

8.8.2.3 External Totalizer Stop

If the contact input is activated, the flow integration will be stopped and the message “Totalizer stop” displayed in place of the totalizer value. This function is not available with HART-Protocol.

Terminals X1/G2
Ext. total.stop

8.8.2.4 No Function / entry from table

Terminals X1/G2
No function

The contact input is deactivated when "No function" is selected.

8.9 Submenu Function Test / numeric entry only for I_{out}

Submenu
Function test

The function test offers a variety of routines to test the instrument independent of the actual flowrate value. During a function test the converter is no longer On-Line (current and pulse outputs no longer indicate the actual operating conditions). The individual test routines listed below can be selected using the STEP and DATA keys.

I_{Out}, RAM (ASIC), NVRAM, EPROM (Program), EEPROM, External EEPROM, Terminals P7/G2, Switch S201 (not available in custody transfer certified designs), Display, Pulse Output, Terminals X1/G2, HART Command, HART Transmitter, Simulation and Test Mode.

The function tests are terminated using the C/CE key.

Select I_{Out}, press ENTER and enter the desired value in mA (for HART-Protocol enter in %). Check the value at the output terminals with a digital multimeter (mA range) and the process instrumentation for agreement with the value set.

Information!

No automatic return to process measurements. Terminate using the C/CE key.

Select **Pulse Output**, press ENTER. A scaled pulse output with a frequency of 1 Hz and a pulse width of 500 ms is transmitted.

Select **terminal P7/G2** and press ENTER. The contact can be toggled on and off using the STEP or DATA key. Use an ohmmeter to measure the response at terminals P7/G2.

Select **RAM** (ASIC) and press ENTER. The computer automatically tests its RAM and displays the diagnosis.

Select **NVRAM** and press ENTER. The computer automatically tests its NVRAM and displays the diagnosis.

Select **EPROM** (Program) and press ENTER. The computer automatically tests the EPROM and displays the diagnosis.

Select **EEPROM** and press ENTER. The computer automatically tests the EEPROM and displays the diagnosis.

Select **S201** and press ENTER. The status of switch S201 on/off and the jumper settings BR 201... 5 are identified by an asterisk* for the "function turned on" after the Code Number has been entered.

Select **Display** and press ENTER. The converter writes the numbers 0 to 9 and the letters A to F in the 1st and 2nd lines of the display. Visually monitor for proper operation of the dot matrix.

Terminals X1/G2
Select **External Zero Return** and press ENTER. Apply an external 24 V DC voltage to terminals X1 and G2. Plus polarity to X1. The converter displays off/on.

Terminals X1/G2
Select **Totalizer Reset** and press ENTER. Apply an external 24 V DC voltage to terminals X1 and G2. Plus polarity to X1. The converter displays off/on.

Select ****Simulation**** and press ENTER. Use the STEP or DATA key to turn simulation "on or off".
When the simulation is turned on, press C/CE to return to process metering. Any desired flowrate value in steps of 1 % can be set. The output values correspond to the values entered. The message **Simulation** is displayed in the 2nd line alternately with the totalizer value. After completion of the simulation program the parameter **Simulation** should be turned off.

Test Mode
If the converter is to checked with a simulator, the parameter Test Mode must be turned "on".

Only for HART-Protocol:

HART-Command
The display indicates the No. and the slot of the HART command.

Information!

No automatic return to process measurements. Terminate using the C/CE key.

HART Transmitter
This command is used to check the HART communication. Press ENTER and select „1200 Hz“ or „2200 Hz“ using the STEP key. This frequency is transmitted over the current output leads. Exit menu using the C/CE key.

9 Communication

9.1 PROFIBUS PA (Profile 3.0)

This section of the Operation Manual contains information relating to the converter designs which include the communication option using PROFIBUS PA .

The Fieldbus converter is designed to be connected to a Segment Coupler DP/PA or the ABB Multibarrier MB204.

The PROFIBUS PA-data link in the converter conforms to Profile 3.0 (Fieldbus Standard PROFIBUS, EN 50170, alias DIN 19245 [PRO91]). The transmission signal from the converter corresponds to IEC 61158-2.

The manufacturer specific PROFIBUS PA Ident-No. for the converter is : 0691 hex.

Alternately, the instrument can also be operated using the PROFIBUS Standard Indent Nos. 9700 or 9740. The converter settings are made in the Submenu „Data Link“. The Ident-No. 0x6668 assures backward compatibility with Profile 2.0. If the converter is operated using 0x6668, acyclical communication is not possible.

Layout Information

A typical PA-Network is shown in the following picture.

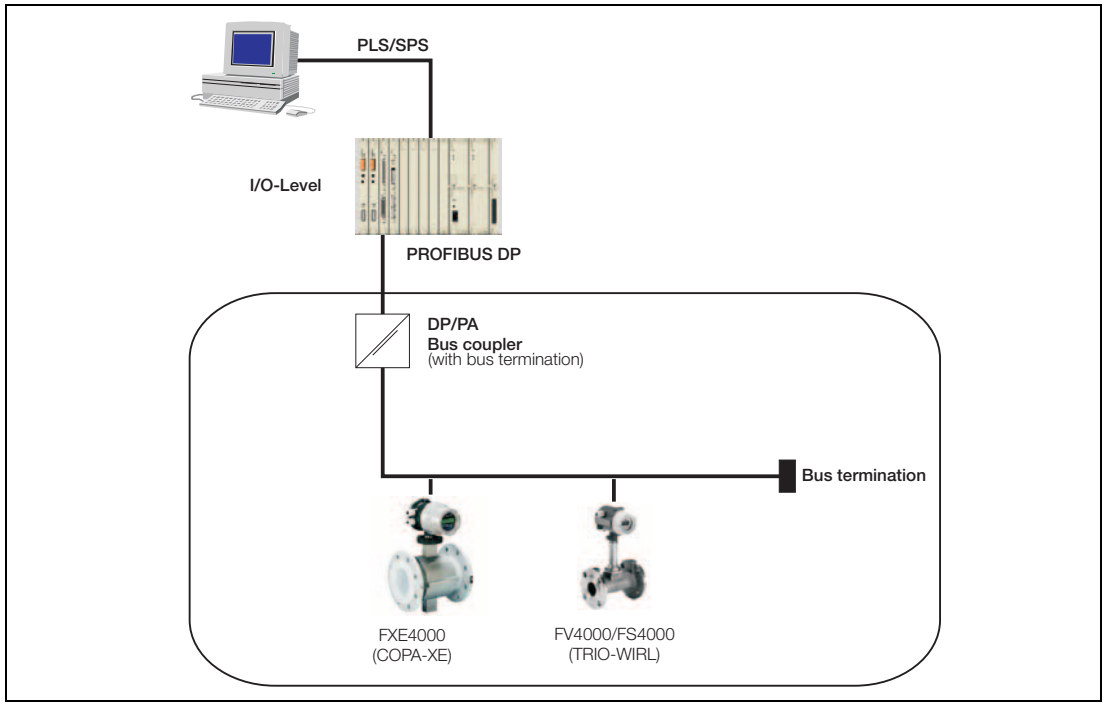


Fig. 62: Typical PA-Network

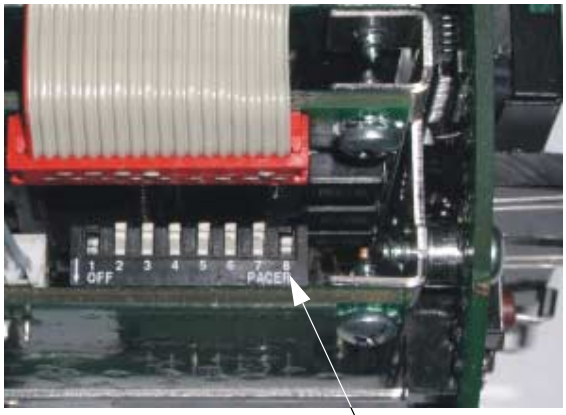
A twisted, shielded cable is recommended (as defined in IEC 61158-2 , types A or B are preferred).

Additional detailed layout information may be found in the Brochure „PROFIBUS - Solutions from ABB" (No. 30/FB-10). Accessories such as distributors, connectors and cable may be found in List Sheet 10/63- 6.44. In addition, supplementary information is available on our Home Page at http://www.abb.de as well as on the Home Page of the Profibus International Organization at http://www.profibus.com.

