Operating Instruction
D184B084U02

Electromagnetic Flowmeter
FXF2000 (COPA-XF)

Valid for Software Levels B.2x and up
EPROM Part No. D699B181U01/U02

Product Designation
FXF2000 (COPA-XF)

Operating Instruction

Part No. D184B084U02

Issued date: 12.05
Revision: 01

Manufacturer:

ABB Automation Products GmbH
Dransfelder Str. 2

37079 Göttingen, Germany

Telephone: +49 (0) 55 19 05- 0
Telefax: +49 (0) 55 19 05- 777

1 Safety Information

1.1 Basic Safety Requirements

1.1.1 Instrument Safety Standards

- This instrument complies with the safety requirements of the Pressure Equipment Directive and uses state of the art technology in its design. 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 flow of electrically conductive liquids, slurries or sludges and metering:

- the volumetric flow or
- the mass flow (at constant pressure/temperature) when mass engineering units have been selected
- continuous flows or batch processes (dependent on selected Operating Mode)

The regulated usages include:

- installation within the specification technical limits
- observing and following the information relating to the allowable fluids.
- observing and following the information in this 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 type plate 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 operations 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 type plate 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 maximum operating temperature 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 per EN60529
- Only original equipment instrument gaskets may be used.
- 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, etc.. 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 maintained. (Values were determined based on IEC801-2 or IEC TC 77B (SEC 101)).

1.1.4 Allowable Fluids

- Only such fluids may be metered for which assurance is available, either based on available 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 or which are abrasive may only be metered if the user institutes a regular and appropriate inspection program to assure the safe condition of the instrument.
- The specifications on the type plate are to be observed.

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

All safety marks, symbols and the type plates 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.
	**Attention!**	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 directives and satisfying the basic safety directives: • CE-Mark on the type plate (on the converter) – Compliance with the EMC-Directive 89/336/EWG • CE-Mark on the factory plate (on the flowmeter primary) – Compliance with the Pressure Equipment Directive (DGRL) 97/23/EG Pressure equipment will not have a CE-Mark on the factory plate if: – the max. allow, pressure (PS) is less than 0.5 bar. – there are minimal pressure risks (meter sizes ≤ DN 25 [1"]) therefore a compliance evaluation is not required. – the instruments are used as water meters in Water/Waste Water facilities. Applies to sizes >DN 600 [24”].

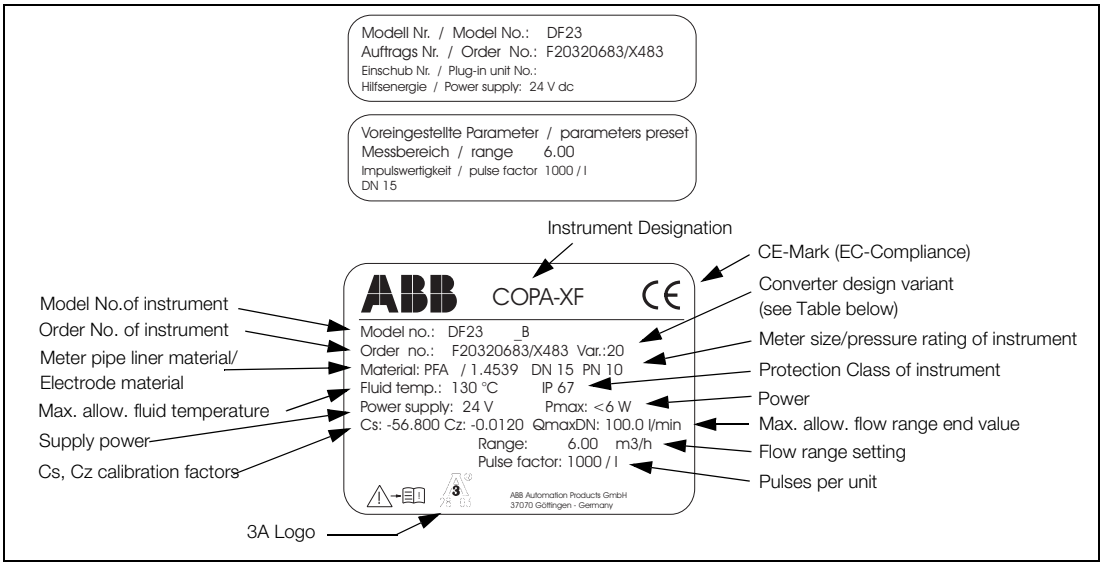
1.1.6 Type Plate / Factory Plate / EHEDG Label

1.1.6.1 Type Plate Specifications

The type plate is located on the converter housing.

Note:

Information regarding the instrument design, parameter settings and the original calibration data may be obtained from the factory whenever required using the Order No.



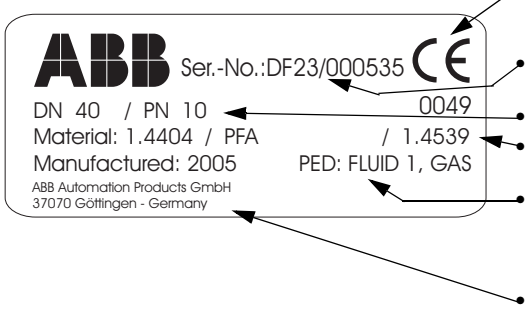
The identification of the converter design may be found on the plate on the metal frame of the converter module or on the type plate on the converter housing.

Variant 02	Contact output + Pulse passive, Opto + Contact input + RS485 (2nd plug)
Variant 07	Contact output + Pulse passive, Opto + Contact input + Current output (standard)
Variant ≥ 20	User specified converter design

1.1.6.2 Factory Plate Specifications

The factory plate 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/EC):

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



The factory plate contains the following specifications:

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

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

The factory plate 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/EC.
- 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).

1.1.6.3 Specifications on the EHEDG Label

The EHEDG-Logo on the instrument certifies that the instrument complies with the complete scope of the EHEDG-Test criteria for use in hygienic applications.

- Logo with Certifying Location
- Type of certification
- Date of the certification

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, 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:

- that 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.

1.1.10 Possible Dangers During Installation

Before installing assure that:

- the flow direction corresponds with the arrow on the instrument, if present.
- the instrument is installed in a stress free manner (torsion, bending), fixed clamps / multiconnections are installed with axisymmetric, parallel mating fittings and the gaskets used are suitable for the anticipated operating conditions.

1.1.11 Possible Dangers During Electrical Installation

The electrical connections may only be made by authorized and 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.

- 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 process connection gaskets (e.g. Food Industry fittings, Tri-Clamp etc.) leaks of the fluid under pressure could occur.
- The internal flat gaskets for the process connections „Multiconnection“ can become 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 adjacent piping or tanks have been depressurized.
- Before opening 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 opened.
- Within the framework of operator responsibilities, perform a regular inspection of the instrument including:
  - the pressure containing walls/liners of the pressure equipment
  - proper metering function
  - seal integrity
  - wear (corrosion)

Warning!

- Exercise care if an instrument should fail before removing the cover because dangerous fluid could leak from the instrument. Assure that the pipeline is depressurized before opening the instrument.

1.1.14 Returns

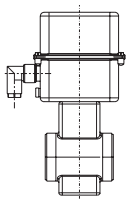
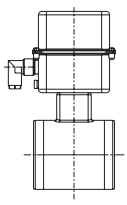
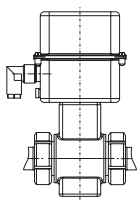
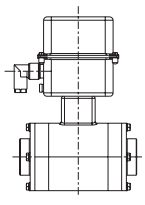
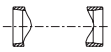
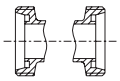
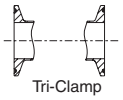
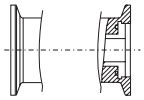
- If it is necessary to return the instrument for repair or recalibration to the ABB factory in Göttingen, Germany, use the original packaging material or a suitably protective packing material. Please indicate the reason for the return.

Important! EC 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.

1.2 Overview of the Flowmeter Primary and Converter Designs
Overview Process Connections

Model DF23	**Wafer Design**  DN 3 – DN 40 1/10" – 1½"  DN 50 – DN 100 2" – 4"	**Design Variable Process Connections**  DN 3 – DN 40 1/10" – 1½"  DN 50 – DN 100 2" – 4"  Weld Stubs  External Threads  Pipe Coupling  Tri-Clamp  Fixed Clamp

Flowmeter Primary Specifications								
Accuracy Specifications								
Measurement deviations	0.5 % of rate				0.5 % of rate			
Reproducibility	0.2 % of rate				0.2 % of rate			
Flowmeter Primary								
Process Connections	**Meter size**		**Max. pres. PN**		**Meter size DN**	**Inch**	**Max. pres. PN**	
Wafer Design	DN3–100 1/10" – 4"	DN 3 – 50 1/10" – 2" DN 65 – 100 2½" – 4"	10 – 40 10 – 40	W W	–		–	
Weld stubs DIN 11850	–		–		3 – 40 50, 80 65, 100	1/10" – 1½" 2", 3" 2½", 4"	40 16 10	R R R
Weld stubs DIN 2463	–		–		3 – 40 50, 80 65, 100	1/10" – 1½" 2", 3" 2½", 4"	40 16 10	Q Q Q
Weld stubs ISO 2037	–		–		25 – 40 50, 80 65, 100	1" – 1½" 2", 3" 2½", 4"	40 16 10	P P P
Weld stubs SMS	–		–		25, 40 50, 80 65, 100	1" – 1½" 2", 3" 2½", 4"	40 16 10	X X X
Pipe couplings DIN 11851	–		–		3 – 40 50, 80 65, 100	1/10" – 1½" 2", 3" 2½", 4"	40 16 10	S S S
Tri-Clamp DIN 32676	–		–		3 – 50 65 – 100	1/10" – 2" 2½" – 4"	16 10	T T
Fixed-Clamp	–		–		10 – 40	3/8" – 1½"	10	C
Ext. threads ISO 228 / DIN 2999	–		–		3 – 25	1/10" – 1"	10	E
Liner	PFA				PFA			
Conductivity	≥ 5 µS/cm				≥ 5 µS/cm			
Electrodes	Stn. stl. 1.4571[316Ti], 1.4539, Hastelloy C4, Platinum-Iridium, Tantalum, Titanium				Stn. stl. 1.4571[316Ti], 1.4539, Hastelloy C4, Platinum-Iridium, Tantalum, Titanium			
Process connection material					Stn. stl. 1.4404[316L], Optional 1.4435			
Protection Class	IP 67, optional tropicalized				IP 67, optional tropicalized			

2 Accuracy, Reference Conditions and Operating Principle

2.1 Description

The Electromagnetic Flowmeters from ABB are the ideal flowmeters for liquids, slurries and sludges that have a specific minimum conductivity. The instruments measure accurately, create no additional pressure drop, have no moving parts or parts that project into the flow stream and are wear free. They can readily be installed in any existing pipeline.

ABB flowmeters have been proven over decades and are the preferred flowmeters in the chemical, pharmaceutical and cosmetic industries, in municipal water and waste water treatment facilities, the food industry and in pulp and paper plants.

2.2 Operating Principle

The operation of the electromagnetic flowmeter is based on Faraday's Laws of Induction. A voltage is induced in a conductor as it moves through a magnetic field.

This measurement principle is applied to a conductive fluid which flows in a pipe through which a magnetic field is generated perpendicular to the flow direction (see Schematic, Fig. 1).

$$U_E \sim B \cdot D \cdot v$$

The signal voltage which is induced in the fluid is measured at 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 fluid velocity **v**. From the equation for the volume flowrate *) it follows that: $\mathbf{U_E \sim q_v}$. The signal voltage $\mathbf{U_E}$ is linear and proportional to the volume flowrate.

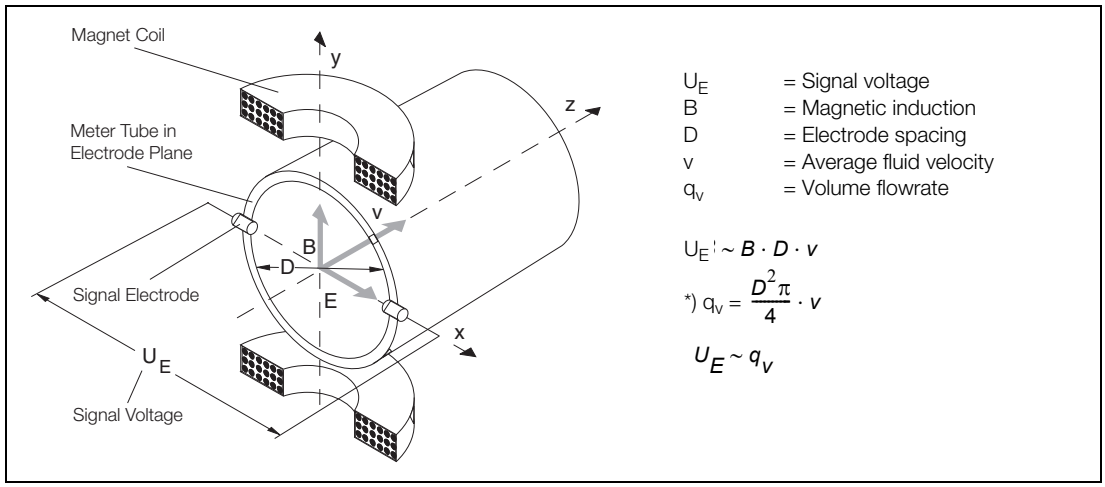


Fig. 1: Electromagnetic Flowmeter Schematic

2.3 Design

A very special position is occupied by the Compact Design electromagnetic flowmeters. In this design the converter is mounted directly on the flowmeter primary. This appreciably reduces the installation costs because no longer is wiring between the converter and the flowmeter primary required.

2.4 Reference Conditions per EN 29104

Fluid

Water, conductivity 200 µS/cm ± 10 %

Fluid Temperature

20 °C ± 2 K

Ambient Temperature

20 °C ± 2 K

Supply Power

Nominal voltage per the Type plate U_N ± 1 %

Installation Requirements, Straight Pipe Sections

Upstream >10xD
Downstream >5xD
D = Size of the flowmeter primary

Warm-up Phase

≥ 30 Minutes

Influence on the Analog Output

Same as pulse output ± 0.1 % of rate

Pulse Output

Pulse output>0.07 Cal-fac ± 0.5 % of rate
Q<0.07 Cal-fac ± 0.00035 Cal-fac

Cal-fac = maximum flowrate for the meter at 10 m/s

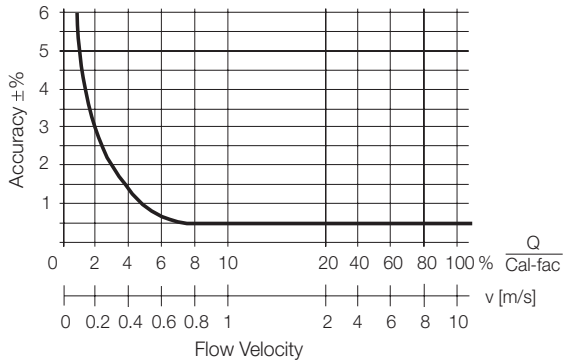


Fig. 2: Accuracy

Reproducibility – Batch Operation

If the boundary conditions are constant, the above accuracy specifications / system accuracies (± 0.5 % of rate) in
Fig. 2 , for batch operation (standard deviation) become:

± 0.2 % at $T_{Batch} \geq 4$ s
± 0.4 % at $2 s \leq T_{Batch} \leq 4$ s

Reproducibility – Continuous Operation

± 0.2 % of rate
± 0.4 % of rate

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

3.2.1 Shipment Contents

Dependent on the converter variant included with the shipment of a FXF2000 are either 1 signal plug or 2 plugs for the compact design (Fig. 3). An Operation Manual and a Calibration Certificate are also included with the shipment for each instrument.

3.2.2 Shipped Status

The calibration data for the flowmeter primary is stored in the EEPROM which is plugged into the converter module. The parameters are set to their default values (Section 10) and the customer specified parameters listed in the ABB Specifications, if they were included with the order.

Shipment contents Variant 07
(8 pole plug)

Shipment contents Variant 02
(8 pole and 4 pole plugs)

Fig. 3: Shipment Contents FXF2000 (COPA-XF)

3.3 Installation Requirements, Flowmeter Primary

When installing the flowmeter assure that the flow direction is correct (fluid flows into the plug connection), because the preferred flowmeter primary operation is the forward mode. It is possible to change the flow direction indicated in the display between forward/reverse in the software if required.

3.3.1 Installation

During installation assure that

- the flow direction agrees with the flow arrow - if present - on the flowmeter primary.
- the instrument is installed without mechanical stresses (torsion, bending), and that appropriate gaskets are used.
- the gaskets do not extend into the flow area as this might cause eddies which could adversely affect the accuracy of the instrument.
- the pipeline does not exert any unallowable forces or moments on the instrument.
- the plug when the installation is vertical points downward.
- the signal cable plug is properly installed and tightened, in order to assure Protection Class IP67 operation.
- the cover gasket is properly seated and the cover is screwed down tightly to assure IP67 operation.