Setting the Bus-Address with PROFIBUS PA

If there were no customer requirements relating to the Bus-Address available, the Bus-Address was set at the factory to „126". This address must be changed at start-up of the FXE4000 to a value within the valid range (0 - 125). A address may only be used once in a segment. The setting can be made at the instrument (using the DIP-switches located on the digital board) or using a System Tool or a PROFIBUS DP Master Class 2, such as SMART VISION. The factory setting of the DIP-switch is 8 = Off, i.e., the address is set over the Fieldbus. To change the settings unscrew the front cover.

Alternately the address can be set from the menu using the keys on the display board.



DIP-Switch 8

Example for setting the address at the converter (Switch 8 = On):

Switch 1,5,7 = On means 1 + 16 + 64 = Busaddress 81

Switch	1	2	3	4	5	6	7	8
Status	Instrument Address							Address Mode
Off	0	0	0	0	0	0	0	Bus
On	1	2	4	8	16	32	64	Local

Assignments for DIP-switches 1 to 7:

PROFIBUS Address

Switch 8:

Defines the Address Setting Mode:

Off = Set Address using the Bus (factory setting)
On = Set Address using the DIP-Switches 1–7

DIP-Switch

Fig. 63: Settings for the DIP-Switches in Example FXE4000 (COPA-XE)

Instrument Behavior when Turning on the Supply Power.

After the supply power is turned on DIP-Switch 8 is interrogated.

If **DIP-Switch 8 is ON**, then the address is defined by the settings of DIP-Switches 1-7. It is no longer possible to change the address over the bus during normal operation, because DIP-Switch 8 is only interrogated once when the supply power is turned on.

If the **DIP-Switch 8 is OFF** (factory setting), then the converter starts with the address stored in the FRAM of the Gateway. The address is set to 126 when the instrument is shipped or to the customer's specifications. During normal operation the address can only be changed over the bus or by using the keys on the converter. The instrument must be connected to the bus.

Instrument Behavior after a Converter Module is Exchanged.

After the supply power is turned on again the data stored in the external EEPROM, located on the display board, are loaded. The instrument must be connected to the bus. Since the instrument address is not stored in the external EEPROM, the converter starts with the default address 126. Therefore after a converter is exchanged it is necessary to reset the address once in order to store it in the Gateway. After this has been completed, the converter will start with the correct Bus-Address each time the supply power is turned on. Then the Ident-No. Selector must be checked. The factory setting is 0x0691. Also Ident-Nos. 0x0691, 0x9700 or 0x9740 can be used. The Ident-No. Selector 0x6668 assures the backward compatibility with PROFIBUS PA Profile 2.0. If the converter is operated using 0x6668, acyclical communication is not possible.

Information for Voltage / Current Requirements

The turn on behavior corresponds to the Draft DIN IEC 65C / 155 / CDV of June 1996.
The average current draw of the FXE4000 on the bus is 13 mA.
During an error condition the FDE -Function (= Fault Disconnection Electronic) integrated in the instrument assures that the current cannot exceed 17 mA.
The upper limit of the current is electronically limited.
The value of the voltage on the bus must be in the range 9 - 32 V DC.

System Integration

Every PROFIBUS-instrument has been assigned a unique Identification-Number by the PNO (Profibus User Organization). For the FXE4000-Converter it is 0x0691. The associated database file name is ABB_0691.GSD. The use of this Ident-Number assures that the entire functionality of the instrument is available: one AI-Block and two Totalizer-Blocks together with the manufacturer specific parameters.

The PNO (Profibus User Organization) has defined standard Ident-Numbers.
The FXE4000 supports 0x9740 (one AI and one Totalizer-Block) and 0x9700 (only one AI-Block).
The use of these profiles (0x9740 and 0x9700 assures manufacturer independent exchangeability, without requiring any configuration changes in the process control system. The functionality however is restricted, because not all the special features of the FXE4000 are included when using the Standard Ident-Numbers.

In order to access the entire functionality of the FXE4000, the Ident-Number 0x691 must be used.

For system integration ABB provides 3 different GSD-Files (GSD= Instrument database file), see the following table). A switch can be made using the parameter ID-Number Selector, which can only be changed acyclically.
The manufacturer specific GSD-File ABB_0691 and the "Data Link Description PROFIBUS PA" for FXE4000 (Part No.: D184B093U25) are contained on the CD (Part No.: D699D002U01) included with the shipment.
The Standard GSD-Files PA1397xx.gsd are available for download on the Home Page of Profibus International - http://www.profibus.com .

The updated GSD-Files can also be downloaded from the ABB Home Page at http://www.abb.com/Flow → Electromagnetic Flowmeter (select actual type) → read more → Fieldbus & HART Files → Version Matrix (read first: all available files and documentation for the product are listed) → close again Version Matrix → Download Software for the desired Communication Profibus.

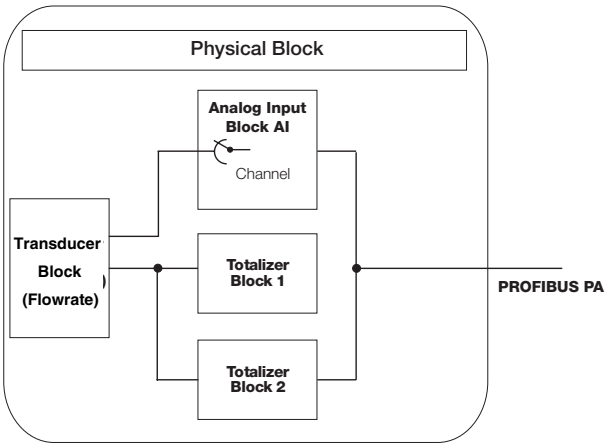
Number and Type of the Function Blocks	Ident Number	GSD-File Name
1 x AI	0x9700	PA139700.gsd
1 x AI; 1 x TOT	0x9740	PA139740.gsd
1 x AI; 2 x TOT; and all manufacturer specific parameters	0x0691	ABB_0691.gsd

Block Diagram of the FXE4000 (COPA-XE/MAG-XE) with PROFIBUS PA

The diagram is presented as a function diagram showing the blocks available in the FXE4000 (COPA-XE/MAG-XE). Acyclically a communication tool or a SPC with Master Class 2 functionality can access all blocks for configuration.

Detailed Description of the Blocks:

Physical Block (Instrument characteristics and present status)	Contains general specifications about the fieldbus instrument, e.g., software version, TAG-No. etc.
Transducer Block (Measurement parameters)	Contains the data for the flowmeter primary, e.g., meter size, flow ranges, etc. and all manufacturer specific parameters which are not included in the function blocks.
Analog Input Block (Output of measured values and status)	Contains the current instantaneous value of the flowrate, its engineering units and status.
Totalizer Block (Totalizer)	Here the totalizer value can be monitored acyclically using e.g., the PROFIBUS PA-DTM in SMART VISION. The totalizer can be reset and the totalizer value can be changed cyclically.



The measurement values are calculated in the Transducer-Block. The Transducer-Block provides the measured values internally. The cyclical output of the measured values externally occurs over the Analog Input Block (AI-Block). The FXE4000 has one AI-Block.

The selection, which parameter is to by outputted from the AI-Block, is made using the Channel-Parameter.

The following parameters can be accessed from the Transducer Block over the Channel:

- VOLUME_FLOW
- Transducer-Block-internal totalizer for the forward direction
- Transducer-Block-internal totalizer for the reverse direction

The flowrate values are integrated in the Totalizer-Block, in order to determine the amount of flow through the flowmeter ("totalizer value").

A detailed description of the Blocks/Parameters may be found in a separate document “Data Link Description PROFIBUS PA" (Part No. D184B093U25). This is contained on the CD included with the shipment.

9.2 Communication FOUNDATION Fieldbus

The Fieldbus-Converter is designed to be connected to special bus power supply instruments including the ABB Multibarrier MB204. The voltage on the bus must be in the range 9 - 32 V DC.

The FOUNDATION Fieldbus data link conforms to the Specifications FF-890/891 and FF-902 / 90. The transmission signal from the converter corresponds to IEC 61158-2. The FXE4000 is registered with the Fieldbus FOUNDATION. The Reg.-No. is: IT 008000.

The registration of the FXE4000 is listed with the Fieldbus FOUNDATION under the Manufacturer ID: 0x000320 and the Device ID 0x0016.

Layout Information

The following picture shows a typical FF-Network.