- the instrument is grounded in accordance with the Interconnection Diagrams (see Section 4).

3.3.2 Recommended Installation Conditions

- Meter pipe must always be completely filled, because air can cause measurement errors.
- For horizontal installations, assure that neither electrode is located at the highest point, to exclude errors due to air bubbles. An ideal installation of an EMF is assured in a vertical pipeline. Fig. 4 shows the two preferred installation orientations.
- Valves or shutoff devices should be installed in the outlet section to prevent the meter from draining.

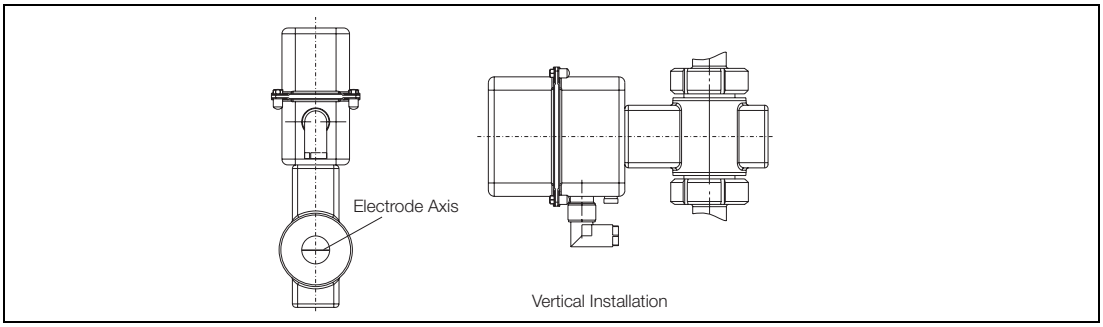


Fig. 4: Installation and Electrode Axis in the EMF

3.3.3 In- and Outlet 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.

Straight pipe sections with the same internal opening as the flowmeter primary are to be installed up- and downstream. The straight length upstream of the flowmeter primary should be at least 10 times the size of the flowmeter primary and downstream at least 5 times. (Fig. 5)

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

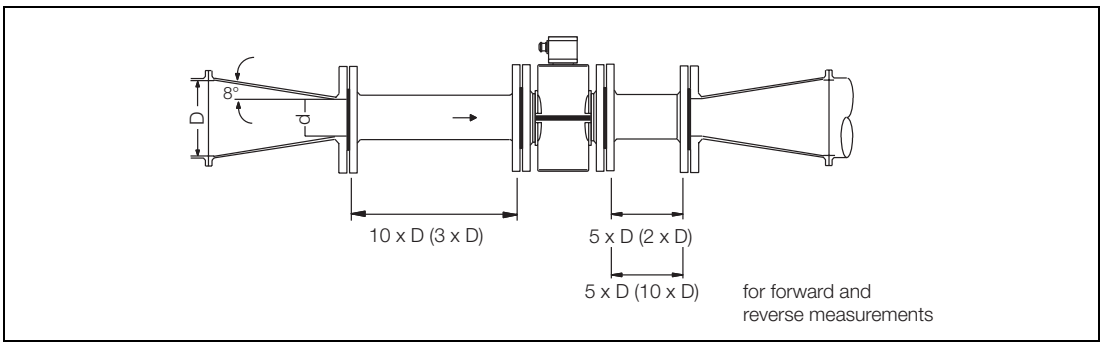


Fig. 5: Pipeline Installations, Reductions if Required

3.3.4 Tightening Torques

3.3.4.1 Tightening Torque M_A for Series 2000 „Multi-Connection“ Based on the PED(DGRL) Calculations using EPDM Gaskets

Tightening Torques for Multi-Connection Instruments

DN	Inch	M_A [1] [Nm]
DN 10	3/8“	6.5
DN 15	1/2“	9
DN 20	3/4“	20
DN 25	1“	32
DN 32	1 1/4“	56
DN 40	1 1/2“	80
DN 50	2“	30
DN 65	2 1/2“	42
DN 80	3“	100
DN 100	4“	125

1) Does not apply to Wafer Design flowmeters

3.3.4.2 Tightening Torques M_A for Series 2000 with PFA Liners „Wafer Design“ Based on the PED(DGRL) Calculations

Tightening Torques for Wafer Design Instruments

Liner	DN		Bolts	Torque	PN
	mm	inch		max. Nm	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	1¼	4 x M16	26.0	40
	40	1½	4 x M16	33.0	40
	50	2	4 x M16	46.0	40
	65	2½	8 x M16	30.0	40
	80	3	8 x M16	40.0	40
	100	4	8 x M20	67.0	40

3.3.5 3A Conformity

The instrument may not be installed in the orientation shown in Fig. 6. In addition, it is important that the leak detection hole be located at the lowest point in the installed instrument (Fig. 7).
The option „Mounting Bracket (Fig. 8)“ is not available for 3A-instruments.

Note:

The above noted requirements assure conformity to the 3A-Requirements relative to cleanability of NON fluid wetted parts on the exterior of the instrument. They have no effect on the operation, accuracy or operating reliability!

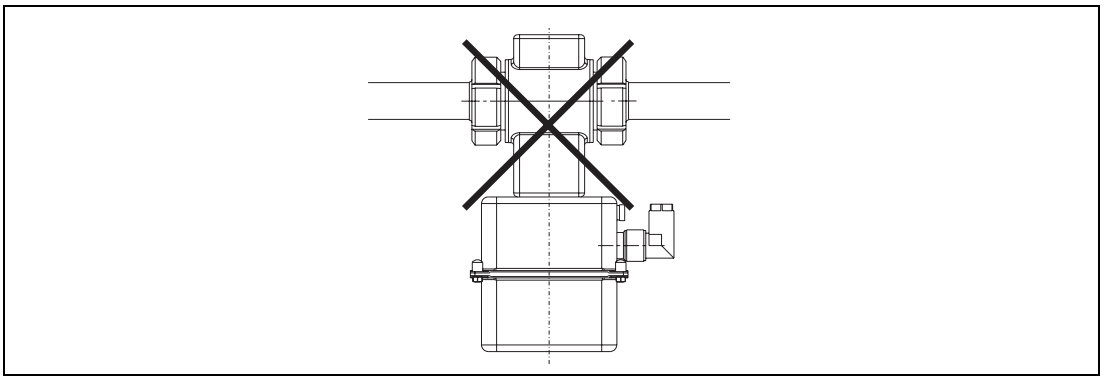


Fig. 6: Model DF23 – FXF2000 (COPA-XF)

Fig. 7:

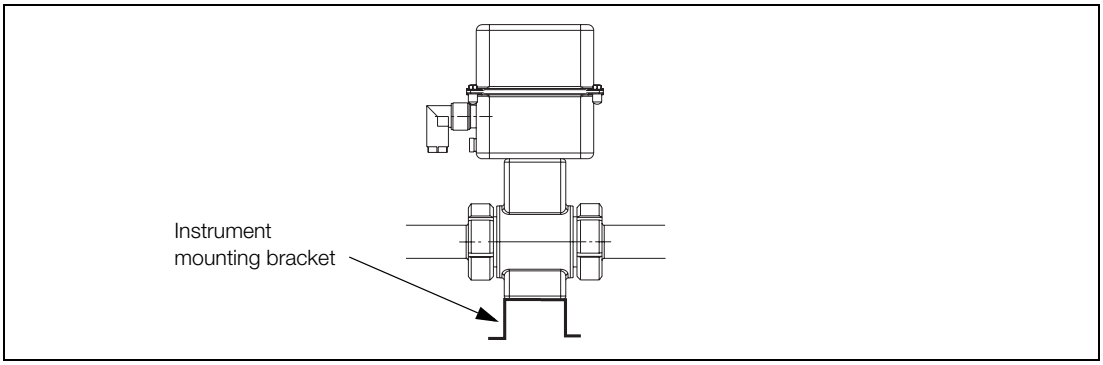


Fig. 8:

3.4 Protection Class Relative to EMC

The Protection Class of the instrument is IP 67. The instrument is to be installed at a sufficient distance from EMC-noise sources such as frequency converters, valves, relays, heaters, etc., to eliminate effects on the accuracy and repeatability. If necessary, appropriate noise suppression measures should be provided such as protection diodes, varistors or R-C combinations (VDE 0580).

We recommend that shielded connection cables be used. It is advantageous to run the cables in grounded metal conduits, in which multiple cables of the same type can be run in the same conduit.

Note:

The instrument satisfies the requirements in the EMC-Directive and the NAMUR-Recommendations NE21 3/93 „Electromagnetic Compatibility of Equipment in Processes and the Laboratory“.

Grounding of the instrument and the connections for the signal cable are to be made as outlined in Section 4. „Grounding, Electrical Connections“.

3.5 Flowrate/Pressure Drop Tables and Nomograph

3.5.1 Meter Size and Pressure Rating (Weld Stubs) with Flow Ranges

Meter Size DN	Meter Size Inch	Std. Pres. Rating PN[1)]	Min. Flow Range Flow Velocity. 0 to 0.5 m/s	Max. Flow Range Flow Velocity. 0 to 10 m/s
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 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	1¼	40	0 to 20 l/min	0 to 400 l/min
40	1½	40	0 to 30 l/min	0 to 600 l/min
50	2	16	0 to 3 m^3/h	0 to 60 m^3/h
65	2½	10	0 to 6 m^3/h	0 to 120 m^3/h
80	3	16	0 to 9 m^3/h	0 to 180 m^3/h
100	4	10	0 to 12 m^3/h	0 to 240 m^3/h

1) For values for other process connections see Page 10

3.5.2 Effective Flow Velocities, Variable Process Connections, PFA

Meter Size DN	Meter Size Inch	Cal-fac [l/min]	d_{eff} [mm]	Q d_{eff} [l/min]	V_{eff} [m/s]
3	1/10	4	3	4.2	9.4
4	5/32	8	4	7.5	10.6
6	3/16	20	6	17.0	11.8
8	5/16	30	8	30.2	9.9
10	3/8	45	10	47.1	9.5
15	1/2	100	13	79.6	12.6
20	3/4	150	18	152.7	9.8
25	1	200	24	271.4	7.4
32	1¼	400	30	424.1	9.4
40	1½	600	36	610.7	9.8
50	2	1000	47	1041.0	9.6
65	2½	2000	62	1811.4	11.0
80	3	3000	74	2580.5	11.6
100	4	4000	96	4342.9	9.2

3.5.3 Flowrate Nomograph

The volume flowrate is a function of the flow velocity and flowmeter primary size. The Nomograph, Fig. 9, shows the flowrates which can be metered with a particular size flowmeter primary and which flowmeter sizes are suitable for a particular flowrate.

Example:

Flowrate = 120 l/min (maximum value = flow range end value).
Suitable are flowmeter sizes DN 20 to 65 [3/4" to 2½"].

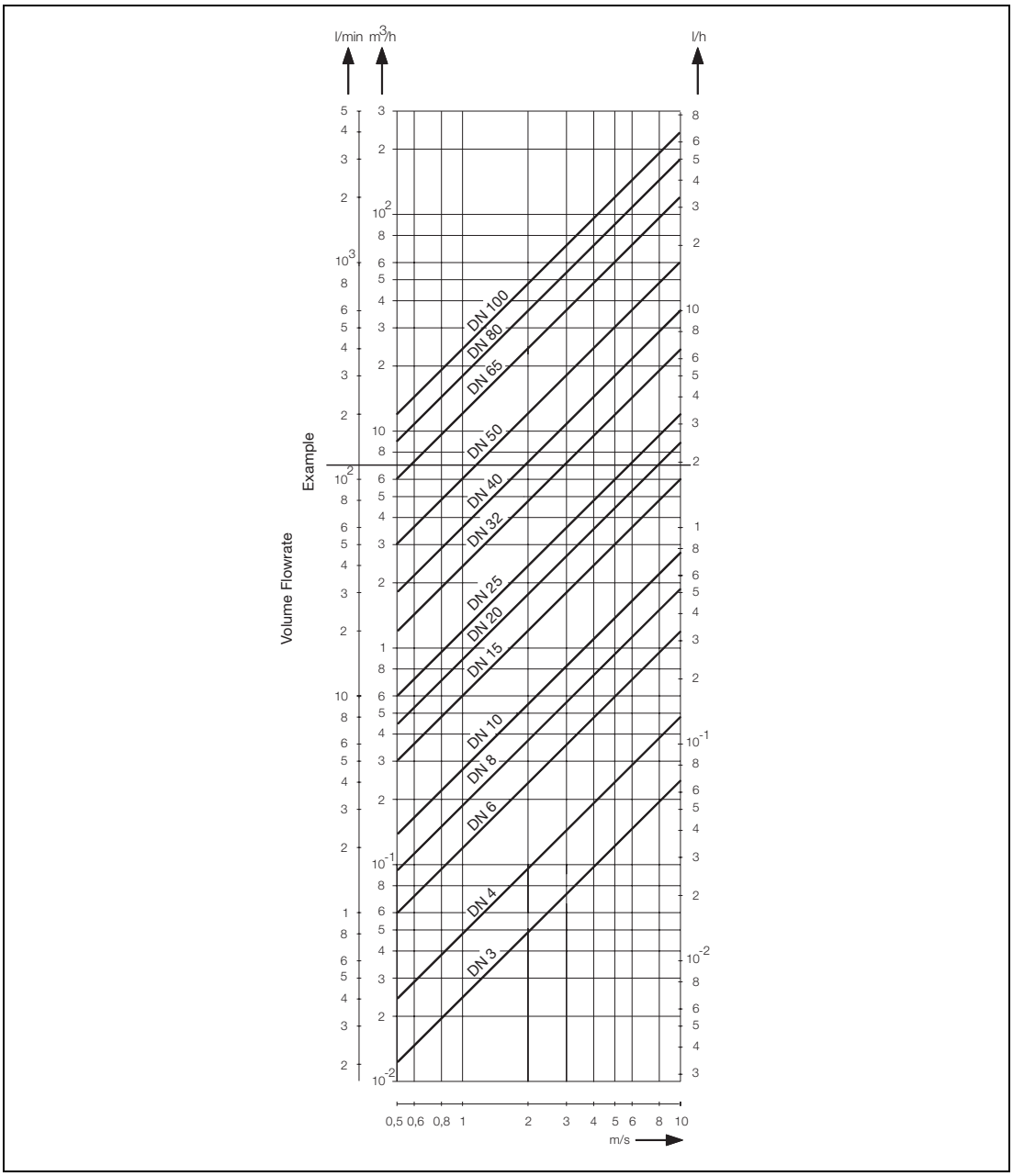


Fig. 9: Flowrate Nomograph DN 3 to DN 100 [1/10" to 4"]

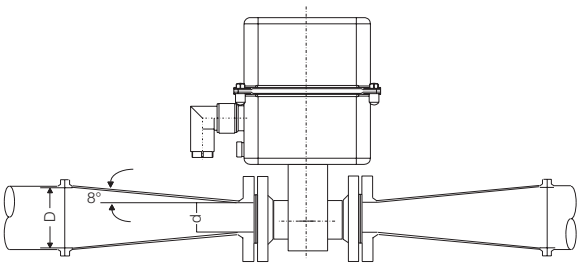
3.5.4 Pressure Drop Calculations

The flowmeter can readily be installed in larger size pipe lines by using of reducers. The pressure drop resulting from the reduction (e.g. flanged reducers per DIN EN 545) can be determined from the Nomograph Fig. 10 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:

$$v = \frac{Q\ (\text{Instantaneous flowrate})}{FlowmeterConstant}$$

   The flow velocity can also be determined from the Flow Rate Nomograph Fig. 9.
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. 10.



d = EMF-Inside diameter
D = Pipe inside diameter
v = Flow velocity in m/s
Δp = Pressure drop in mbar

Pressure Drop Diagram for EMF
Flanged reducers with α /2 = 8°

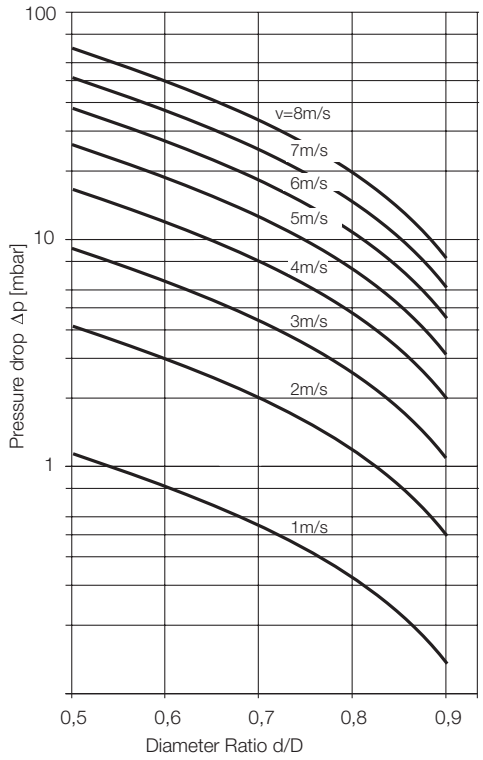


Fig. 10: Nomograph for Pressure Drop Determination

4 Grounding, Electrical Connections

4.1 General

The electrical connections may only be made by authorized technicians in accordance with the Interconnection Diagrams. Please observe the Interconnection Diagrams and the Notes in the Operation Manual. The connections described herein must by observed.
When the housing is opened the EMC-Protection is voided.

4.2 Grounding the Flowmeter Primary

Grounding the flowmeter primary is essential for safety reasons as well as to assure proper functioning of the electromagnetic flowmeter. In accordance with VDE 0100, Part 540 a green/yellow Cu-cable (min. 4 mm²) is to be connected between the grounding screw on the flowmeter primary to protection earth (Fig. 11). For technical reasons this potential should be identical to the pipeline potential.

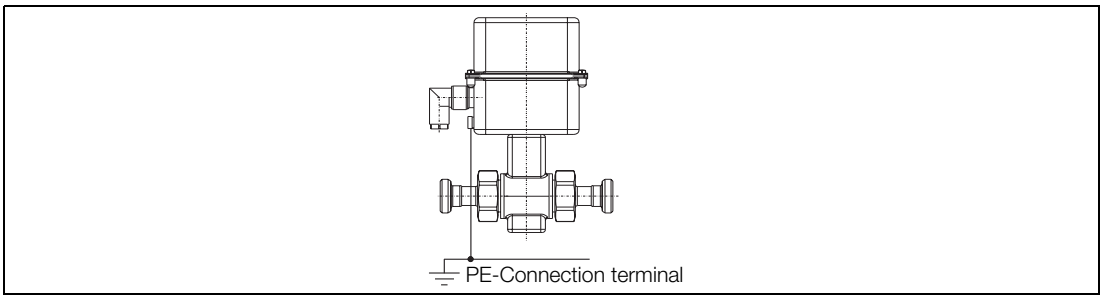
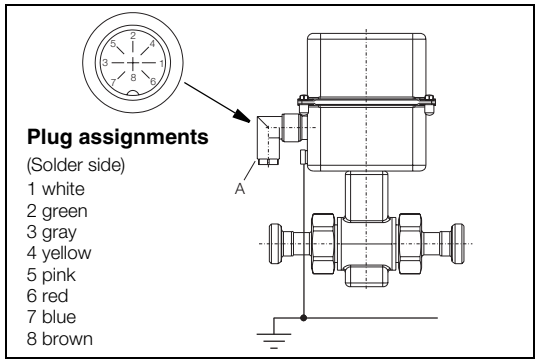


Fig. 11: Grounding the Flowmeter Primary FXF2000 (COPA-XF)

4.3 Interconnection Diagram for the FXF2000, P-Switched, Design Level B, Plug Assignments

Connection Plug (Supply Power, In-/Output)



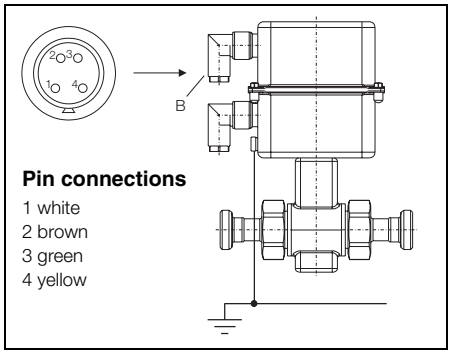
Connection Plug - Angled

Option:

Plug with installed cable, PVC data cable, 5 m
Type Tronic flexible per DIN 47100, LIYY 8 x 0.5 mm²
Outside diameter 7.8 mm, Article No. 18091 Helukabel
Connection plug assignments with installed cable

Scaled pule output passive, Opto, (P-switched)	Ux V8	Pin 3 (gray lead) Pin 4 (yellow lead)
Current output 0/4 - 20 mA	+ –	Pin 5 (pink lead) Pin 8 (brown lead)
Contact output passive, Opto, (P-switched)	Ux P7	Pin 3 (gray lead) Pin 1 (white lead)
Contact input passive, Opto, (P-switched)	X1 G2	Pin 5 (pink lead) Pin 2 (green lead)
Supply Power 24 V DC	U+ U-	Pin 6 (red lead) Pin 7 (blur lead)
No function Function		Pin 8 (brown lead)

Communication Plug



Communication Plug (B) - Angled

Option:

Handheld terminal 55HT4000 with 2.5 m cable and straight plug or a 10 m cable with an angled plug (see Part No. 55HT4000)

Data link RS 485, 2 wire	A B	Pin 4 (yellow lead) Pin 3 (green lead)
Supply power 24 V DC for Handheld terminal 55HT4000 from CM	⊥ +25 V	Pin 1 (white lead) Pin 2 (brown lead)

Fig. 12: Interconnection Diagram and Plug Assignments for Installed Cable

Plug PIN-Assignments

Plug Type	Assignments for Standard Plug FXF2000								Assignments Communication Plug			
Variant	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 1	PIN 2	PIN 3	PIN 4
2	P7	G2	Ux	V8	X1	U+	U-	../..	⊥	+ 25 V	B	A
7	P7	X1	Ux	V8	+	U+	U-	–	../..	../..	../..	../..
User Specified Variants												
20	P7	../..	Ux	V8	+	U+	U-	–	⊥	+ 25 V	B	A
21	P7	G2	Ux	V8	X1	U+	U-	../..	../..	../..	../..	../..
22	P7	Vc	Ux	V8	+	U+	U-	–	../..	../..	../..	../..
23	P7	G2	Ux	V8	X1	U+	U-	Air	../..	../..	../..	../..

Interconnection Diagram FXF2000, P-Switched, Model DF23, Design Level B

Design P-Switched

(Pulse output, current output, contact input, contact output, supply power, external air, data link, supply power handheld terminal)

Assignment	Connection Plug								Communication Plug			
Plug PIN-No.	1	2	3	4	5	6	7	8	1	2	3	4
Legend	Functions (PIN-Assignments)								Functions (PIN-Assignments)			
a)			Ux	V8								
d)					+			–				
e)	P7		Ux									
f)		G2			X1							
g)						U+	U-					
i)											B	A
j)									⊥	+25V	B	A

a) Scaled pulse output, passive optocoupler, pulse width settable from 0.100 ms to 2000 ms
fmax 5 kHz dependent on selections in submenu “Operating Mode”,
$0\ V \le U_{CEL} \le 2\ V$, $16\ V \le U_{CEH} \le 30\ V$
$2\ mA \le I_{CEL} \le 220\ mA$; $0.2\ mA \le I_{CEH} \le 2\ mA$
Connection assignments PIN 3, 4; Function Ux, V8

d) Current output (selectable)
Load ≤ 600 Ω for 0/4–20 mA, 0–10– 20 mA, 4–12–20 mA
Load ≤ 1200 Ω for 0/2–10 mA; Load ≤ 2400 Ω for 0–5 mA
Connection assignments PIN 5 and 8; Function +, –

e) Contact output, function selectable, dependent on selections in submenu “Operating Mode”,
Synchronous-Signal (output signal synchronized to excitation), F/R-signal or end contact,
passive optocoupler, $0\ V \le U_{CEL}\ 2\ V$, $16\ V \le U_{CEH} \le 30\ V$ / $0\ mA \le I_{CEH} \le 0.2\ mA$, $2\ mA \le I_{CEL} \le 220\ mA$
Connection assignments PIN 1, 3; Function P7, Ux

f) Contact input, function selectable dependent on selections in submenu “Operating Mode”,
Start/Stop, external totalizer reset, system zero[1], No function,
passive optocoupler, $16\ V \le U \le 30\ V$, Ri = 2 kOhm
Connection assignments PIN 2, 5; Function G2, X1

g) Supply power 24 V DC ± 30 % ripple ≤ 5 %
Connection assignments PIN 6, 7; Function U+, U-

i) Data link RS 485, 2-wire, VPP = 5 V, input resistance ≥ 12 kOhm
max. cable length ≤ 1200 m, shielded, twisted pair cable required,
Baudrate 110 - 9600 Baud, max. 32 instruments in parallel,
Communication plug assignments PIN 3, 4; Function B, A (RS 485)

j) Connect handheld terminal 55HT4000
Communication plug assignments PIN 3, 4; Function B, A (RS 485);
Communication plug assignments PIN 1, 2; Function ⊥ , +25 V (Supply power from CM for 55HT4000)

1) Initiates a system adjust procedure.
The fluid must be at absolute zero, the meter pipe must be completely filled.

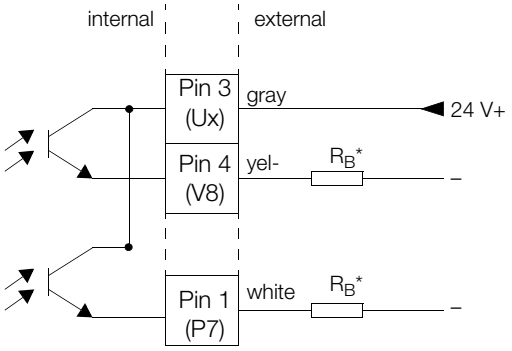
Comments:
To maintain the EMC-Requirements the instrument must be connected to earth.
When the housing is opened the EMC protection is voided.

Fig. 13: Interconnection Diagram, P-Switched In-/Outputs with PIN-Assignments for Connection and Communication Plugs

4.4 Interconnection Examples for Peripherals FXF2000 (COPA-XF), Model DF23, P-Switched In-/Outputs / Data Link

Passive

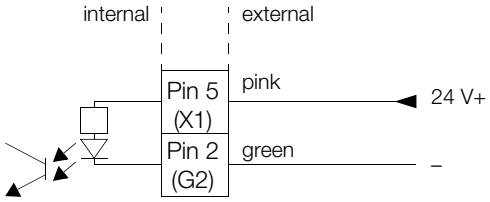
- Pulse output optocoupler Pin 3 / Pin 4
- Contact output optocoupler Pin 3 / Pin 1
  Contact output for Synchronous-Signal
  F/R signal, end contact
  Function selectable in software



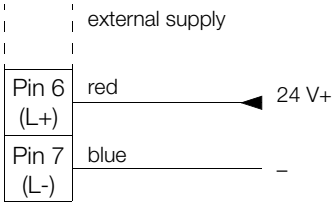
$$R_B^* \geq \frac{U_{CE}}{I_{CE}}$$

Passive

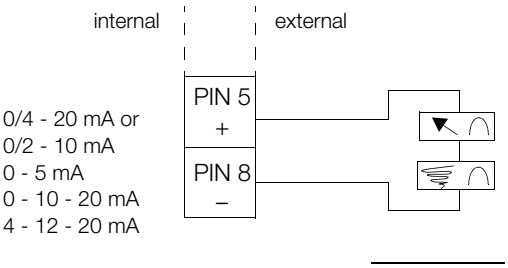
- Contact input optocoupler Pin 5 / Pin 2
  Contact input for Start/Stop, system zero,
  No function
  Function selectable in software



- Supply Power (24 V DC)

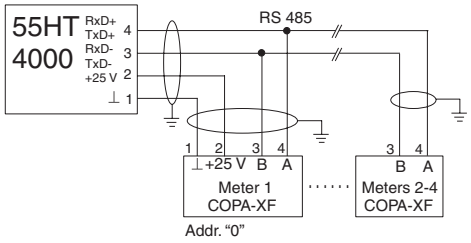


- Current output Pin 5 / Pin 8



0/4 - 20 mA or
0/2 - 10 mA
0 - 5 mA
0 - 10 - 20 mA
4 - 12 - 20 mA

Operation with 55HT4000, max. 4 instruments



Data link RS485, max. 32 instruments

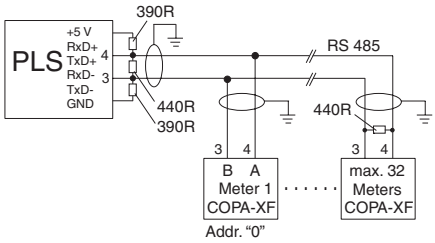


Fig. 14: Interconnection Examples for Peripherals, P-Switched In-/Outputs/Data Link

Variant Overview, P-Switched and SPC-Conformity

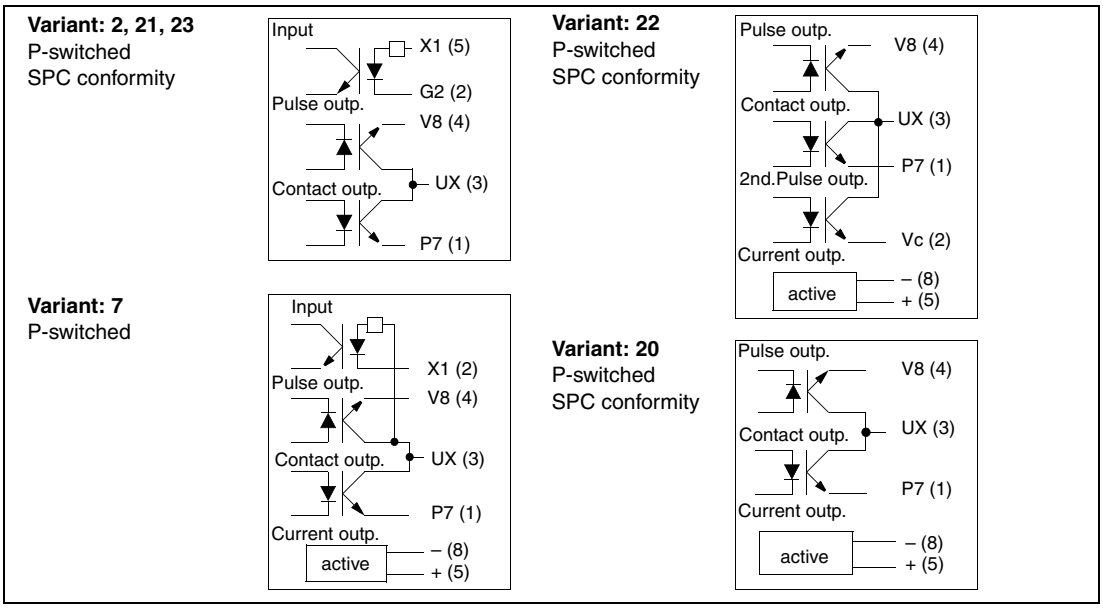


Fig. 15: Variant Overview P-Switched and SPC-Conformity

4.5 Communication

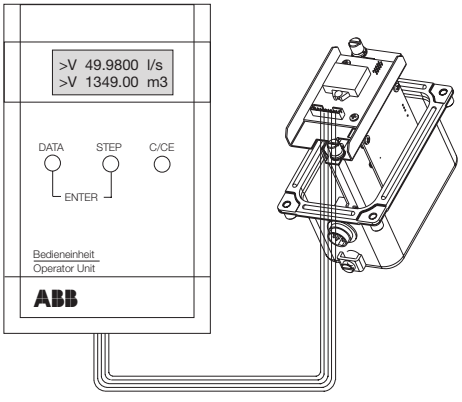
4.5.1 TTL-Service-Data Link for CommuniCation with Operator Unit 55BE1000 or the Configuration Software

The instrument parameters can be changed, viewed or compared during start-up or if service is required using the Operator Unit 55BE1000 or a configuration software over the TTL-Service data link. It is a pure Service-Data link, to which, during normal operation, no other peripheral instruments may be connected.

Ordering Information Operator Unit 55BE1000

Ordering Number	**55BE1**		
Design			
With 9 V Battery for illuminating the display		**10A**	
Type Plate			
German			**1**
English			**2**

Attention!
When the converter housing is open, the EMC protection is reduced.



Data Entry for the Converter

The data is entered using a separate Operator Unit 55BE1000. The front cover of the converter housing is removed, the cable from the Operator Unit is plugged into the front plate of the converter. A 9 V battery installed in the battery compartment provides power to illuminate the display on the Operator Unit. Follow the instructions in the Operation Manual for the Operator Unit to enter data into the converter. (See also Section 11).

Fig. 16: Operator Unit 55BE1000 for Data Entry

4.5.2 RS485 Data Link for Communication with the Handheld Terminal 55HT4000 or a Higher Level Communication Unit

A PCS, SPC, PC or a Handheld Terminal 55HT4000 can be connected to the RS485 user data link. The connection to the RS485 is made using the separate 4 pole communication plug. For communication between the FXF2000 (COPA-XF) and a peripheral instrument the ASCII 2w protocol should be selected in the submenu „Data Link“.