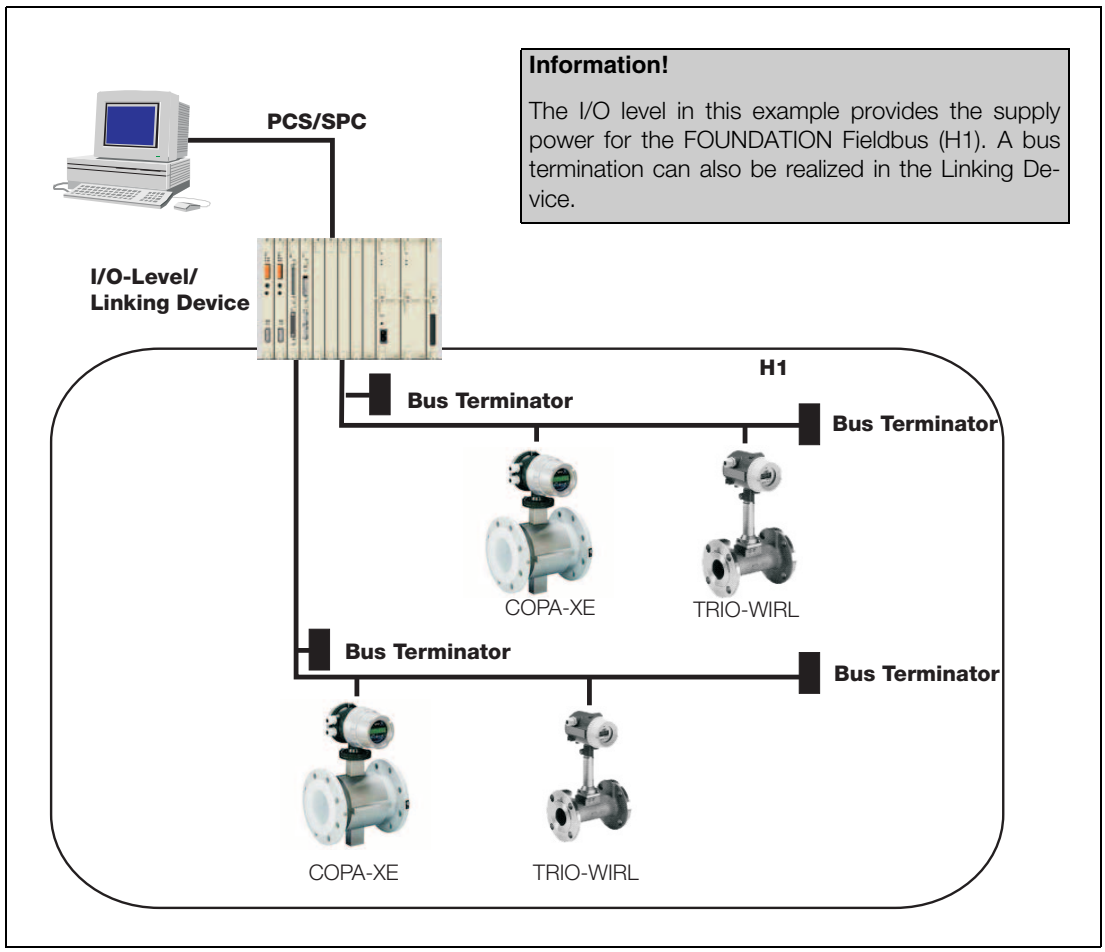


Fig. 64: Typical FF-Network

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

Additional detailed layout information may be found in the Brochure „FOUNDATION Fieldbus- Solutions from ABB" (No. 7592 FF Brochure). In addition, supplementary information is available on our Home Page at http://www.abb.de as well as on the Home Page of the Fieldbus FOUNDATION at http://www.fieldbus.org.

Setting the Bus-Address

The Bus-Address for FF is automatically assigned by the LAS (Link Active Scheduler). The Address-Recognition is made using a unique number (DEVICE_ID), which is made up of the Manufacturer-ID, Instrument-ID and Instrument Series-No.

Information for Voltage / Current Requirements

The turn on behavior corresponds to the Draft DIN IEC 65C / 155 / CDV of June 1996.
The average current draw of the FXE4000 on the bus is 13 mA.
During an error condition the FDE -Function (= Fault Disconnection Electronic) integrated in the instrument assures that the current cannot exceed 17 mA.
The upper limit of the current is electronically limited.
The value of the voltage on the bus must be in the range 9 - 32 V DC**.**

System Integration

For integrating in a process control system a DD-File (Device Description), which contains the instrument description and a CFF-File (Common File Format) are required. The CFF-File is required for engineering the segment. The engineering can be completed on- or offline.

A description of the function blocks may be found in the separate document „Data Link Description FOUNDATION Fieldbus for FXE4000 " (Part No. D184B093U17).

Both files, as well as the data link description are contained on the CD (Part No.: D699D002U01) included with the shipment. This CD may be obtained without cost at anytime from ABB. The files required for operation can also be downloaded at http://www.fieldbus.org.

Attention!

Check for correct DIP-Switch settings in the instrument.

DIP-Switch 2 must be set to OFF. Otherwise it will not be possible for process control system to write data to the instrument (hardware write protect).

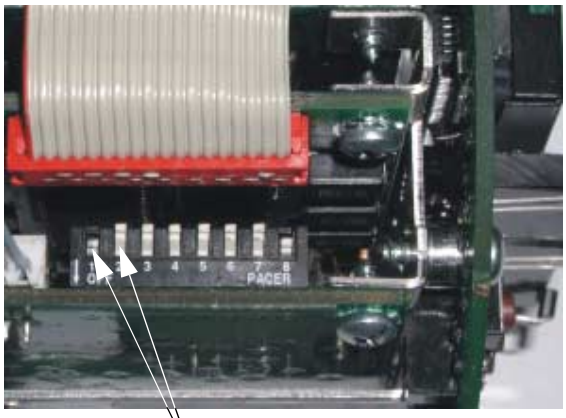
DIP-Switch 1 must also be set to OFF.

Switch Settings

DIP-Switch 1:
Release of the simulation for the AI-Function blocks

DIP-Switch 2:
Hardware write protect for write access over the bus (all blocks protected)

DIP-Switch	1	2
Status	Simulation Mode	Write Protect
Off	Disabled	Disabled
On	Enabled	Enabled



DIP-Switch
1 + 2 to OFF

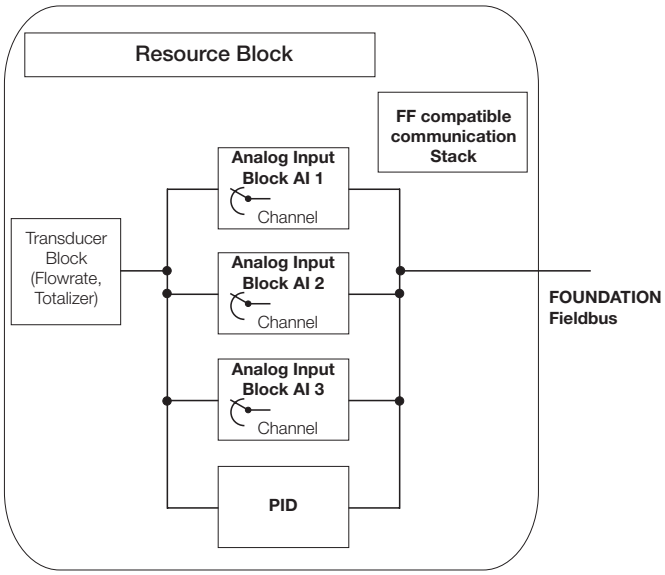
Fig. 65: DIP-Switch Settings for Example FXE4000 (COPA-XE)

Block Descriptions for the FXE4000 (COPA-XE/MAG-XE) with FOUNDATION Fieldbus

The function diagram shows the blocks available in the FXE4000 (COPA-XE/MAG-XE).
Acyclically a communication tool such as a NI-Configurator, System Tools or a SPC with appropriate functionality can access all blocks for configuration.

Detailed Description of the Blocks:

Resource Block	Contains general specifications about the fieldbus instrument, e.g., software version, TAG-No. etc.
Transducer Block	Contains the data for the flowmeter primary, e.g., meter size, flow ranges, etc. and all manufacturer specific parameters which are not included in the AI-Block. Also included are the parameters for the totalizers.
Analog Input Block	AI 1 Contains the current instantaneous value of the flowrate, its engineering units and status. AI 2 Contains the totalizer value for the forward flow direction, its units and status. AI 3 Contains the totalizer value for the reverse flow direction, its units and status.
PID Block	The PID-Function block contains a Proportional-Integral-Differential-Controller plus all the components required for scaling, noise value override, cascades, etc..



The Resource-Block, the AI-Blocks and the PID-Block are "Standard"-FF-Blocks.
The correspond exactly to FF-Specification FF-891-1.4
The measurement value calculations are made in the Transducer-Block. The Transducer-Block provides the measured values internally. The cyclical output of the measured values externally occurs over the AI-Block. The selection, which parameter is to by outputted from the AI-Block, is made using the Channel-Parameter.The PID-Function-Block contains a Proportional-Integral-Differential-Controller.
Details may be found in the FF-Specification FF-891.