Ordering Information Handheld Terminal 55HT4000

Ordering Number	**55HT4**					
Keypad layout						
Standard		**1**				
Supply Power						
24 V AC/DC			**1**			
Connection Cable with Plug						
2.5 m with straight plug, Handheld Terminal				**1**		
10 m with angled plug, for panel mounting				**2**		
Design Level					**0**	
Type plate						
German						**1**
English						**2**

Fig. 17: Handheld Terminal 55HT4000 for Data Entry.
Prerequisite is a FXF2000 design which includes a Data link RS485 and the communication socket

5 Start-Up and Maintenance of the Flowmeter

Only after confirming that the previously described measures including

- Safety Information
- Assembly and Installation
- Grounding and Electrical Connections

have been completed in accordance with the instructions in this Operation Manual, can the EMF system be started-up. Before turning on the supply power check that the power supply values correspond to the values listed on the type plate. Also ascertain the following requirements have been satisfied:

- the specifications in Sections 6 and 7 have not been exceeded.
- the correct EEPROM is plugged into the converter.

Only then can the supply power be turned on.

After the supply power is turned on, the flowmeter primary data stored in the external EEPROM is compared to that stored internally in the converter. If the data are not identical, then an automatic upload is initiated. The desired parameters can now be set or selected.

- Select the desired mode of operation in the submenu „Operating Mode“.
- Enter your flow range in the submenu „Qmax“.
- Dependent on the selected Operating Mode:
  - configure the Pulse or Current Output.
  - configure the parameters such as Low Flow Cutoff, Damping, Unit, Display, In- and Outputs and the Data Link.
  - If the „Detector Empty Pipe“ is turned on, then the detector must be adjusted with the fluid to be metered at the operating conditions as described in this Operation Manual.

5.1 Sockets for the Memory Module (external EEPROM) and the Operator Unit

The sockets for the ext. EEPROM and the Operator Unit (55BE1000) are located on the front plate of the converter (Fig. 18).

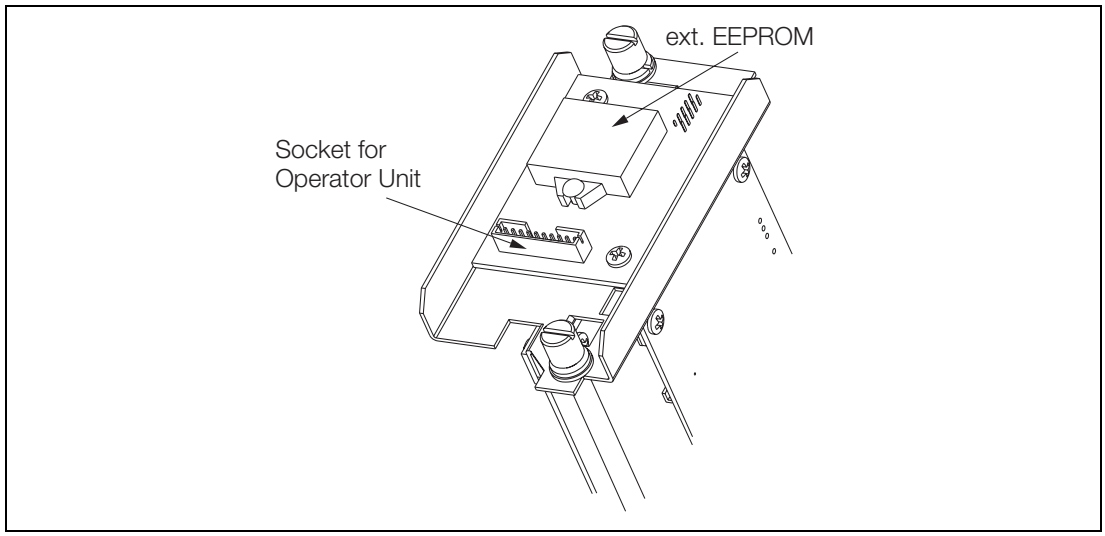


Fig. 18:

5.2 Exchanging Components

When exchanging instrument components note the following information:

Attention!
When the converter housing is opened the EMC-Protection and the personnel contact protection are no longer provided.

5.2.1 Exchanging a Flowmeter Primary

- Turn off the supply power.

When exchanging a flowmeter primary (including the converter housing) be sure to remove the external EEPROM from the associated converter and keep it with the flowmeter primary. The EEPROM for the new flowmeter primary will be plugged into the converter. After the supply power is turned on the data in the converter will be automatically updated.

5.2.2 Exchanging a Converter

- Turn off the supply power.

The parameter settings are stored in an EEPROM, which is plugged into the converter module. When the module is exchanged, the EEPROM associated with the flowmeter primary is to be removed from the old converter and plugged into the new replacement converter. In addition to the data for the flowmeter primary, the parameter settings are also stored in this EEPROM. After the converter module has been exchanged and the EEPROM plugged in, the flowmeter primary data and the converter specific data are automatically updated into the converter.

5.3 System Zero Check

The System Zero for the flowmeter is set in the converter. The fluid flow must be brought to an absolute standstill and the meter pipe in the flowmeter primary must be completely filled. Then the parameter „System Zero“ can be called to manually or automatically adjust the zero value: Select the parameter with ENTER and use the arrow keys to select manual or automatic and accept with ENTER. During an automatic adjustment the converter counts down from 255 to the actual zero value. The progress is displayed in the 2nd line. When the adjustment is completed, the zero adjustment procedure is terminated. The adjustment takes approx. 20 seconds.

A zero adjustment should be made after the instrument start-up has been completed or after an instrument component has been exchanged. (See also Section 11.2 Parameter Overview).

Note!

If the FXF2000 is used as a flowmeter in a batch or filler application in the Operating Mode „Filler 5 kHz“, an automatic system zero adjustment can be initiated using the contact input during between the stop interval between batches .

5.4 Detector Empty Pipe

If the converter function „Detector Empty Pipe“ is turned on, it must be adjusted for the operating conditions with the fluid to be metered before start-up. The procedure is described in Section 11.2.

5.5 Storing the Parameter Settings

After the configuration has been completed, all the parameter settings should be stored in the external EEPROM. Call the menu function „Store Data in external EEPROM“, to save the settings which were changed or set during start-up.

5.6 Data Storage

Utilizing a NV-RAM. All data is stored when the supply power is turned off or a power outage occurs. All the parameter settings, process information and flowmeter primary specific calibration data is stored in the serial EEPROM and also in the external EEPROM. This procedure allows all the data to be uploaded into a replacement converter after exchanging the external EEPROM.

5.7 Maintenance/Repair

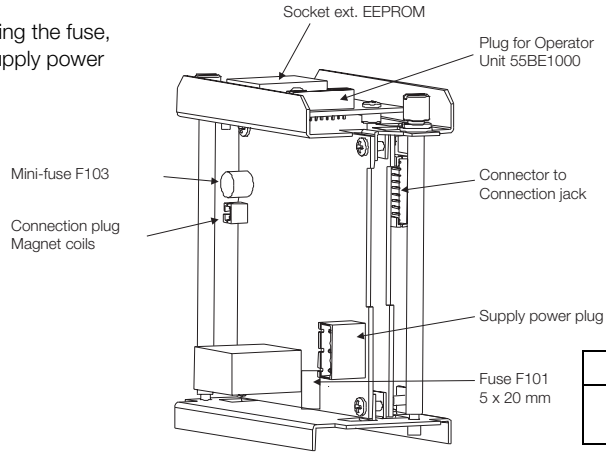
The flowmeter primary is essentially maintenance free. A yearly inspection should be conducted to check the ambient conditions (air flow, seal of the process connections, cable entries and cover screws, safety of the supply power, lightning protection and the ground connections. All repair and maintenance tasks should only be performed by qualified customer personnel. Observe the Note (Returns in the Section Hazardous Material Directives 1.1.14, Page 9), if the flowmeter primary is to be returned to the ABB Automation Products factory in Göttingen, Germany for repair.

Service Information!

When exchanging or repairing individual components only original replacement parts are to be used. Before beginning these tasks, make certain the supply power to the instrument has been turned off.

Connection Plugs and Fuses in the F4 Converter

Note
Before removing the fuse, turn off the supply power



Fuse	Amps	Part No.
F101	1	D151B025U07
F103	0.125	D151F003U14

Fig. 19: Converter Module F4 (MAG-XF)

6 Specifications Flowmeter Primary DF23

6.1 Min. Allowable Absolute Pressure as a Function of the Fluid Temperature

Liner	Meter Size	$P_{Operate}$ mbar abs	at	$T_{Operate}$ °C
PFA	DN3-100 1/10"-4"	0	≤	130

6.2 Maximum Allowable Fluid Temperature and Pressure

Process Connections Liner PFA	Meter Size DN	Meter Size Inch	$P_{Operate}$ bar	at	$T_{Operate}$ °C
Wafer Design Weld stubs DIN 11850 Weld stubs DIN 2463	3–100	1/10–4	10 – 40	≤	130
Weld stubs ISO 2037	25–100	1–4	10 – 40	≤	130
Weld stubs SMS	25–100	1–4	10 – 40	≤	130
Food Ind. fitting DN 11851	3 – 40 50 – 100	1/10–1½ 2–4	40 10 – 16	≤ ≤	130 130
Tri-Clamp DIN 32676	3–100	1/10–4	10 – 16	≤	130
Fixed-Clamp	10–40	3/8–1½	10	≤	130
Ext. threads ISO 228 / DIN 2999	3–25	1/10–1	10	≤	130

6.3 Maximum Allowable Cleaning Temperature PFA-Design

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

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

6.4 Maximum Allowable Shock Temperature

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

6.5 Ambient Conditions

Ambient temperature

$T_{Amb.}$ = -20 °C to +60 °C

Fluid temperature

T_{Fluid} = -25 °C to +130 °C, CIP-cleanable, see Temperature Diagram and max. allowable cleaning temperatures.
Maximum allowable ambient temperature as a function of the fluid temperature for stainless steel process connections and Wafer Designs. (Fig. 20).

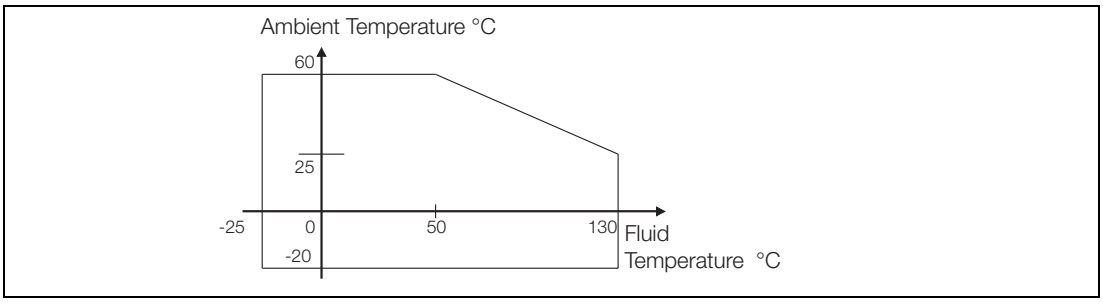


Fig. 20: Temperature Diagram

Storage temperature

$T_{Storage}$ = -25 °C to +70 °C

6.6 Classifications per Pressure Equipment Directive (PED/DGRL)

The conformity evaluation for the FXF2000 (COPA-XF) instrument line is made according to PED/DRGL as Category III, Module B1+D, Fluid Group 1 or as „SEP“ (Art. 3, Par. 3).

6.7 Variant Overview Series 2000 (Stainless Steel Design) Model DF23

Meter Size DN	Meter Size Inch	Process Connection E: Ext. threads	T: Tri-Clamp DIN 32676	R: Weld stubs DIN 11850	Q: Weld stubs DIN 2463	P: Weld stubs ISO 2037	X: Weld stubs SMS	S: Food Ind. fitting DIN 11851	F: Flanged	W: Wafer Design	PED/DGRL
3	1/10	x	x	x	x			x	x	x	SEP Art.3, Par. 3
4	5/32	x	x	x	x			x	x	x	
6	1/4	x	x	x	x			x	x	x	
8	5/16	x	x	x	x			x	x	x	
10	3/8	x	x	x	x			x	x	x	
15	1/2	x	x	x	x			x	x	x	
20	3/4	x	x	x	x			x	x	x	
25	1	x	x	x	x	x	x	x	x	x	
32	1¼		x	x	x	x		x	x	x	Conformity evaluation per Category III Module B1+D, Fluid Group 1
40	1½		x	x	x	x	x	x	x	x	
50	2		x	x	x	x	x	x	x	x	
65	2½		x	x	x	x	x	x	x	x	
80	3		x	x	x	x	x	x	x	x	
100	4		x	x	x	x	x	x	x	x	

6.8 Material Load Curve for Wafer Design Instruments Model DF23

Liner: PFA Wafer Design

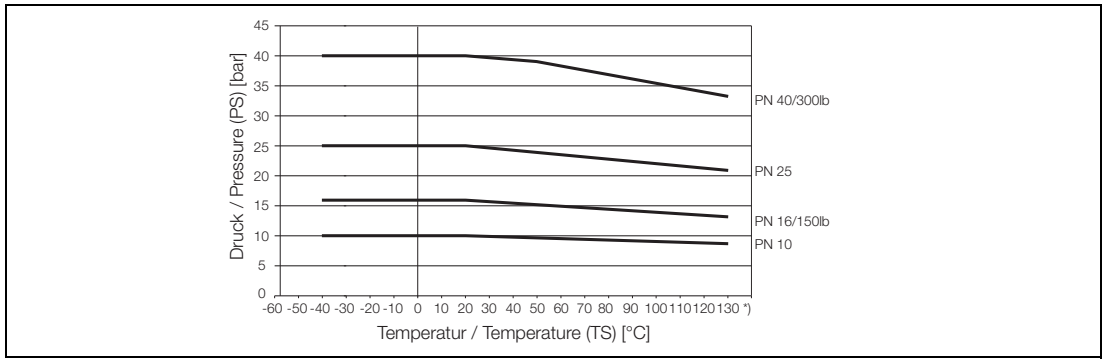


Fig. 21: Material Load Curve for Wafer Design Instruments Model DF23 – Pressure/Temperature Diagram

6.9 Materials Flowmeter Primary

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

6.10 Process Connection Material

	Standard	Option
Wafer Design	None	
Weld stubs	SS No. 1.4404[316L]	SS No. 1.4435
Food Ind. fitting DIN 11851	SS No. 1.4404[316L]	SS No. 1.4435
Tri-Clamp DIN 32676	SS No. 1.4404[316L]	SS No. 1.4435
Fixed-Clamp	SS No. 1.4404[316L]	SS No. 1.4435
Ext. threads	SS No. 1.4404[316L]	SS No. 1.4435

6.11 Gasket Material, Electrical Connections, Weight and Design

Process Connection Material	Gasket Material
Wafer Design	None
Weld stubs Food Ind. fitting Tri-Clamp Fixed-Clamp Ext. threads	EPDM (Ethylene-Propylene) Std. with FDA-Approval Silicone with FDA-Approval (Option)
Flat housing gasket	Silicone

Supply Power

From converter

Weight

See Dimension Drawings Section 6.13

Design

Flowmeter primary with integrated µP-converter
Flowmeter primary and converter housing made of SS No. 1.4301 [304]

Process Connections DN 3 – 100 [1/10" – 4"]

See Page 10 and Section 6.13

Protection Class

Standard IP67, Option „tropicalized"

Max. Pipeline Vibration

10-58 Hz at 0.15 mm amplitude
58-150 Hz at 1.5 g acceleration

Max. allow. Fluid Temperature and Pressure
Process Connections DF23

Process Connections Liner PFA	Meter Size DN	Inch	PS bar	at	TS °C
Wafer Design	3-50	1/10-2	40	≤	130*)
	65-100	2½-4	16	≤	130*)
Weld stubs	3-40	1/10-1½	40	≤	130*)
	50, 80	2, 3	16	≤	130*)
	65, 100	2½, 4	10	≤	130*)
Tri-Clamp	3-50	1/10-2	16	≤	121
	65-100	2½-4	10	≤	121
Food Ind. fitting	3-40	1/10-1½	40	≤	130*)
	50, 80	2, 3	16	≤	130*)
	65, 100	2½, 4	10	≤	130*)
External threads	3-25	1/10-1	10	≤	130*)
Fixed-Clamp	10-40	3/8-1½	10	≤	130*)

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

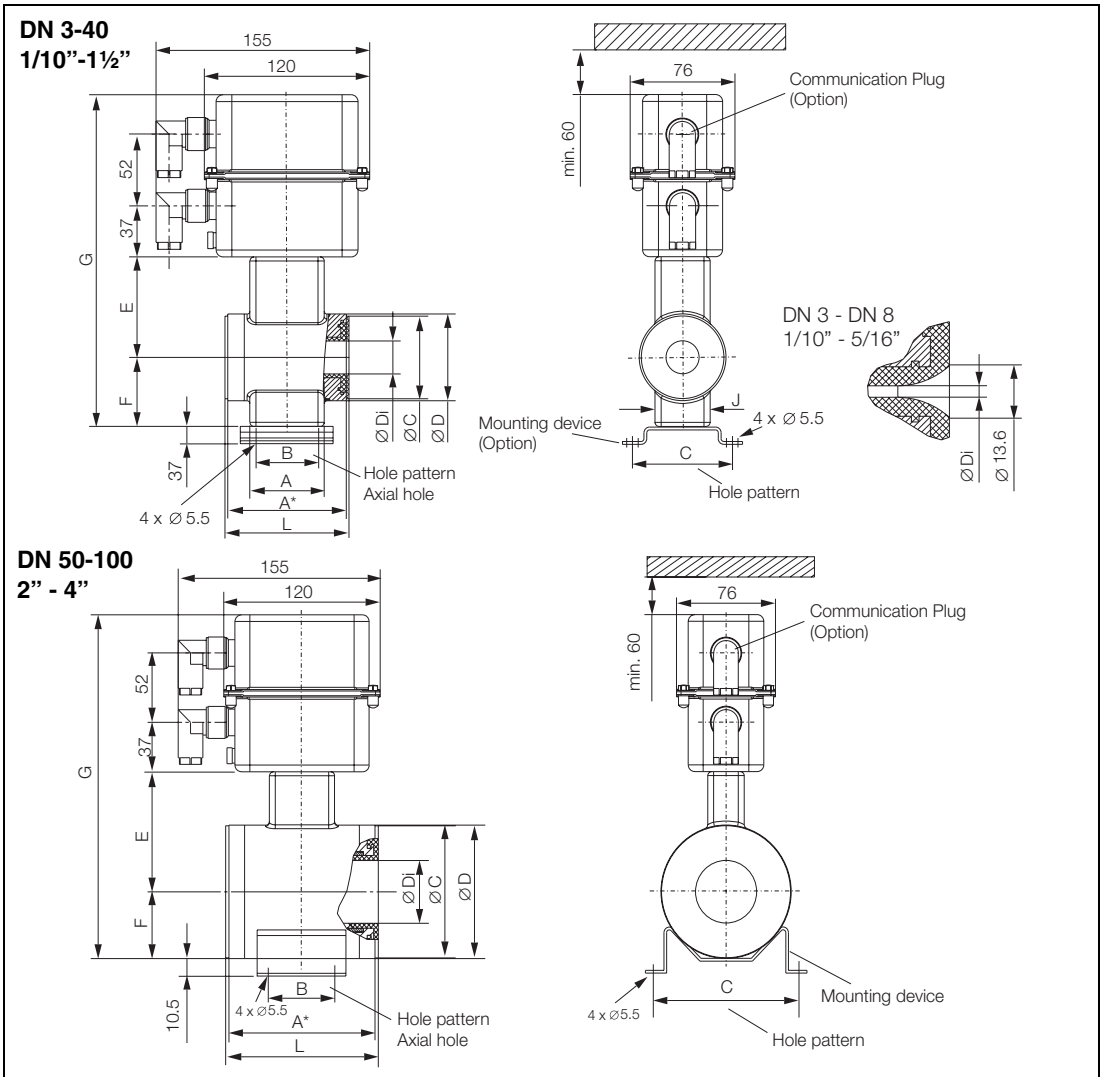
6.12 Certifications /Approvals

The following have been granted for the FXF2000 (COPA-XF):
EHEDG-Certificate and 3A-Approval.
In addition, all the fluid wetted parts, such as liner and gaskets have the appropriate FDA-Approvals.

For the Series 2000 the Canadian CRN-Registration has also been granted.

6.13 Dimension Drawings DF23

6.13.1 Dimension Drawings, Flowmeter Primary DN 3-100 [1/10”-4”], Wafer Design, PFA



DN	Inch	PN	L[1)]	A*	A	B	C	Ø C	Ø Di	Ø D	E	F	G	J	Weight ca. kg
3 4 6 8 10 15	1/10 5/32 1/4 5/16 3/8 1/2	10–40 CL150 CL300	68	64	37	28	50	42	3 4 6 8 10 13	45	62	39	219	28	2.0
20	3/4		78	74	42	28	50	50	18	54	66	43	227	32	2.0
25	1		90	86	42	46	70	59	24	63	73	48	239	32	2.5
32	1¼		98	94	42	46	70	69	30	73	78	53	249	32	2.5
40	1½		103	99	42	46	70	77	36	82	82	57	257	32	3.5
50	2		117	112	–	60	110	95	47	100	90	50	258	–	4.0
65	2½		103	99	–	60	110	111	62	116	105	58	281	–	5.0
80	3		103	99	–	60	110	128	74	133	114	67	299	–	6.5
100	4		133	129	–	60	110	155	96	160	128	80	326	–	9.0

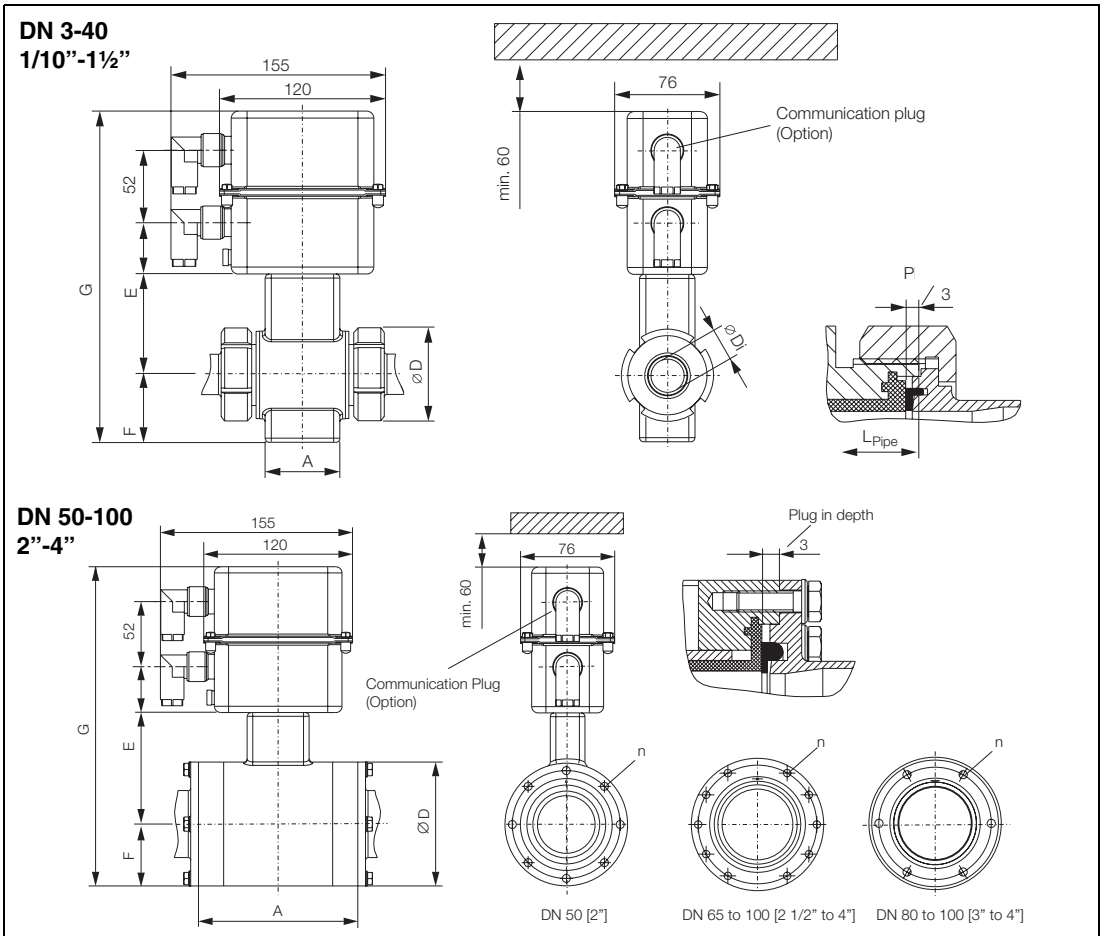
1) Installation lengths with 2 grounding plates L + 3 mm
Mounting device, option
With mounting device total height „G“ +37 mm DN 3 ... DN 40 [1/10”...1½”],
„G“ +10.5 mm DN 50 ... DN 100 [2”... 4”]

All dim´s in mm

ISO Projection Method E

Fig. 22: Dimension Drawing, Model DF23, DN 3-100 [1/10” - 4”], Wafer Design

6.13.2 Dimension Drawings, flowmeter primary DN 3-100, variable Process Connections, PFA, Series 2000



DN	Inch	PN	L_{Pipe}	A	B	C	Ø Di	Ø D	E	F	G	J	n	Weight ca. kg
3	1/10	10–40 CL150 CL300	85	37	28	50	3	44	62	39	219	28	–	2.0
4	5/32						4						–	
6	1/4						6						–	
8	5/16						8						–	
10	3/8						10						–	
15	1/2						13						–	
20	3/4		90	42	28	50	18	63	66	43	227	32	–	2.0
25	1		105	42	46	70	24	63	73	48	239	32	–	2.5
32	1¼		120	42	46	70	30	78	78	53	249	32	–	2.5
40	1½		125	42	46	70	36	78	82	57	257	32	–	3.5
50	2		128	–	60	110	47	100	90	50	258	–	8	4.0
65	2½		114	–	60	110	62	116	105	58	281	–	10	5.0
80	3		114	–	60	110	74	133	114	67	299	–	6	6.5
100	4		144	–	60	110	96	160	128	80	326	–	6	9.0

Installation lengths with process connection See Pages 34–35.
1) Plus process connection weight See Pages 34–35.
Mounting device option
With mounting device, total height „G" +37 mm DN 3 ... DN 40 [1/10"...1½"],
„G" +10.5 mm DN 50 ... DN 100 [2"... 4"]

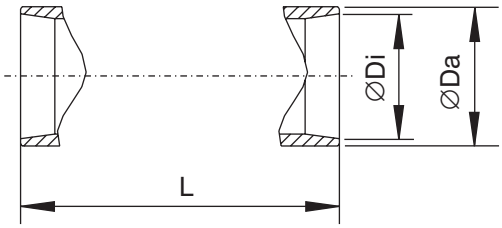
All dim´s in mm

ISO Projection Method E

Fig. 23: Dimension Drawing, Model DF23, DN 3-100, Variable Process Connections

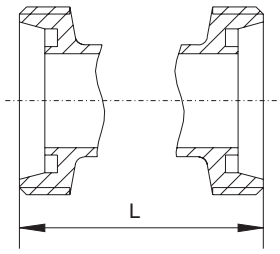
6.13.3 Dimension Drawings, Adapters for Variable Process Connections, Series 2000

		Weld stubs															
		ISO 2037				DIN 11850				DIN 2463				SMS			
DN	Inch	Ø Di	Ø Da	L	Wgt. kg[1)]	Ø Di	Ø Da	L	Wgt. kg[1)]	Ø Di	Ø Da	L	Wgt. kg[1)]	Ø Di	Ø Da	L	Wgt. kg[1)]
3-10	1/10-3/8	–	–	–	–	10.0	13.0	127	0.4	10.3	13.5	127	0.4	–	–	–	–
15	1/2	–	–	–	–	16.0	19.0	127	0.4	18.1	21.3	127	0.4	–	–	–	–
20	3/4	–	–	–	–	20.0	23.0	132	0.7	23.7	26.9	132	0.7	–	–	–	–
25	1	22.6	25.0	149	0.7	26.0	29.0	149	0.7	25	28	149	0.7	22.6	25.0	149	0.7
32	1¼	31.3	33.7	166	1.0	32.0	34.0	166	1.0	32	35	166	1.0	–	–	–	–
40	1½	35.6	38.0	171	1.0	38.0	41.0	171	1.0	36.8	40	171	1.0	35.6	38.0	171	1.0
50	2	48.6	51.0	173	1.0	50.0	54.0	173	1.0	49	52	173	1.0	48.6	51.0	173	1.0
65	2½	60.3	63.5	165	1.4	66.0	70.0	165	1.4	66	70	165	1.4	60.3	63.5	165	1.4
80	3	72.9	76.1	169	2.0	81.0	85.0	169	2.0	81	85	169	2.0	72.9	76.1	169	2.0
100	4	97.6	101.6	199	2.6	100.0	104.0	199	2.6	100	104	227	3.0	100	104	199	2.6



Weld stubs per
DIN 11850 or ISO 2037 or DIN 2463 or SMS

		Food Industry Fittings DIN 11851		
DN	Inch	Rd. Thds.	L	Wgt./kg[1)]
3-10	1/10-3/8	28 x 1/8”	169	0.5
15	1/2	34 x 1/8”	169	0.5
20	3/4	44 x 1/6”	180	0.9
25	1	52 x 1/6”	207	0.9
32	1¼	58 x 1/6”	230	1.4
40	1½	65 x 1/6”	237	1.4
50	2	78 x 1/6”	243	1.4
65	2½	95 x 1/6”	245	2.2
80	3	110 x 1/4”	259	3.2
100	4	130 x 1/4”	307	4.4



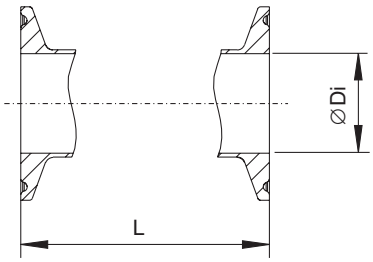
Food Ind. Fitting DIN 11851

All dim´s in mm

ISO Projection Method E

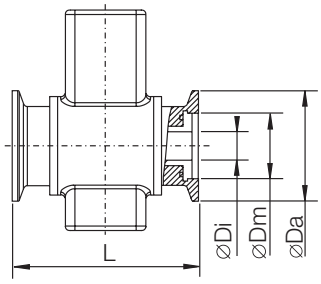
Fig. 24: Dimension Drawing, DN 3-100, Adapters for Variable Process Connections

Meter Size		Tri-Clamp DIN 32676		
DN	Inch	∅ Di	L	Wgt./kg[1)]
3-10	1/10-3/8	10.0	163	0.5
15	1/2	16.0	163	0.5
20	3/4	20.0	168	0.7
25	1	26.0	192	0.8
32	1¼	32.0	209	1.5
40	1½	38.0	214	1.4
50	2	50.0	216	1.2
65	2½	66.0	221	1.6
80	3	81.0	225	2.4
100	4	100.0	255	3.1



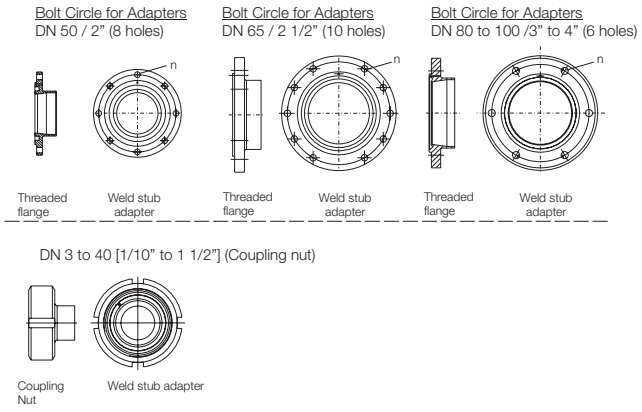
Tri-Clamp per DIN 32676

Meter Size		Fixed-Clamp				
DN	Inch	∅ Di	∅ Dm	∅ Da	L	Wgt./ kg[2)]
10	3/8	10	30	50.5	85	2.5
15	1/2	13	30	50.5	85	2.5
20	3/4	18	40	64	90	2.7
25	1	24	40	64	105	3.3
32	1¼	30	55	91	120	4.0
40	1½	36	55	91	125	4.9

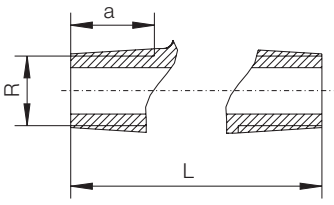


Fixed Clamp

Meter Size		Attaching the Adapter
DN	Inch	n
3-10	1/10-3/8	Coupling nut
15	1/2	Coupling nut
20	3/4	Coupling nut
25	1	Coupling nut
32	1¼	Coupling nut
40	1½	Coupling nut
50	2	8
65	2½	10
80	3	6
100	4	6



Ext. Threads ISO 228 / DIN 2999					
DN	Inch	R	a	L	Weight kg[1)]
3-10	1/10-3/8	3/8"	18	139	0.4
15	1/2	3/8"	18	139	0.4
20	3/4	3/4"	25	164	0.8
25	1	1"	25	179	0.8



External threads

All dim´s in mm

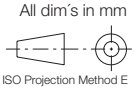

ISO Projection Method E

Fig. 25: Dimension Drawing, DN 3-100 [1/10"-4"], Adapters for Variable Process Connections

7 Specifications Converter F4

7.1 Specifications Converter FXF2000 (COPA-XF)

Flow Range

Selectable between 0.05 – 1* Cal-fac

Reproducibility

0.2 % at $T_{Batch} \geq 4$ s
0.4 % at 2 s ≤ $T_{Batch} \leq 4$ s

Flow Direction

Forward / reverse

Minimum Conductivity

≥ 5 µS/cm, ≥ 20 µS/cm DN 3-8 [1/10"-5/16"], ≥ 20 µS/cm deionized water

Electrical Connections

8 pole plug (supply power and signals)
4 pole plug (Data Link RS485 - option)

Supply Power

24 V DC , allowable voltage deviations +/-30 %
Ripple ≤ 5 %

Power

DN 3 to DN 100 [1/10" to 4"] ≤ 6 W (flowmeter primary incl. converter)

Magnetic Field Excitation

12.5 Hz / 25 Hz

Ambient Temperature

-20 °C to +60 °C (See also Temperature Diagram Fig. 20)

Max. Pipeline Vibration

See Section 6.11

Response Time for Pulse/Frequency Output

Min. response time $T_{0/99} = \frac{1}{Magneticfieldexcitation}$

Min. batch time $T_{Abfüll} = 2$ s

Zero Return

Set between 0 and 10 % of max.