A detailed description of the Blocks/Parameters may be found in a separate document “Data Link Description FOUNDATION Fieldbus for FXE4000 (COPA/MAG-XE) (Part No. D184B093U17). This is contained on the CD included with the shipment.

9.3 HART®-Communication

9.3.1 General Description

Provides the ability to simultaneously output process variables and to digitally communicate without any added installation expenses. The 4–20 mA current output signal transmits both the process information and the digital signal used to communicate bidirectionally. The analog process value output allows connection to analog indicators, recorders and controllers while the simultaneous digital communication uses HART-Protocol.

The HART-Protocol utilizes Frequency Shift Keyed (FSK) modulation for communication based on the Bell Standard 202. The digital signal is composed of two frequencies 1200 Hz and 2200 Hz, which represent the 1 or 0 bit information.

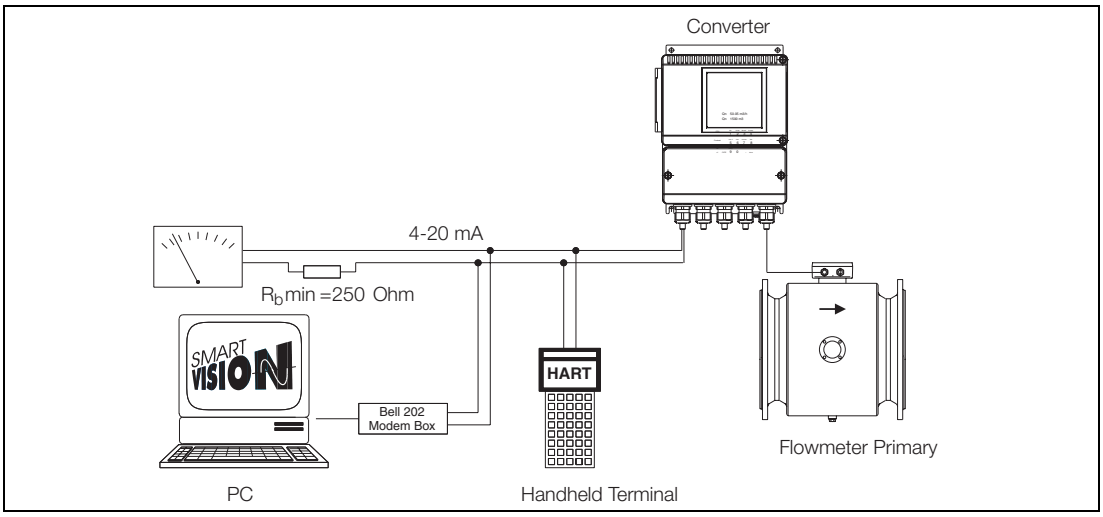


Fig. 66: Communication using HART-Protocol

9.3.2 Software SMART VISION ®

General Description

A FSK-Modem must be installed to connect to a PC.

The software program SMART VISION ® from ABB can be used in the control room or the service area to monitor and evaluate the data from field instruments utilizing the HART-Protocol. The SMART VISION program includes the ability to configure and display the process relevant variables with a periodic self monitoring function to check the connected field instruments.

SMART VISION ® is a universal and intuitive graphic software program for use with intelligent field instruments.

SMART VISION ® communicates with all HART-capable instruments within the extent of the „universal“ and „common practice“ HART-Commands. For ABB-instruments, the manufacturer specific commands are also supported, so that the entire functional range of the instruments with a DTM can be utilized.

SMART VISION ® supports both HART- and PROFIBUS-DTMs as well as all other PROFIBUS instruments within the framework of Profile Specification 2.0/3.0.

Application Spectrum

- Configuration and setting parameters in field instruments.
- Diagnosis of instruments, access status messages.
- Visual graphic overview of the connections for instruments integrated in the system.
- Storage/management of instrument data.
- Instrument measurement site planning and management
- Online display of instrument data (measurement values, diagnostics, configuration/parameter and status information) in multi visual form.

10 Error Messages

The Error Code list below includes an explanation of the error together with corrective measures.
During data entry Error Codes 0 to 9, A, B, C are not applicable.

Error Code	System Error Detected	Corrective Measures
0	Pipeline not full.	Open shut off valve; fill pipeline; adjust Detector Empty Plpe
1	A/D-converter	Reduce flowrate, throttle valve.
2	Positive or negative reference too small.	Check connection board and converter;
3	Flowrate greater than 130 %.	Reduce flowrate, change flow range
4	External zero return activated.	Zero return was activated from a pump or field contact.
5	RAM invalid 1st Error 5 is displayed 2nd Error 5 is only displayed in Error Register	Program must be reinitialized; Contact ABB Service; Information: Corrupted data in RAM, the converter automatically initiates a reboot and reloads the data from the EEPROM.
7	Positive reference too large.	Check signal cable and magnetic field excitation,
8	Negative reference too large.	Check signal cable and magnetic field excitation.
6	Error > F	Reset forward totalizer or enter a new value in the totalizer.
	Error Totalizer < R	Reset reverse totalizer or enter a new value in the totalizer.
	Error Totalizer	Forward, reverse or difference totalizer invalid, reset forward/reverse totalizers.
9	Excitation frequency incorrect	Check supply power 50/60 Hz line frequency or for AC/DC supply power, error in the Digital-Signal board.
A	MAX-Alarm limit reached	Decrease flowrate
B	MIN-Alarm limit reached	Increase flowrate
C	Flowmeter primary data invalid	The flowmeter primary data in the external EEPROM are invalid. Compare data In Submenu "Primary" with factory tag values. If the values agree, the error message can be reset by using "Store Primary". If the values do not agree, then the data for the flowmeter primary must be reentered followed by "Store Primary". Contact ABB-Service
10	Entry >1.00 Cal-fact >10 m/s.	Decrease flow range setting.
11	Entry <0.05 Cal-fact <0.5 m/s.	Increase flow range setting.
16	Entry >10 % low flow cut-off.	Reduce entry value.
17	Entry < 0 % low flow cut-off.	Increase entry value.
20	Entry ≥ 100 s damping.	Reduce entry value.
21	Entry <0.5 s damping.	Increase entry value. (as a function of the excitation frequency)
22	Entry >99 instrument address.	Reduce entry value.
38	Entry >1000 pulses/unit.	Reduce entry value.
39	Entry < 0.001 pulses/unit.	Increase entry value.
40	Value above max. count frequency, scaled pulse output, pulse factor (5 kHz).	Decrease pulse factor.
41	Value below min. count frequency <0.00016 Hz.	Increase pulse factor
42	Entry >2000 ms pulse width.	Decrease entry value.
43	Entry <0.1 ms pulse width.	Increase entry value.
44	Entry >5.0 g/cm3 density.	Decrease entry value.
45	Entry <0.01 g/cm3 density.	Increase entry value.
46	Entry too large	Decrease entry value
54	Flowmeter primary zero > 50 Hz	Check earth and ground signals. Adjustment can be made when the flowmeter primary is full and the flow is at absolute zero.
56	Entry >3000 threshold, Detector empty pipe.	Decrease entry value, check "Detector empty pipe" adjustment.
74/76	Entry > 130 % MAX - or MIN-Alarm	Decrease entry value
91	Data in EEPROM invalid	Data in internal EEPROM invalid, see Error Code 5 for corrective measures.
92	Data ext. EEPROM invalid	Data (e.g. Range, damping) in external EEPROM invalid, Access possible. Occurs when the function "Store data in ext. EEPROM" was not executed. To clear the error message use the function "Store data in ext. EEPROM"
93	Ext. EEPROM invalid or not installed	Access not possible, module defective. Chip is not installed, in which case the latest EEPROM corresponding to the flowmeter primary must be plugged in above the display.
94	Ver. ext. EEPROM invalid	The database is not valid for the current software version. Using the function "Load data from ext. EEPROM" initiates an automatic update of the ext. data. The function "Store data in ext. EEPROM" clears the error message.
95	External flowmeter primary data invalid	See Error Code C.
96	Ver. EEPROM invalid	Database in EEPROM has a different version than the installed software. The error message can be cleared using the function "Update".
97	Flowmeter primary invalid	The flowmeter primary data in the internal EEPROM are invalid. Use the function "Load Primary" to clear the error message. (See Error Coed C).
98	Ver. EEPROM invalid or not installed	Access not possible, module defective. Chip is not installed, in which case the latest EEPROM corresponding to the flowmeter primary must be plugged in above the display.
99	Entry too large	Decrease entry
99	Entry too small	Increase entry

11 Maintenance and Repair

11.1 General Information

Before opening the housing all connection leads should be potential free. When the housing is opened, the EMC protection is limited and the personnel contact protection is no longer provided.

11.1.1 Flowmeter Primary

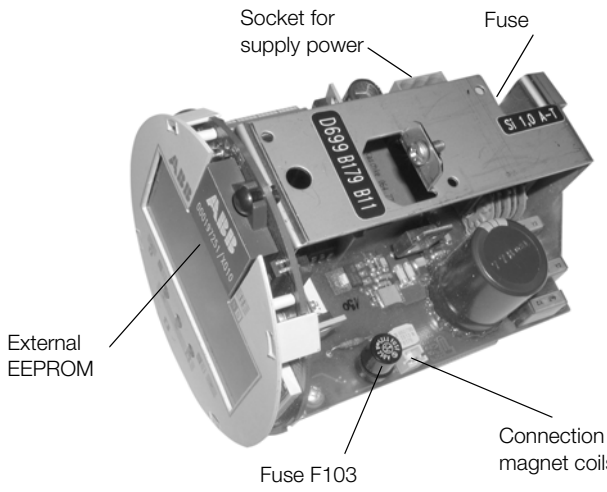
The flowmeter primary is essentially maintenance free. An annual check should be made of the ambient conditions (air flow, humidity), the seal integrity of the process connections, the condition of the cable connectors and the tightness of the screws and bolts, safety of the supply power. lightning protection and the earth connections.

All repair and maintenance tasks should only be performed by qualified personnel.

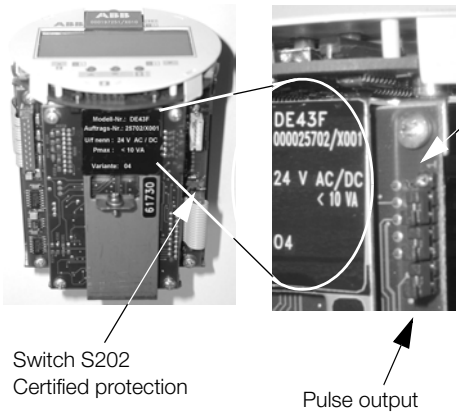
Observe the information (Hazardous Material Regulation), if the flowmeter primary is to be returned to ABB Automation Products for repair!

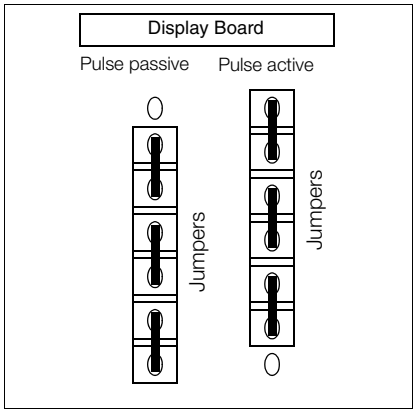
11.1.2 Converter

Identification of the Converter Design, Socket Location for ext. EEPROM



Setting the Pulse Output





Model No.:	DE43F
Order No.:	25702/X001
V/f:	AC/DC 24 V 50/60 Hz
Smax:	< 10 VA
Variant:	04

Fuse	**A**	Part No.
For 24V AC/DC	**1A**	D151B025U07
For 100 - 230 V AC	**0.5 A**	D151B025U06
Fuse F103	**0.125 A**	D151F003U14

The Identification of the design of the converter is listed on the type tag which may be found on the tag located on the frame of the converter (see Figure).

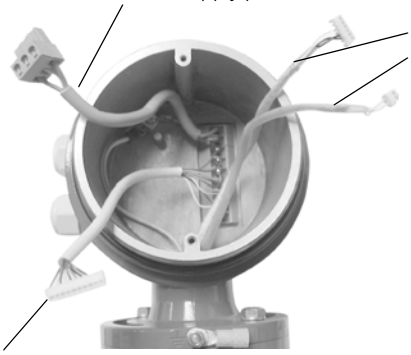
Variant 01	Current output + pulse output active	+ contact input	+ contact output	
Variant 02	Current output + pulse output active	+ contact input	+ contact output	+ HART Protocol
Variant 03	Current output + pulse output passive	+ contact input	+ contact output	
Variant 04	Current output + pulse output passive	+ contact input	+ contact output	+ HART Protocol
Variant 05	Current output + pulse output passive	+ contact output	+ RS 485	
Variant 06	Pulse output passive + contact output + PROFIBUS DP			
Variant 14	PROFIBUS PA 3.0			
Variant 15	FOUNDATION Fieldbus			
Variant 16	PROFIBUS PA 3.0 (with M12 plug)			

Fig. 67:

12 Replaceable Parts List

12.1 Replaceable Parts List for Compact Design Instrument

	Description	Part No.
1	Cover with glass window	D614A023U01
2	O-Ring 100 x 3.5	D101A026U01
3	Cable connector M20 x 1.5	D150A008U15
4	Cover small	D379D134U02

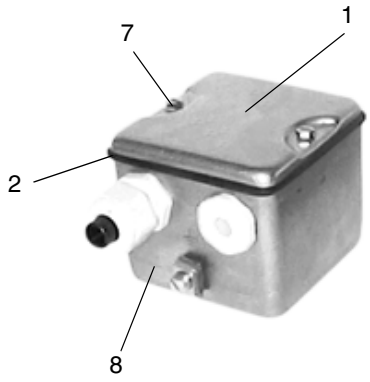


Variant	Cable Assembly for In-/Outputs	Part No.
01 - 04	Current output + pulse output active + contact input + contact output	D677A294U01
05	Current output + pulse output passive + contact output + RS485	D677A294U04
06	Pulse output passive + contact output + PROFIBUS DP	D677A294U05
14	PROFIBUS PA 3.0	D677A294U08
15	FOUNDATION Fieldbus	D677A294U09
16	PROFIBUS PA 3.0 (with M12 plug)	D677A294U08

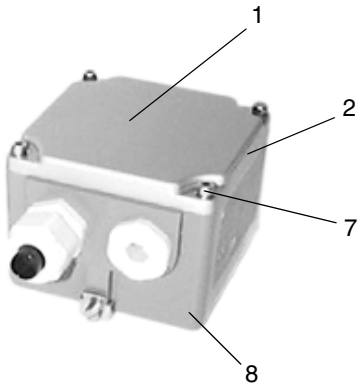
Fig. 68:

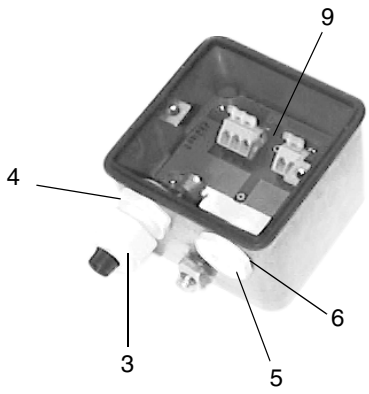
12.2 Replaceable Parts for Flowmeter Primary

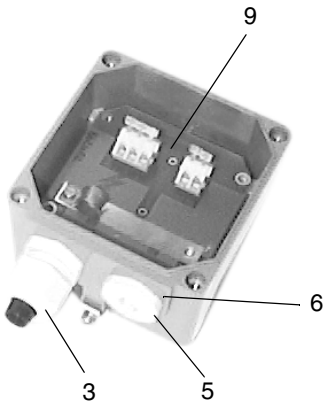
Connection box for flowmeter primary in stainless steel design



Connection box for flowmeter primary in Aluminum design





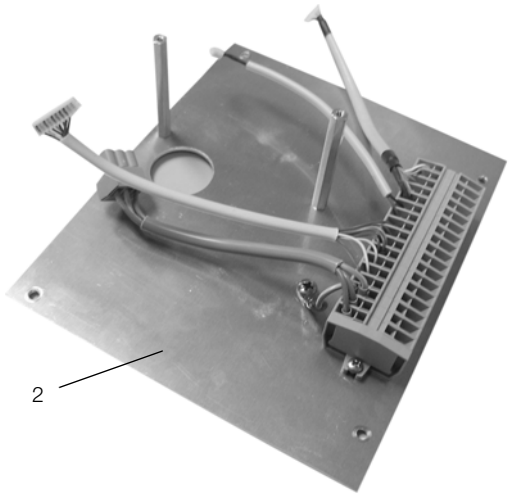


	Description	Connection Box for Series 2000 Part No.	Connection Box for Series 4000 Part No.
1	Housing cover	D612A127U01	D612A152U01
2	Housing cover gasket	D333F016U01	D333F022U01
3	Cable connector	D150A008U02	D150A004U14 (M20 x 1.5)
4	Seal ring for cable connector	D150Z007U06	–
5	Seal plug	D150Z007U05	D150Z007U08 (M20 x 1.5)
6	Gasket for seal plug	D150Z007U06	–
7	Screw M4 x 14 with flat washer and spacer	D396B013U01 and D115B004U01 and D375A018U01	D009G113AU20 D085A021BU20 D106A001U25
8	Connection box, lower section	D612A128U01	D612A153U09
9	Connection board, complete	D684A690U02	D685A862U02