Output Signals

– Scaled pulse output, passive, optocoupler
$0 \leq U_{CEL} \leq 2$ V; 16 V ≤ $U_{CEH} \leq 30$ V
2 mA ≤ $I_{CEL} \leq 220$ mA; 0.2 mA ≤ $I_{CEH} \leq 2$ mA
Setting range: 0.001 – 1000 pulses per selected unit
Pulse Width: 100 µ s – 2000 ms
fmax: 5 kHz
PIN 3 and 4

– Flowrate proportional frequency output
1.2 or 5 kHz at flowrate = 100 %
passive, optocoupler
$0 \leq U_{CEL} \leq 2$ V; 16 V ≤ $U_{CEH} \leq 30$ V
2 mA ≤ $I_{CEL} \leq 220$ mA; 0.2 mA ≤ $I_{CEH} \leq 2$ mA
PIN 3 and 4

– Current output (selectable)
Load ≤ 600 Ω at 0/4–20 mA, 0–10– 20 mA, 4–12–20 mA
Load ≤ 1200 Ω at 0/2–10 mA

Load ≤ 2400 Ω at 0–5 mA
PIN 5 and 8

– Data Link RS 485
max. cable length 1200 m
max. number of instruments: 32 Instruments in parallel
max. Baudrate: 9600 Baud
Communication Protocol: ASCII 2W
"Communication plug" PIN 3 and 4
Connection for Handheld Terminal or SPC, PCS, PC

– Handheld Terminal 55HT4000
Can be plugged into "Communication socket"
Supply Power 24 V DC on PIN 1 and 2

– Contact output (function depends on Operating Mode setting)
Alarm- forward/reverse-, synchronous- or end contact, passive, optocoupler
$0 \le U_{CEL} \le 2$ V; 16 V ≤ $U_{CEH} \le 30$ V
2 mA ≤ $I_{CEL} \le 220$ mA, 0 mA ≤ $I_{CEH} \le 0.2$ mA
PIN 1 and 3

– Contact input (function depends on Operating Mode setting) Ext. zero return, system zero, synchronous input, Start/Stop input, optocoupler
16 V ≤ U ≤ 30 V, Ri = 2 kOhm
PIN 5 and 2

7.2 Overview, Possible Converter Variants with Their Hardware Options and Operating Modes

Design Level B	Variant	
	02	07
Hardware		
Contact output	x	x
Contact input	x	x
Pulse passive	x	x
Current output		x
RS 485	x	
Menus		
Operating Mode		
Standard conti. K	x	x
Standard Batch B	o	o
Batch 1 kHz B1	o	o
Batch 2 kHz B2	o	o
Batch 5 kHz B5	o	o
Filler 5 kHz A	o	o
Conti 1 kHz K1	o	o
Conti 2 kHz K2	o	o
Conti 5 kHz K5	o	o
Contact output		
Alarm	x	x
Forward/Reverse	o	o
Synchronous	o	o
End contact	A	A
Contact input		
Ext. Zero Return	x	x
System zero	o	o
Start	A	A
Current output		K K1 K2 K5
Data Link		
ASCII	x	
ASCII2w	o	
DEP	K	K

Explanation:
x Default setting
o Selectable
A, B, K etc.: Selectable only with corresponding Operating Mode selections.

7.3 Functional Schematic of the FXF2000 (COPA-XF) as „Flow Sensor“ or „Stand-Alone Filler“

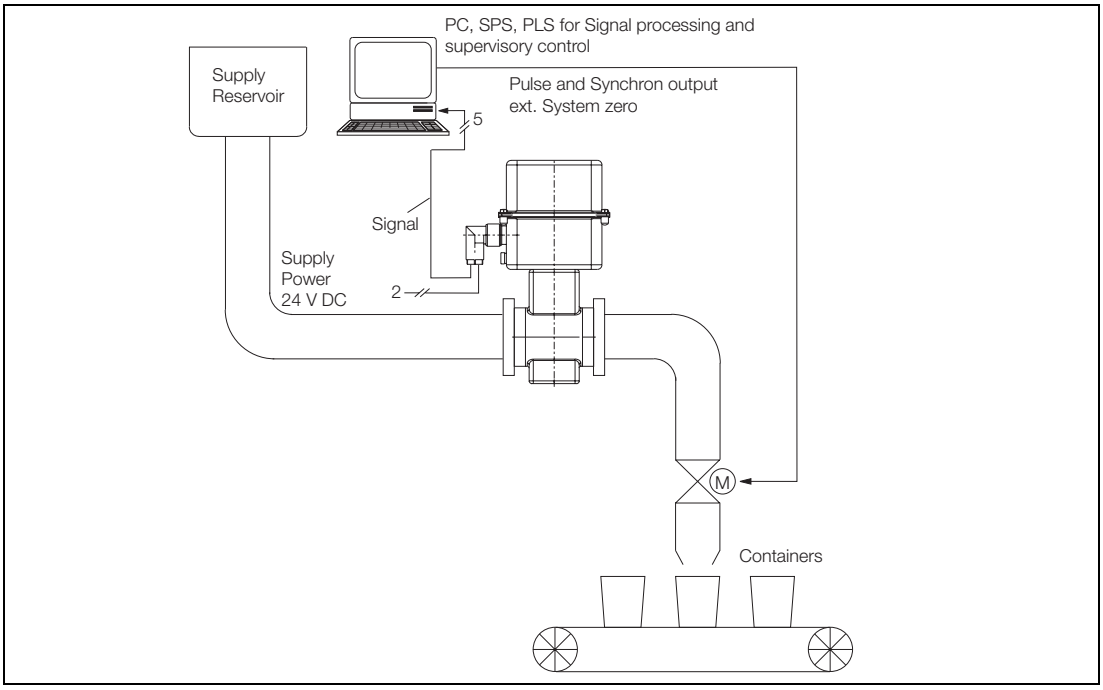


Fig. 26: Schematic of a Filler System with FXF2000 as Flow Sensor with Higher Level Filler Control

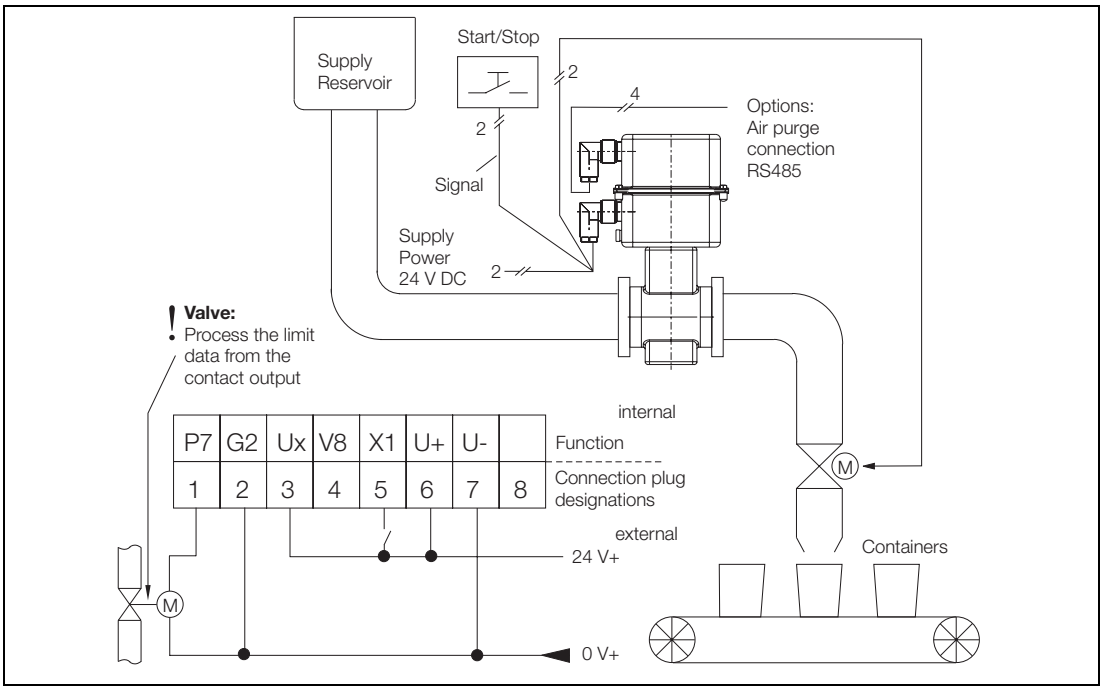


Fig. 27: Schematic and Electrical Connections for FXF2000 as Stand-Alone „Filler“ with Integrated Batch Software

8 Ordering Numbers, Electromagnetic Flowmeter Model DF23

In addition to the Ordering Number, please include the following information:
Fluid, fluid temperature, operating pressure, pipeline design (grounding plates)

Compact Design FXF2000 (COPA-XF)	DF23																					
Process Connection																						
Wafer Design[1]			W																			
Weld stubs DIN 11850	(Standard)		R																			
Weld stubs DIN 2463			Q																			
Weld stubs ISO 2037	(DN 25-100 [1"-4"])		P																			
Weld stubs SMS	(DN 25-100 [1"-4"])		X																			
Food Ind. fitting DIN 11851			S																			
Tri-Clamp DIN 32676			T																			
Fixed-Clamp	(DN 10-40 [3/8"-1½"])		C																			
Ext. threads ISO 228/DIN 2999	(DN 3-25 [1/10"-1"])		E																			
Without adapter (without coupling nuts or bolts)			V																			
Liner Material																						
PFA				P																		
Meter Size																						
DN 3	1/10"				03																	
DN 4	3/32"				04																	
DN 6	1/4"				06																	
DN 8	5/16"				08																	
DN 10	3/8"				10																	
DN 15	1/2"				15																	
DN 20	3/4"				20																	
DN 25	1"				25																	
DN 32	1¼"				32																	
DN 40	1½"				40																	
DN 50	2"				50																	
DN 65	2½"				65																	
DN 80	3"				80																	
DN 100	4"				1H																	
Signal Electrode Material/ Ground Electrode Material [2]																						
SS (1.4539)	/ none (Standard)					F																
SS (1.4571[316Ti])	/ none					S																
Hastelloy C-4 (2.4610)	/ none					H																
Titanium	/ none					M																
Tantalum	/ none					T																
Stn. stl. (1.4539)	/ with (Standard)					R																
Stn. stl. (1.4571[316Ti])	/ with					E																
Hastelloy C-4 (2.4610)	/ with					O																
Titanium	/ with					I																
Tantalum	/ with					Q																
Pressure Rating																						
PN 10	Tri-Clamp (DN 65-100 [2½"-4"], Ext. threads/Food Ind. fitting/ Weld stubs (DN 65, 100 [2½", 4"])						C															
PN 16	Wafer Design/Tri-Clamp (DN 3-50 [1/10"-2"]), Food Ind. fitting/ Weld stubs (DN 50, 80 [2",3"])						D															
PN 40	Wafer Design (DN 3-50 [1/10"-2"]), Food Ind. fitting/ Weld stubs (DN 3-40 [1/10"-1½")						F															
JIS K10	Wafer Design DN 3-100 [1/10"-4"]						K															
ASME CL 150	Wafer Design DN 3-100 [1/10"-4"]						P															
ASME CL 300	Wafer Design DN 3-50 [1/10"-2"]						Q															
Process Connection Material																						
None	(only Wafer Design)							0														
Stn. stl. 1.4404[316L]	(Standard)							4														
Accessories																						
None	(Standard)								A													
With instrument mounting device (not 3A conform)									C													
Temperature Range																						
Standard design <130 °C fluid temperature										S												
Certifications																						
None (standard)											A											
Material traceability 3.1B per EN 10204 and pressure test per AD-2000											D											
Inspection test certificate per EN 10204 3.1B											F											
Pressure test per AD-2000											G											

1) Mounting accessories See Table H in the Price List
2) Ground electrodes starting at DN 3 [1/10"]

Compact Design FXF2000 (COPA-XF)	**DF23**																		
Protection Class																			
IP 67 Standard)											**2**								
Tropicalized											**4**								
Supply Power																			
24 V DC												**H**							
External Connections																			
Connection plug (angled), (Standard),(for Variant selection 07)													**1**						
Connection plug (angled), plus communication connector and plug (for Variant selection 02)													**6**						
In-/Output (Variants) [3] **(See External Connections)**																			
Contact output /pulse passive, opto /contact input/RS 485 (2nd plug) (6)														**02**					
Contact output /pulse passive, opto /contact input/current output (standard) (1)														**07**					
Application																			
Standard															**0**				
Type Plate																			
German																**G**			
English																**E**			
Design Level																	**B**		
Gasket Material																			
EPDM with FDA-Approval (Standard)																		**E**	
Silicone with FDA-Approval (Option)																		**S**	
None (only Wafer Design)																		**O**	
Electrode Design																			
Standard																			**1**
Pointed head [4] (from DN 10 [3/8"])																			**2**

3) Variant Nos. ≥ 20: customer specific Variants

4) Use for high grease content fluids

Attention!

The Operator Unit 55BE1000 is required to configure the converters, whereby the housing cover must be removed.

Attention! When the housing cover is open, the EMC-Protection is restricted.

If a data link is installed in the converter, it can be configured without opening the housing cover by using the Handheld Terminal 55HT4000 or PCS-System or PC using the ASCII-Protocol.

9 Error Messages and Testing

9.1 Error Messages During Operation

.1.	A/D saturated
.2.	Uref too small
.3.	(set) Flowrate >130 %
.5.	RAM defect
.6.	Totalizer
.7.	Urefp too large
.8.	Urefn too large
.9.	Excitation
.B.	(set) Pulse calculation
.C.	

Error Register
3B

In the example the errors identified above (set) Error 3 (Flowrate >130 %) and Error B (Pulse calculation) have been detected. The display, after calling the parameter „Error Register“, appears as shown to the left in the Operator Unit.

The following list contains explanations for the error codes outputted by the converter.

Error Code	Detected System Error	Corrective Measures
1	A/D-Converter	Reduce flowrate, throttle valve.
2	Positive or negative reference too small	Check min-fuse F103, See Page 27.
3	Flowrate greater than 130 %	Reduce flowrate, increase flow range.
5	RAM defect Function 1: Data in EEPROM corrupted Function 2: Stored data in NVRAM	Start test program, possibly reinitialize. Request customer number from ABB Service Dept.; No corrective measures. Information: Corrupted data in RAM, the converter initiates an automatic reset and uploads the data from the EEPROM.
7	Positive reference too large	Magnetic field excitation incorrect.
8	Negative reference too large	Contact ABB-Service.
6	Totalizer error	Difference totalizer incorrect.
9	Excitation frequency in correct	Reset difference totalizer forward/reverse, See Section 11.2 „Parameter Overview“
C	Flowmeter primary data invalid	Supply power error on the digital signal board. The flowmeter primary data in the external EEPROM are invalid. In submenu „Flowmeter Primary“ compare values with those on the type plate. If the values agree, the error message can be reset using „Store Primary“. If the values are not identical, the flowmeter primary data must first be reentered and when finished, call „Store Primary“. Contact ABB-Service.
B	Incorrect calculation or pulse factor	Contact ABB-Service.

9.2 Error Messages During Data Entry

The following list contains explanations for the error codes outputted by the converter.