Fig. 69:

12.3 Replaceable Parts List for Converter E4

12.3.1 Field Mount Housing



No.	Description	Part No.
1	Field mount housing M20x1.5 complete (empty), without converter module ,without connection board	D641A033U01
2	Connection board complete including cable assembly for standard outputs incl. HART (Variant 01-04) Connection board complete including cable assembly for RS485 (Variant 05) Connection board complete including cable assembly for PROFIBUS DP (Variant 06) Connection board complete including cable assembly for PROFIBUS PA or FOUNDATION Fieldbus (Variant 14-16)	D674A861U01 D674A861U92 D674A861U03 D674A861U04
3	Cover small	D641A029U01
4	Cable connector M20x1.5	D150A008U15
5	Mach. screw, Phillips, phillister head M4x10	D004G108AU01
6	Spring washer	D085D020AU20

Fig. 70:

12.3.2 Replaceable Parts List 19“ Insert

Description	Part No.
19“ Cassette compl. including cable assembly for Module Variant 1 - 5	D674A571U03
19“ Cassette compl. including cable assembly for Module Variant 6	D674A571U02

Fig. 71:

12.3.3 Replaceable Parts List Panel Mount Design

Description	Part No.
Panel mount hsg. compl. including cable assembly for Module Variant 1 - 5	D674A663U01
Panel mount hsg. compl. including cable assembly for Module Variant 6	D674A663U02

Fig. 72:

12.3.4 Replaceable Parts List Rail Mount Housing

Description	Part No.
Rail mount hsg. compl. including cable assembly for Module Variant 1 - 5	D674A572U03
Rail mount hsg. compl. including cable assembly for Module Variant 6	D674A572U02

Fig. 73:

13 Dimensions

13.1 Dimensions Converter FXE4000 (MAG-XE)

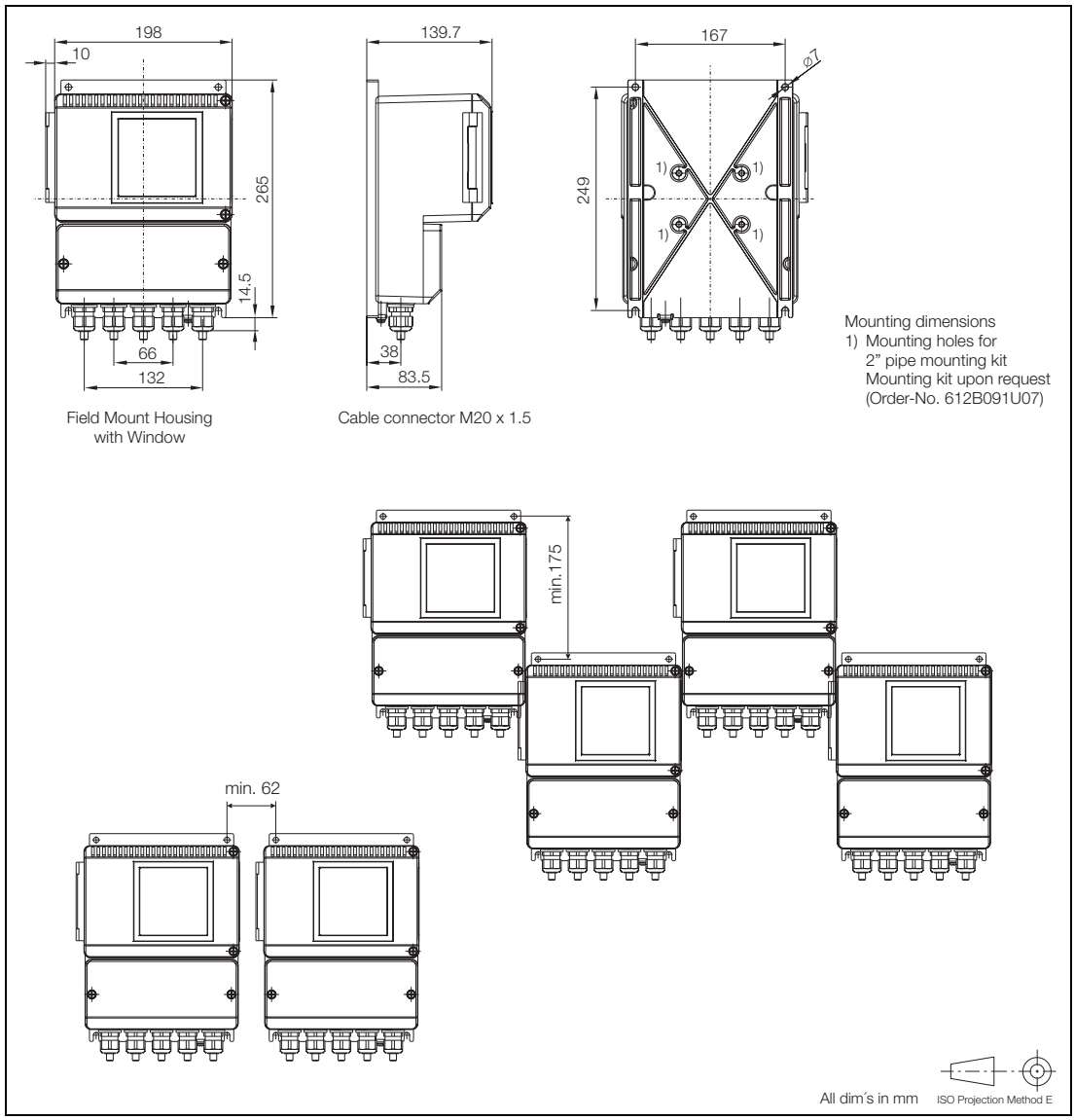


Fig. 74: Dimensions Converter Field Mount Housing, Mounting Options

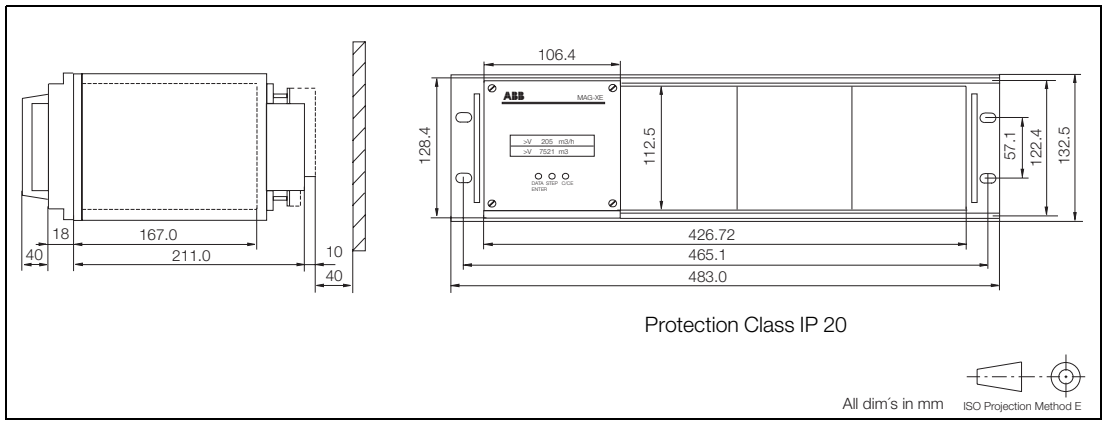


Fig. 75: Dimensions 19“ Converter FXE4000 (MAG-XE), Card Frame

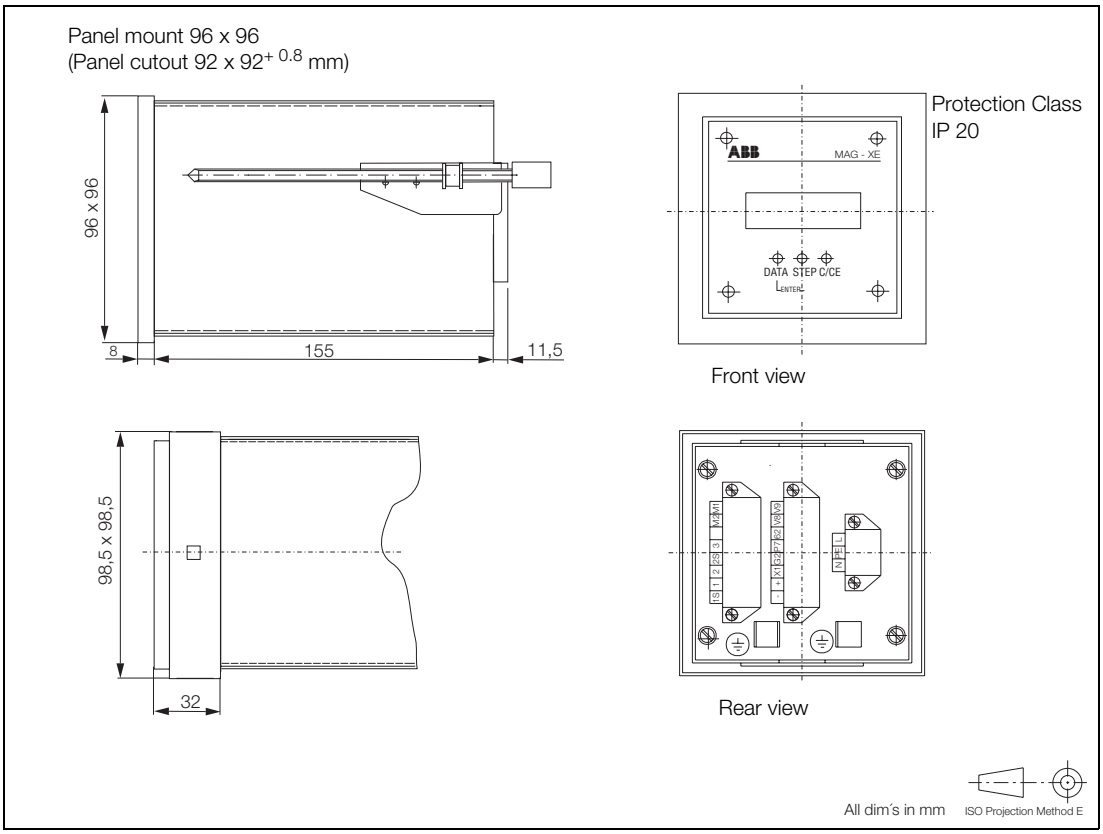


Fig. 76: Dimensions Converter FXE4000 (MAG-XE), Panel Mount Housing

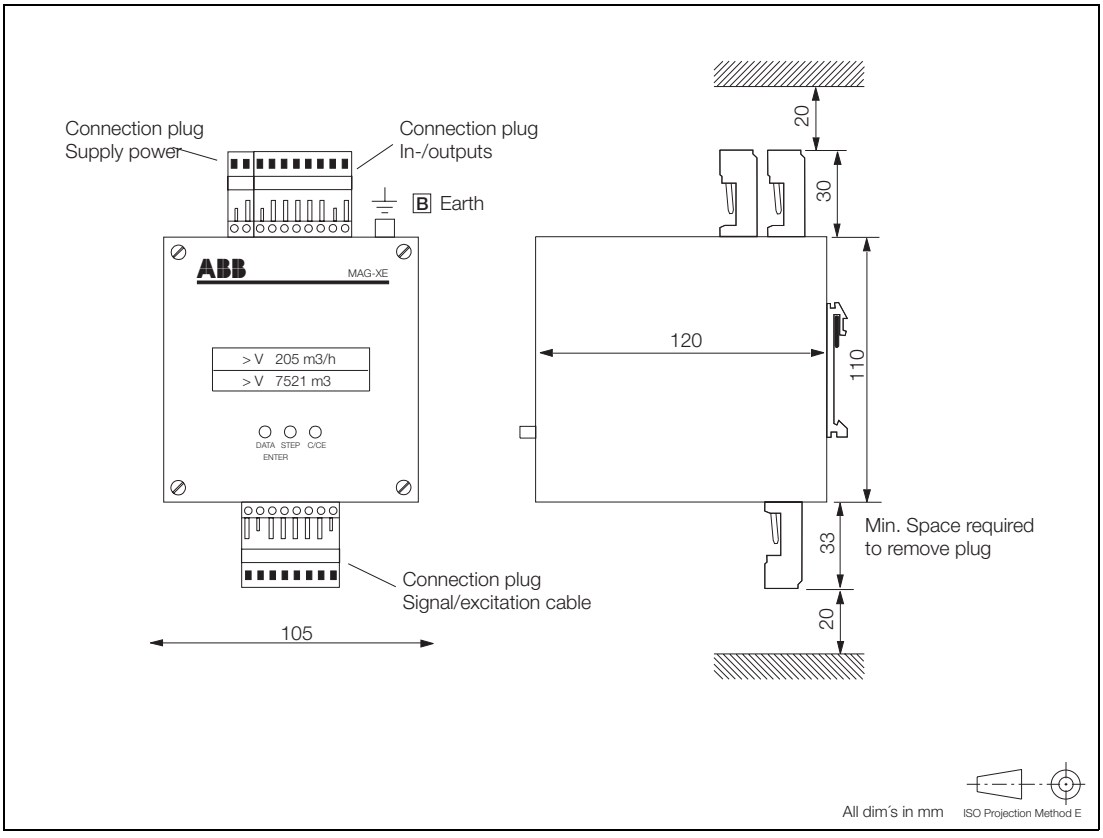


Fig. 77: Dimensions Converter FXE4000 (MAG-XE, Rail Mount Housing

14 Accuracy

Reference conditions per EN 29104

Fluid Temperature

20 °C ± 2 K

Supply Power

Nominal voltage per type tag U_N ± 1 % and
Frequency ± 1 %

Installation Requirements, Straight Sections

Upstream > 10 x D
Downstream > 5 x D
D = flowmeter primary size

Warm Up Phase

30 min

Effect on Current Output

Same as pulse output plus ± 0.1 % of rate

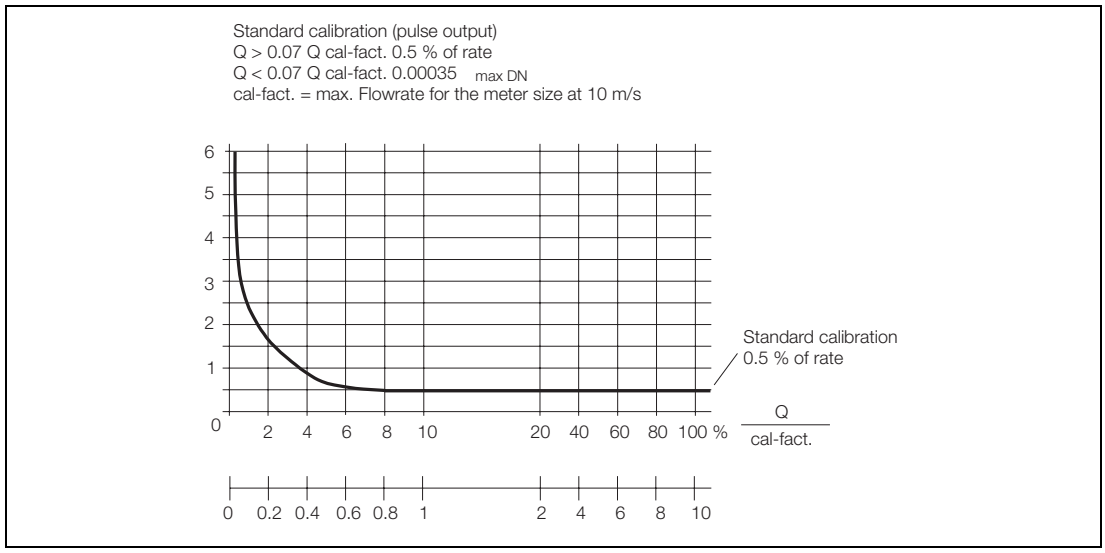


Fig. 78: Metering System Accuracy FXE4000 (COPA-XE / MAG-XE)

15 Specifications Converter

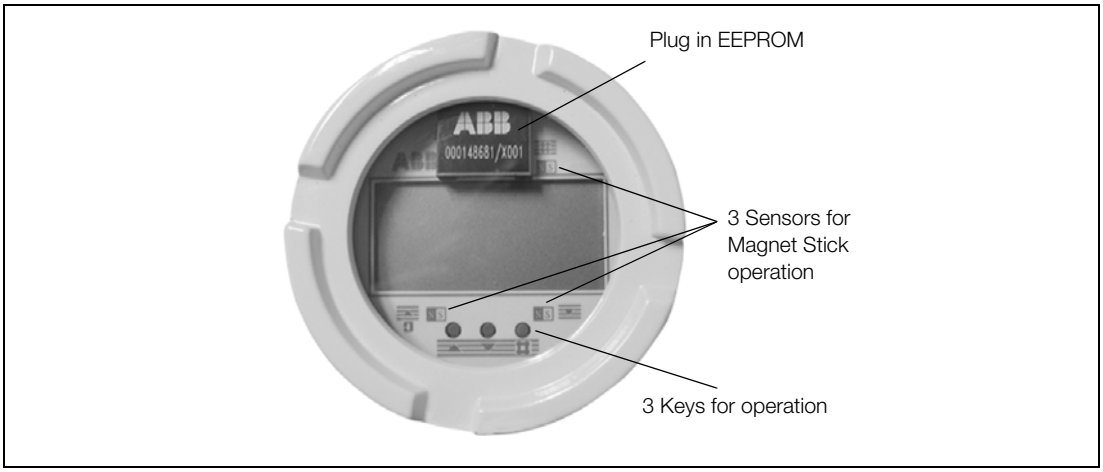


Fig. 79: Converter Keypad and Display

Flow Range

Continuous settings between 0.5 and 10 m/s

Max. Measurement Deviation of the Metering System

≤ 0.5 % of rate (0.25 % option)

Reproducibility

≤ 0.15 % of rate

Minimum Conductivity

5 µS/cm (20 µS/cm for demineralized water)

Response Time

For a step change 0-99 % (corresp. 5 τ) ≥ 1 s

Supply Power

High voltage AC 100-230 V (-15/+10 %)
Low voltage AC 16.8-26.4 V
Low voltage DC 16.8-31.2 V
Ripple: < 5 %

Magnetic Field Supply

6 1/4 Hz, 7 1/2 Hz 12½ Hz, 15 Hz, 25 Hz, 30 Hz (50/60 Hz supply power)

Power

≤ 14 VA (flowmeter primary including converter) for
AC supply power
≤ 6 W for DC supply power (flowmeter primary including converter)

Ambient Temperature

-20 to +60 °C

Electrical Connections

Screwless spring loaded terminals

Protection Class per EN 60529

IP 67, IP 68 (only for MAG-XE flowmeter primary)

Forward/Reverse Flow Metering

Direction is indicated in the display by the direction arrows and over an optocoupler output (ext. signal).

Display

With a lighted display, data is entered using the 3 keys or directly using the Magnet Stick externally without opening the housing.

2x16-character LC-Dot matrix display. The flow is integrated separately for each flow direction on two internal totalizers in 16 different units. The flowrate can be displayed in percent or in one of 45 different units. The converter housing can be rotated 90°. The display can be plugged into 3 different orientations to assure optimal readability. In multiplex operation, a second value (flowrate in percent or in direct reading engineering units or as a bargraph, totalizer value for forward or reverse direction, Tag No., or current output value) can be displayed alternately in addition to the selections for 1st and 2nd line.

Design Variants for the Converter Housing

For Model COPA XE
Compact design instrument with a light metal converter housing, painted, paint coat 60 µm thick, center section RAL 7012 dark gray, front an rear sections (cover) RAL 9002 light gray

Option:
Converter housing made of stainless steel 1.4301 [304]

For Model MAG-XE
a) Field mount housing, light metal housing, painted,
'paint coat 60 µm thick, basic housing part RAL 7012 dark gray,
cover RAL 9002 light gray
b) 19" Insert
c) Panel mount housing
d) Rail mount housing

Weight:

COPA-XE: see Dimensions (Specification D184S044U01)
MAG-XE: Field mount housing: 4.5 kg
19" Insert: 1.5 kg
Rail mount housing : 1.2 kg
Panel mount housing 1.2 kg

Signal Cable (only for MAG-XE)

The maximum cable length between the flowmeter primary and converter is 50 m. A 10 m long cable is included with the shipment of each flowmeter. If more than 10 m is required, order Part No. D173D018U02 or D173D025U01.

The instruments satisfy the general safety requirements per EN61010-1 and the EMC-Requirements per EN 61326 as well as the NAMUR-Recommendation NE21.

Attention: When the housing cover is the EMC and personnel contact protection are limited.

Data Safeguard

All data is stored during a power outage or when the power is turned off in an EEPROM in the converter. When a converter module and external EEPROM are exchanged, the original data is automatically uploaded when the power is turned on.

16 Overview Parameter Settings and Flowmeter Design Options

Meter location:			TAG No.:
Primary type:			Converter type:
Order No.:	Instrument No.:		Order No.:
Instrument No.:			
Fluid temp.:			Supply voltage :
Liner	Electrode:		Excitation freq.:
C_{zero}:	C zero:		System zero:

Parameter		**Entry Range**
Prog. Prot. Code	.....	0-255 (0=factory default setting)
Language	.....	German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish
Meter size:	.....	DN 3 - 1000 [1/10" - 40"]
Range:	.....	0.05 Cal-factor -1 Cal-factor
Pulse factor:	.....	0.001 - 1000 pulses/unit
Pulse width	.....	0.100 - 2000 ms
Low flow cut-off:	.....	0 - 10 % of flow range end value
Damping:	.....	0.125 - 99.99 seconds
Filter:	.....	ON/OFF
Density:	.....	0.01 g/cm^3 - 5.0 g/cm^3
Unit range:	.....	l/s, l/min, l/h, hl/s, hl/min, hl/h, m^3/s, m^3/min, m^3/h, igps, igpm, igph, mdg, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, ml/s, ml/min, ml/h, Ml/min, Ml/h, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, kgal/s, kgal/min, kgal/h,
Unit totalizer:	.....	l, hl, m^3, igal, gal, mgal, bbl, bls, g, kg, t, ml, uton, lb, kgal
Max. Alarm:	.....	%
Min. Alarm:	.....	%
Terminals P7/G2:	.....	Max. Alarm, Min. Alarm, Max./Min. Alarm, General Alarm, empty pipe, F/R-Signal, no function
Terminals X1/G2:	.....	External zero return, totalizer reset, no function
Current output:	.....	0/4-20 mA, 0/2-10 mA, 0-5 mA, 0-10-20 mA, 4-12-20 mA
Iout at Alarm:	.....	0 %, 130 %, 3.8 mA
Detector e. pipe:	.....	ON/OFF
Alarm e. pipe	.....	ON/OFF
Iout at e. pipe:	.....	0 %, 130 %, 3.8 mA
Threshold:	.....	2300 Hz
Adjust e. pipe:	.....	Software potentiometer
Totalizer function:	.....	Standard, difference totalizer
1st Display line:	.....	Q (%), Q (unit), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
2nd Display line:	.....	Q (%), Q (unit), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
1st line Multiplex:	.....	ON/OFF
2nd line Multiplex:	.....	ON/OFF
Operating mode:	.....	Standard/fast
Flow indication:	.....	Forward/reverse, forward
Flow direction:	.....	Standard, opposite
Store data in ext. EEPROM:	.....	Yes/No

Pulse output:	❑ Optocoupler	❑ Active 24 V
Contact in-/output:	❑ Yes optocoupler	❑ No
Detector empty pipe:	❑ Yes	❑ No
Communication:	❑ HART-Protocol	❑
Display:	❑ None	❑ Lighted and Magnet Stick

17 EU-Certificates of Compliance

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:*	50XE4... / E4... 10DE2... / DE2... 10DX4... / DE4...
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-2, 2/96 *
Richtlinie: *Directive:*	Niederspannungsrichtlinie 73/23/EWG * Low voltage directive 73/23/EEC *
Europäische Norm: *European Standard:*	EN 61010-1, 3/94 *

* einschließlich Nachträge
including alterations

Göttingen, 10.05.2000

.....
Unterschrift / Signature

BZ-13-5108, Rev.1, 1699

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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:*	D_2.., D_2_W, D_4_W, SE2.., SE2_W *D_2.., D_2_W, D_4_W, SE2.., SE2_W*
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 052/2/0006
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)

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:*	SE2_F, D_2_F, SE4_F, D_4_F *SE2_F, D_2_F, SE4_F, D_4_F*
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 4534 Z 0601 / 3 / H
benannte Stelle: *notified body:*	TÜV Nord e.V. Rudolf-Diesel-Str. 5 37075 Göttingen - Germany
Kennnummer: *identification no.*	0045

Göttingen, den 10.02.2003

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

2310 BZ-25-0002 Rev.03

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Printed in the Fed. Rep. of Germany (04.04)

D184B105U02 Rev. 02

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