Error Code	Detected System Error	Corrective Measures
10	Entry >1.00 Cal-fac >10 m/s	Reduce flow range Qmax
11	Entry < 0.005 Cal-fac < 0.5 m/s	Increase flow range Qmax
16	Entry >10 % Low Flow Cutoff	Reduce entry value
17	Entry < 0 % Low Flow Cutoff	Increase entry value
38	Entry >1000 pulses/unit	Reduce entry value
39	Entry < 0/.001 pulses/unit	Increase entry value
40	Max. totalizer frequency exceeded, scaled pulse output, pulse factor (5 kHz)	Reduce pulse factor
41	Value below min. totalizer frequency < 0.00016 Hz	Increase pulse factor
42	Entry >2000 ms pulse width	Reduce entry value
43	Entry < 0.1 ms pulse width	Increase entry value
46	Entry too large	Reduce pulse width entry value
54	Flowmeter primary zero >50 Hz	Check ground and ground signals. A zero adjustment can be made if the flowmeter primary is filled with fluid and the flowrate is at absolute zero.
91	Data in EEPROM corrupted	Data in internal EEPROM invalid, See Error Code 5 for corrective measures.
92	Data in ext. EEPROM corrupted	Data (e.g. Qmax, Damping) in external EEPROM invalid, access possible. The error message can be cleared by calling the function „Store data in ext. EEPROM“.
93	Ext. EEPROM corrupted or not installed	No access possible, component defective. If the component in not installed, then install the actual ext. EEPROM associated with the flowmeter primary
94	Incorrect version ext. EEPROM	The database has not been updated to the present software version. Use the function „Load Data from ext. EEPROM“ to automatically upload the external data. The function „Store Data in ext. EEPROM“ clears the error message.
95	External flowmeter primary data corrupted	See Error Code C.
96	Incorrect version EEPROM	Database in EEPROM has a different version than the installed software. Use the function „Update“ to reset the error.
97	Flowmeter primary incorrect	The flowmeter primary data in the internal EEPROM are invalid. Use the function „Load Primary“ to clear the error. (See Error Code C).
98	EEPROM corrupted or not installed	No access possible, component defective. If the component in not installed, then plug in the actual ext. EEPROM associated with the flowmeter primary.
99	Entry too large	Reduce entry
99	Entry too small	Increase entry

10 Parameter Setting Overview with Default Values

10.1 Specification Help: FXF2000, 50XF4000, Design-Level B, Variant 02

Order Number:		Name:		
Customer:		Date:		
Parameter	**Selection/Entry**	**Default**	**Range**	**Comments**
Variant	❑ 02			
Meter Size	❑ DN 3 ❑ 1/10" ❑ DN 4 ❑ 5/32" ❑ DN 6 ❑ 1/4" ❑ DN 8 ❑ 5/16" ❑ DN 10 ❑ 3/8" ❑ DN 15 ❑ 1/2" ❑ DN 20 ❑ 3/4" ❑ DN 25 ❑ 1" ❑ DN 32 ❑ 1¼" ❑ DN 40 ❑ 1½" ❑ DN 50 ❑ 2" ❑ DN 65 ❑ 2½" ❑ DN 80 ❑ 3" ❑ DN 100 ❑ 4"			Excitation freq. for DN 3- 40[1/10"-1½"]: 25 Hz Excitation freq. for DN 50-100[2"-4"]: 12 1/2 Hz
Flow Range Qmax		1*Cal-fact	0.05 to 1*Cal-fact	
Unit Qmax	❑ ml/s ❑ l/s ❑ ml/min ❑ l/min ❑ Others:	l/min From DN 50[2"}: m3/h		
Unit Totalizer	❑ ml ❑ l ❑ Others:	l From DN 50[2"}: m3		
Density		1 g/cm3	0.1 to 5 g/cm3	Only for mass units
Operating Mode	❑ Standard conti. ❑ Conti. 1 kHz ❑ Conti. 2 kHz ❑ Conti. 5 kHz ❑ Standard Batch ❑ Batch 1 kHz ❑ Batch 2 kHz ❑ Batch 5 kHz ❑ Filler 5 kHz	Standard conti.		
Pulse Factor		1/Unit	0.001 to 1000	Only for OM „Standard..."
Pulse Width		30 ms	0.1 to 1000 ms	Only for OM „Standard..."
Damping		5 s	0.125 to 20 s	Only for „conti." OM
Low Flow Cutoff		1 %	0 to 10 %	
Flow indication	❑ normal ❑ inverse	normal		
Flow Direction	❑ F/R ❑ forward	Forward/reverse		
Prog. Output P7	❑ No function ❑ General Alarm norm. closed ❑ General Alarm norm. open ❑ F/R-Signal ❑ Synchronous Signal	General Alarm norm. closed		For OM „Filler" always „End Contact"
Protocol	❑ ASCII ❑ ASCII2w	ASCII		If more than one instrument, ASCII2w must be selected
Baudrate	❑ 1200 Bd ❑ 2400 Bd ❑ 4800 Bd ❑ 9600 Bd	1200 Bd		
Address		0	0 to 99	
Language	❑ German ❑ English	German		

10.2 Specification Help: FXF2000, 50XF4000, Design-Level B, Variant 07

Order Number:			Name:		
Customer:			Date:		
Parameter	**Selection/Entry**		**Default**	**Range**	**Comments**
Variant	❑ 07				
Meter Size	❑ DN 3 ❑ DN 4 ❑ DN 6 ❑ DN 8 ❑ DN 10 ❑ DN 15 ❑ DN 20 ❑ DN 25 ❑ DN 32 ❑ DN 40 ❑ DN 50 ❑ DN 65 ❑ DN 80 ❑ DN 100	❑ 1/10” ❑ 5/32” ❑ 1/4” ❑ 5/16” ❑ 3/8” ❑ 1/2” ❑ 3/4” ❑ 1” ❑ 1¼” ❑ 1½” ❑ 2” ❑ 2½” ❑ 3” ❑ 4”			Excitation freq. for DN 3- 40[1/10”-1½”]: 25 Hz Excitation freq. for DN 50-100[2”-4”]: 12 1/2 Hz
Flow Range Qmax			1*Cal-fact	0.05 to 1*Cal-fact	
Unit Qmax	❑ ml/s ❑ ml/min ❑ Others:	❑ l/s ❑ l/min	l/min From DN 50[2”]: m3/h		
Unit Totalizer	❑ ml ❑ Others:	❑ l	l From DN 50[2”]: m3		
Density			1 g/cm3	0.1 to 5 g/cm3	Only for mass units
Operating Mode	❑ Standard conti. ❑ Conti. 1 kHz ❑ Conti. 2 kHz ❑ Conti. 5 kHz ❑ Standard Batch ❑ Batch 1 kHz ❑ Batch 2 kHz ❑ Batch 5 kHz ❑ Filler 5 kHz		Standard conti.		
Pulse Factor			1/Unit	0.001 to 1000	Only for OM „Standard...“
Pulse Width			30 ms	0.1 to 1000 ms	Only for OM „Standard...“
Damping			5 s	0.125 to 20 s	Only for „conti.“ OM
Low Flow Cutoff			1 %	0 to 10 %	
Flow indication	❑ normal	❑ inverse	Normal		
Flow Direction	❑ F/R	❑ forward	Forward/reverse		
Prog. Input X1	❑ No function ❑ Ext. Zero Return		Ext. Zero Return		For OM „Filler“ always „Start-Input“
Prog. Output P7	❑ No function ❑ General Alarm norm. closed ❑ General Alarm norm. open ❑ F/R-Signal ❑ Synchronous Signal		General Alarm norm. closed		For OM „Filler“ always „End Contact“
Current Output	❑ 0-20 mA ❑ Others:	❑ 4-20 mA	0-20 mA		Only for „conti.“ Operating Mode
Iout at Alarm	❑ 0 % ❑ 3.6 mA	❑ 130 %	0 %		Only for „conti.“ Operating Mode
Language	❑ German	❑ English	German		

11 Data Entry and Programming Using Operator Unit 55BE1000

11.1 Data Entry and Programming Using Operator Unit 55BE1000

Data is entered using 3 keys. After the Program Protection has been turned off the parameters can be selected using the ENTER-Function, the STEP-/or DATA key can be used to either select the setting for the parameter from the list in the table, or to enter a numerical value. During data entry the converter remains online, i.e. the instrument continues to operate normally. The functions of the keys are described below.

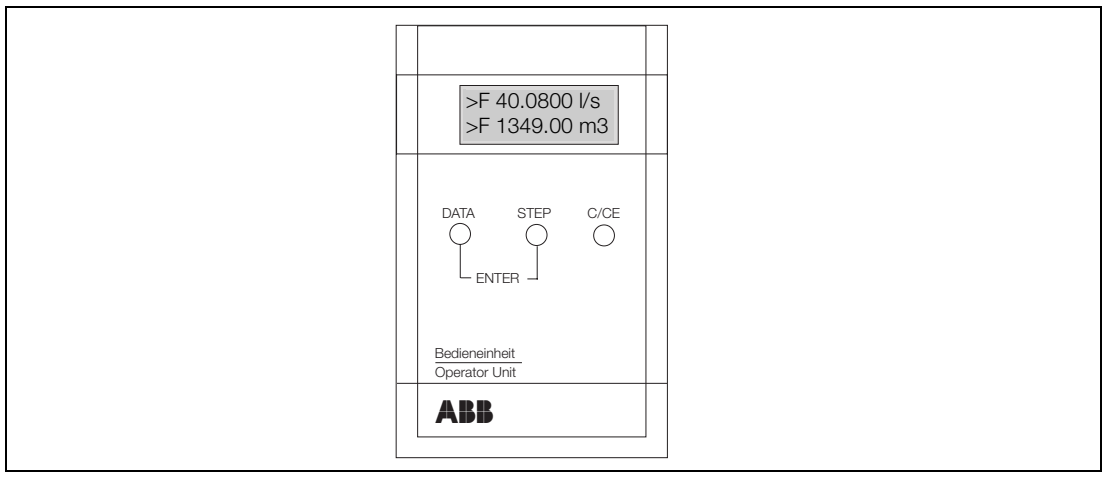


Fig. 28: Operator Unit 55BE1000

C/CE Use the C/CE-Key to toggle between normal operation and the menus.

STEP ↓ The STEP-Key is one of two arrow keys. Use STEP to scroll forward through the menu. All desired parameters can be accessed.

DATA ↑ The DATA-Key is one of two arrow keys. Use DATA to scroll backward through the menu. All desired parameters can be accessed.

ENTER The ENTER-Function is activated by pressing both arrow keys, STEP and DATA, simultaneously.

First use ENTER to turn the program protection off. Then use ENTER to access the parameter to be changed and then to confirm the new entries or selections. Finally use ENTER to turn the program protection on again.

The ENTER-Function is active for approx. 10 seconds. If no action occurs within this 10 second interval, the converter the old value is displayed again.

There are two types of entry modes:

- Numeric entry
- Selection from a list in a table.

Information!

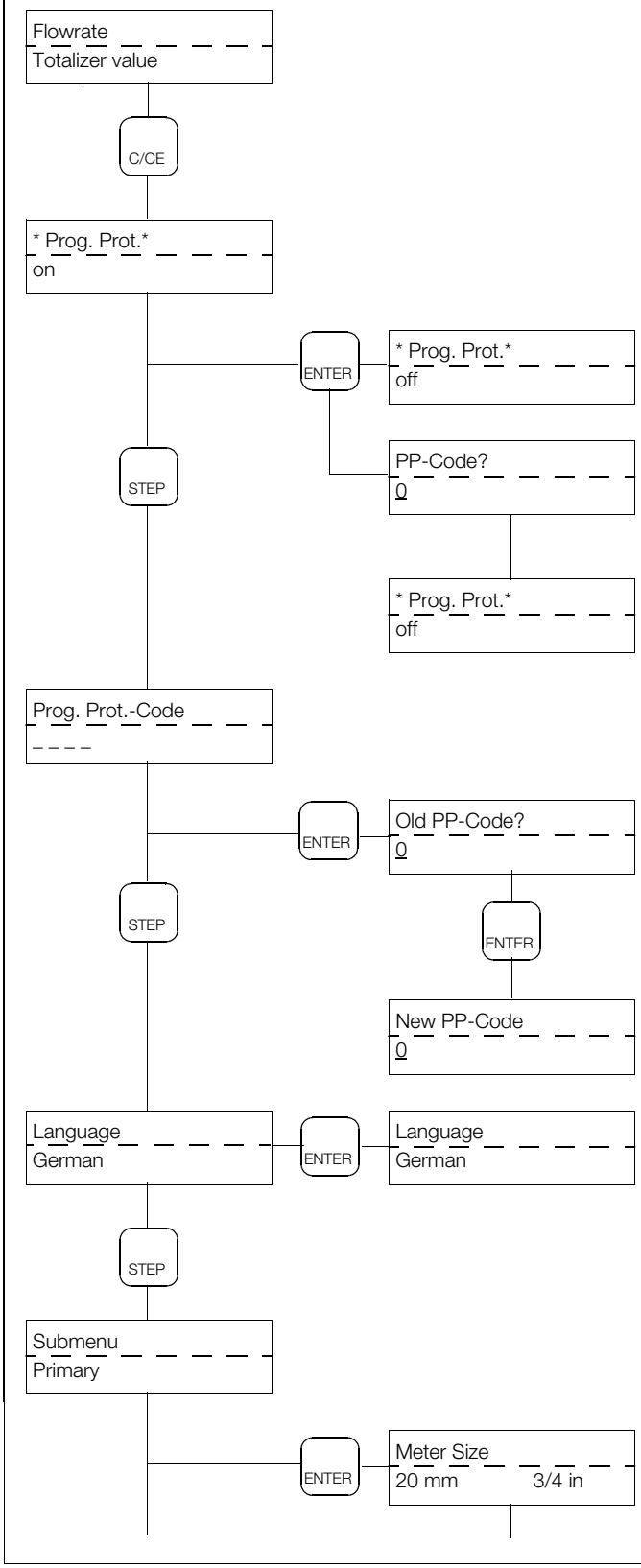
During data entry the values entered are checked for plausibility and if invalid they are rejected and an appropriate message is displayed.

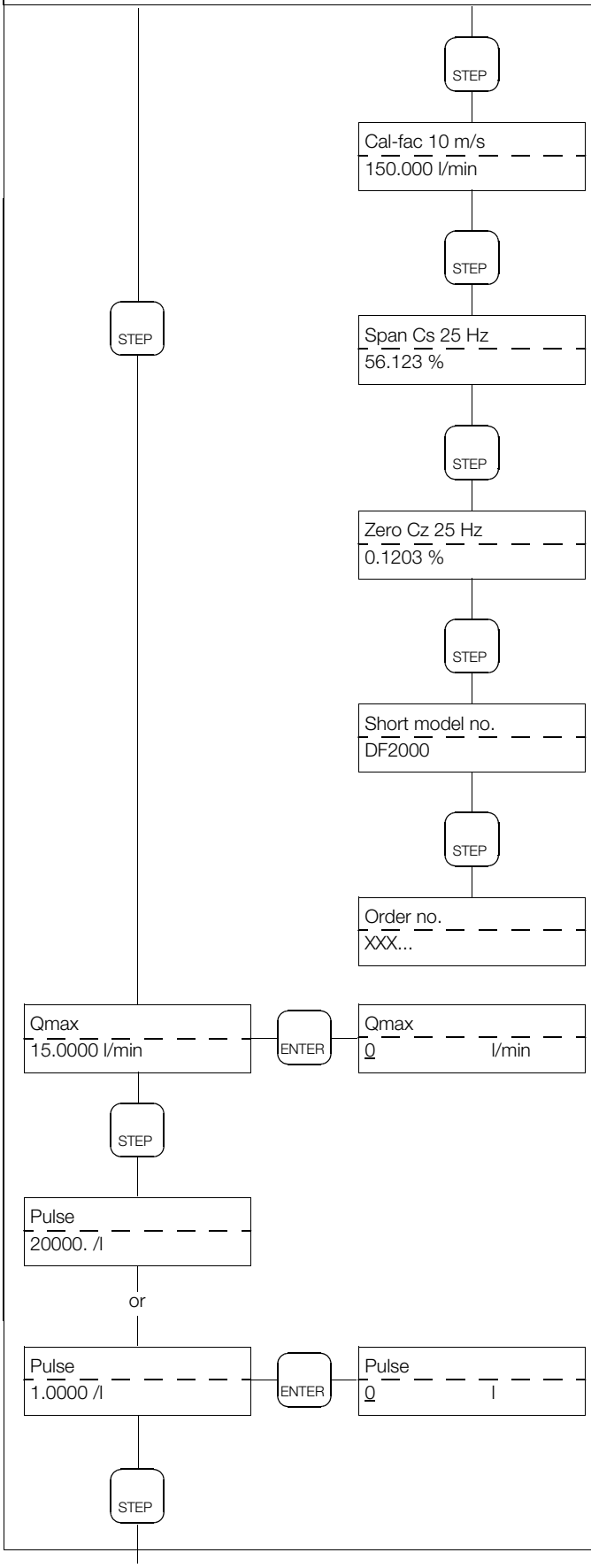
Caution!

When the converter housing is open the EMC-Protection and the personnel contact protection are voided.

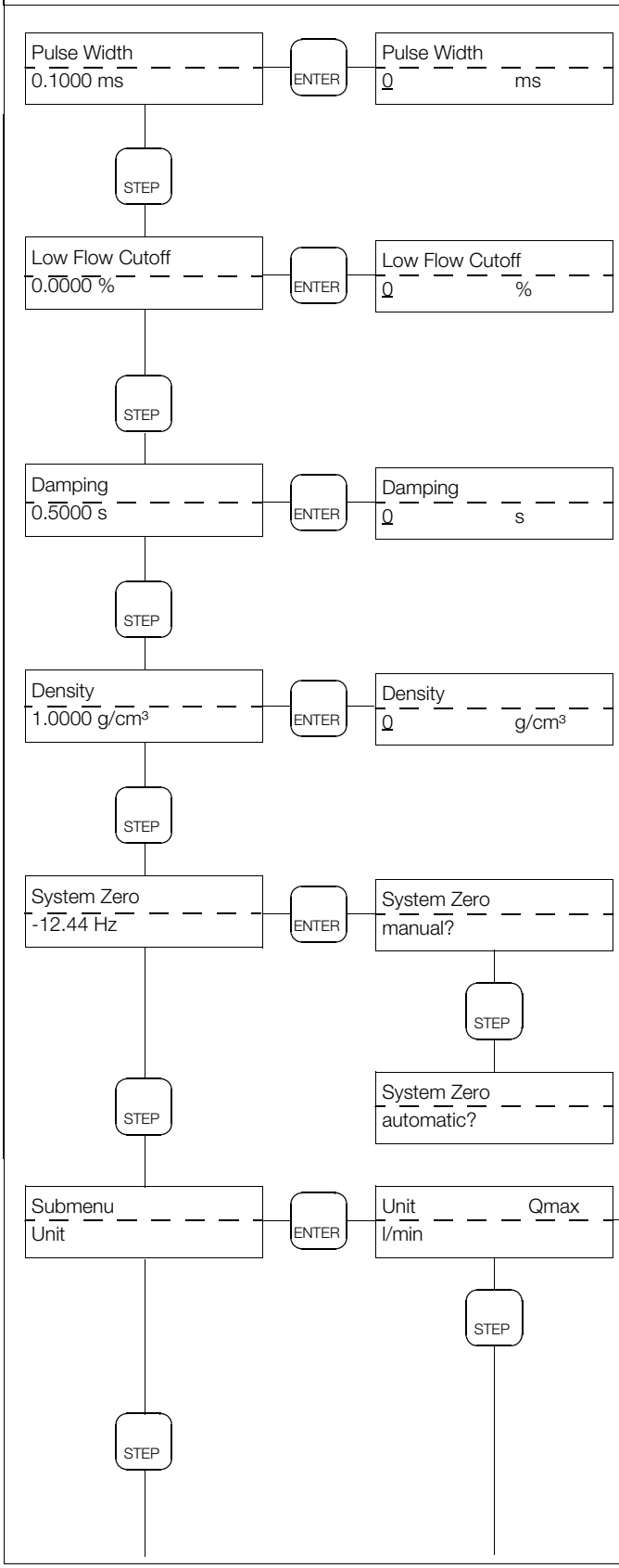
11.2 Parameter Overview

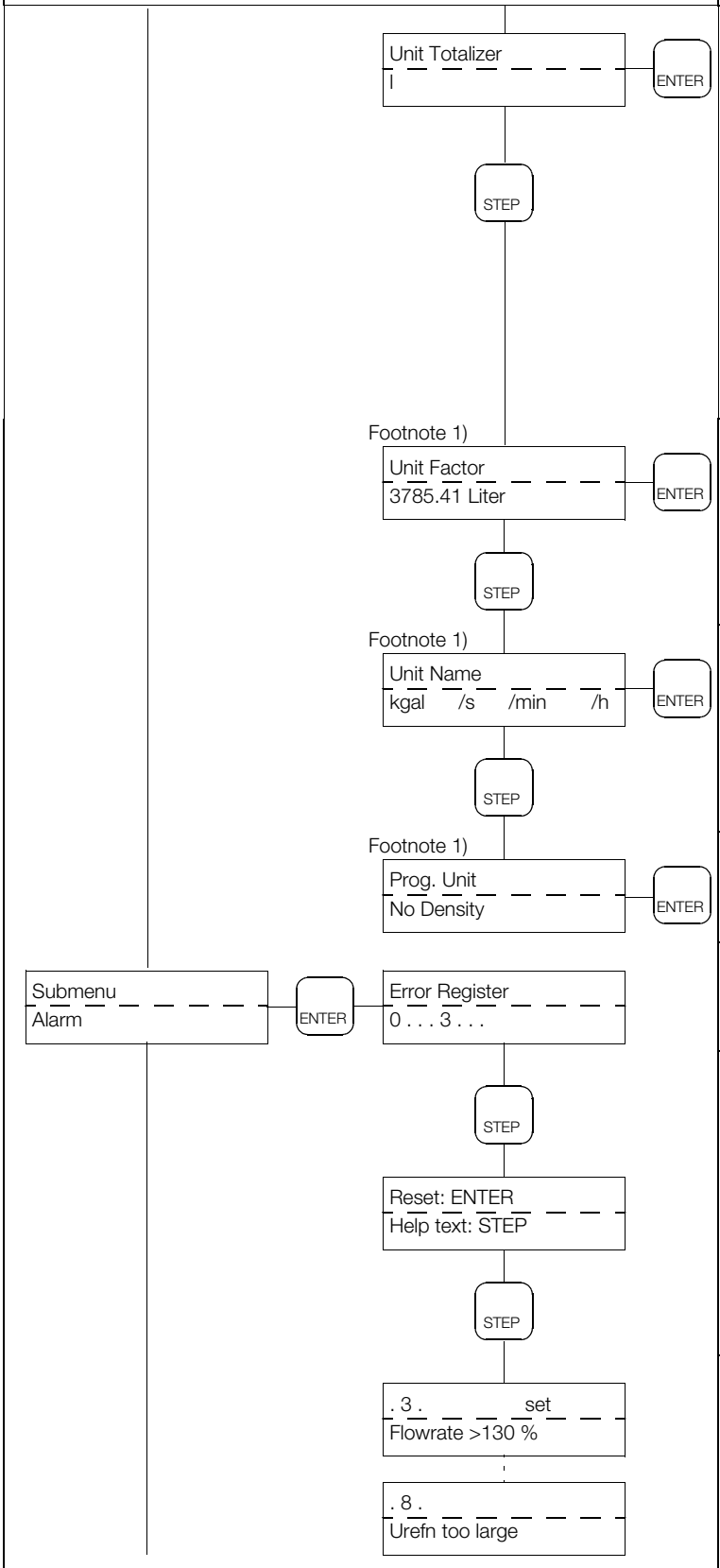
Legend: ENTER = DATA + STEP

Submenu/Parameters	Comments
	Process display Data can only be entered when the Program Protection is turned off. Tabular Selection on/off Numeric Entry If a number other than „0“ (factory default setting) has been entered for the Prog. Prot.-Code, then the Prog. Prot. can only be turned off after this number has been entered as the PP-Code (1-255) . Display When the Prog. Prot. is turned off, parameters cannot be changed. When the Program Protection is turned off, the PP-Code can be changed. Numeric Entry Enter old PP-Code 0 = Factory default setting Numeric Entry Enter new PP-Code (0-255). Tabular Selection German or English can be selected as the language for the display Display Flowmeter primary specific data Display Present meter size See type plate on flowmeter primary.

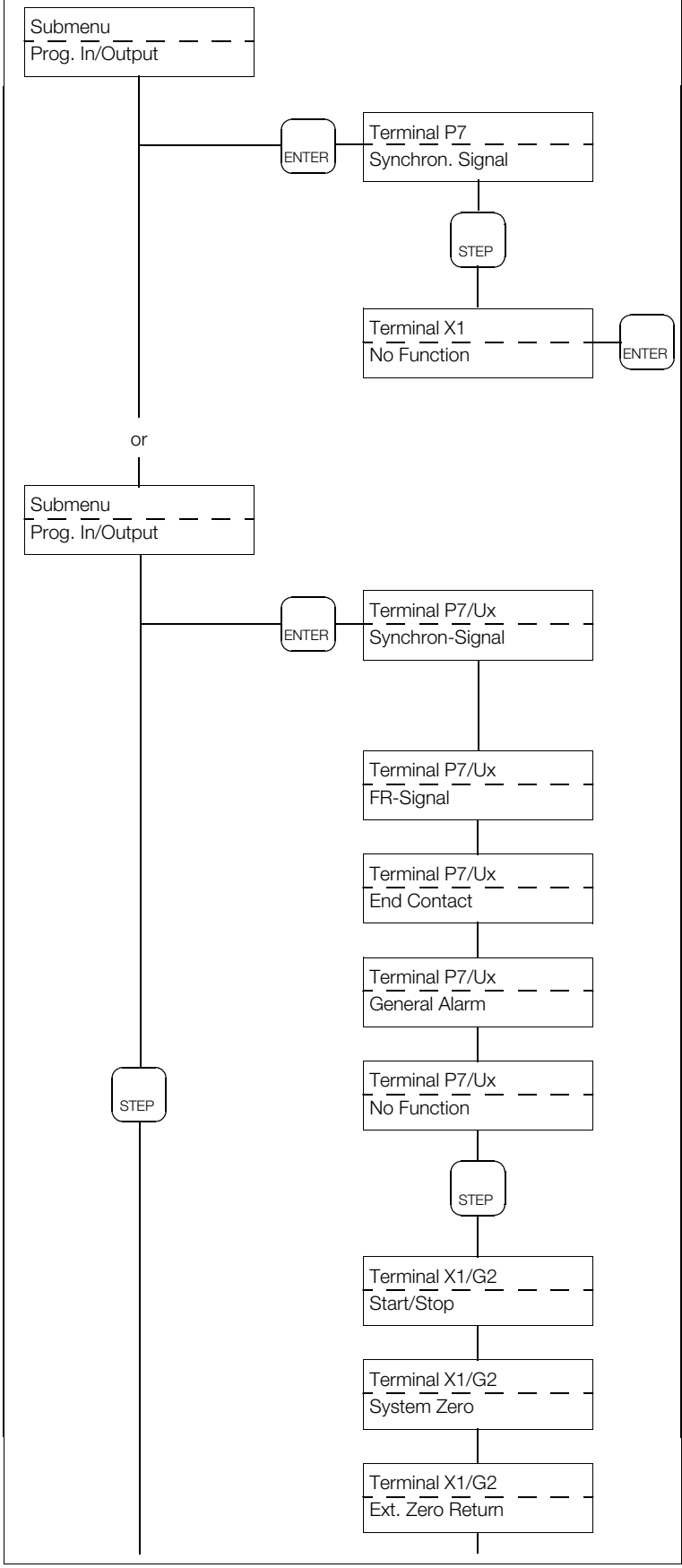


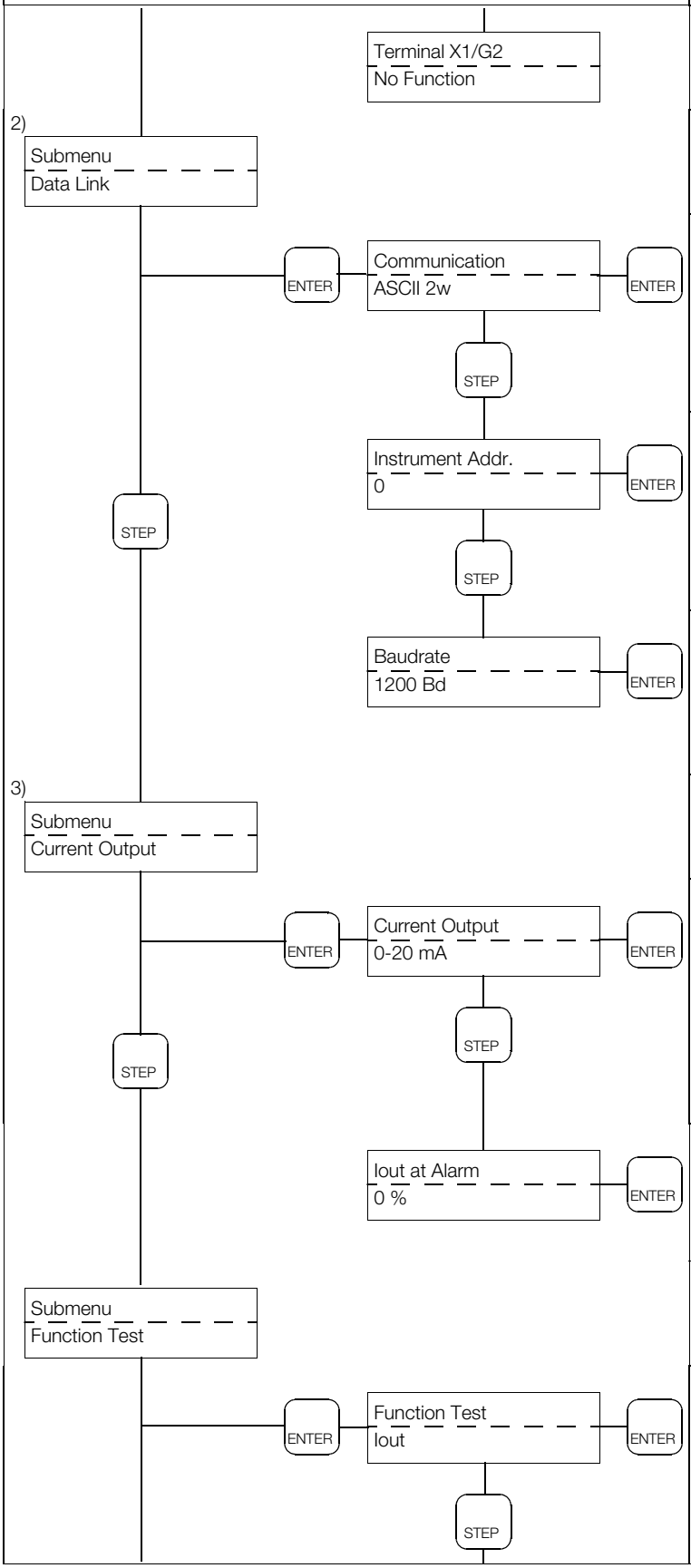
Submenu/Parameters	Comments
Cal-fac 10 m/s 150.000 l/min	Display Max. flowrate for the meter size at 10 m/s flow velocity
Span Cs 25 Hz 56.123 %	Display Span value Cs for the flowmeter primary at the selected excitation frequency. See type plate.
Zero Cz 25 Hz 0.1203 %	Display Zero value Cz for the flowmeter primary at the selected excitation frequency. See type plate.
Short model no. DF2000	Display Short Model No. of the flowmeter primary
Order no. XXX...	Display Order No. for the flowmeter. This number is identical to the number listed on the type plates on the flowmeter primary and the converter and on the tag on the external EEPROM.
Qmax 15.0000 l/min ENTER Qmax 0 l/min	Numeric Entry Entry of the max. flowrate at which the current output corresponds to 20 mA.
Pulse 20000. /l	CM-Variant 21 Display Display of the pulse factor (dependent on Operating Mode)
Pulse 1.0000 /l ENTER Pulse 0 l	CM-Variants 02/05/07 Numeric Entry Entry or display the pulse factor (dependent on Operating Mode) The pulse factor is calculated by the converter so that the output frequency set in the submenu „Operating Mode“ is achieved at 100 % Flowrate (= Qmax). In the operating modes with a scaled pulse output („Standard Conti“ and „Standard Batch“) a pulse factor from 0.001 to 1000 pulses/unit can be programmed by the user, (fmax = 5 kHz).

Submenu/Parameters	Comments
	Numeric Entry For the external pulse output. Range 0.1 ms-2000 ms in multiples of 0.064 ms. The max. allow. pulse width is checked by the software and corrected if necessary. Numeric Entry Range 0-10 % of the set flow range end value (Qmax). Applies to the displayed values and all outputs. The switching point for the low flow cutoff incorporates a hysteresis of 0.5 %. In the Operating Mode „Filler 5 kHz“ this function only apples to the display indications. CM-Variants 02/05/07 Numeric Entry The damping parameters are only displayed in the Operating Modes „conti“. In the other operating modes there is no damping. Numeric Entry Range 0.01-5 g/cm³. Mass flowrate for the display and totalizer values in g, kg, t, uton or pounds. System Zero in Hz based on Cal-fac (Cal-fac is equivalent to 10000 Hz) Numeric Entry Manual entry, e.g. when a converter is exchanged Automatic Adjustment Valve must be closed, flowrate must be at absolute zero and the meter pipe must be completely filled. The automatic adjustment is started with ENTER. The limits for the zero value are ± 50 Hz. If the value is outside of these limits, no adjustment is made. Selection of the units for Qmax, totalizer and the user programmable units and units factor Tabular Selection ml/s, ml/min, ml/h, Ml/min, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, kgal/s[1)], kgal/min[1)], kgal/h[1)], 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, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h. The units are used for Cal-fac, Qmax forward, Qmax reverse and the instantaneous display values, when direct reading engineering units have been selected. [1)] User programmable units



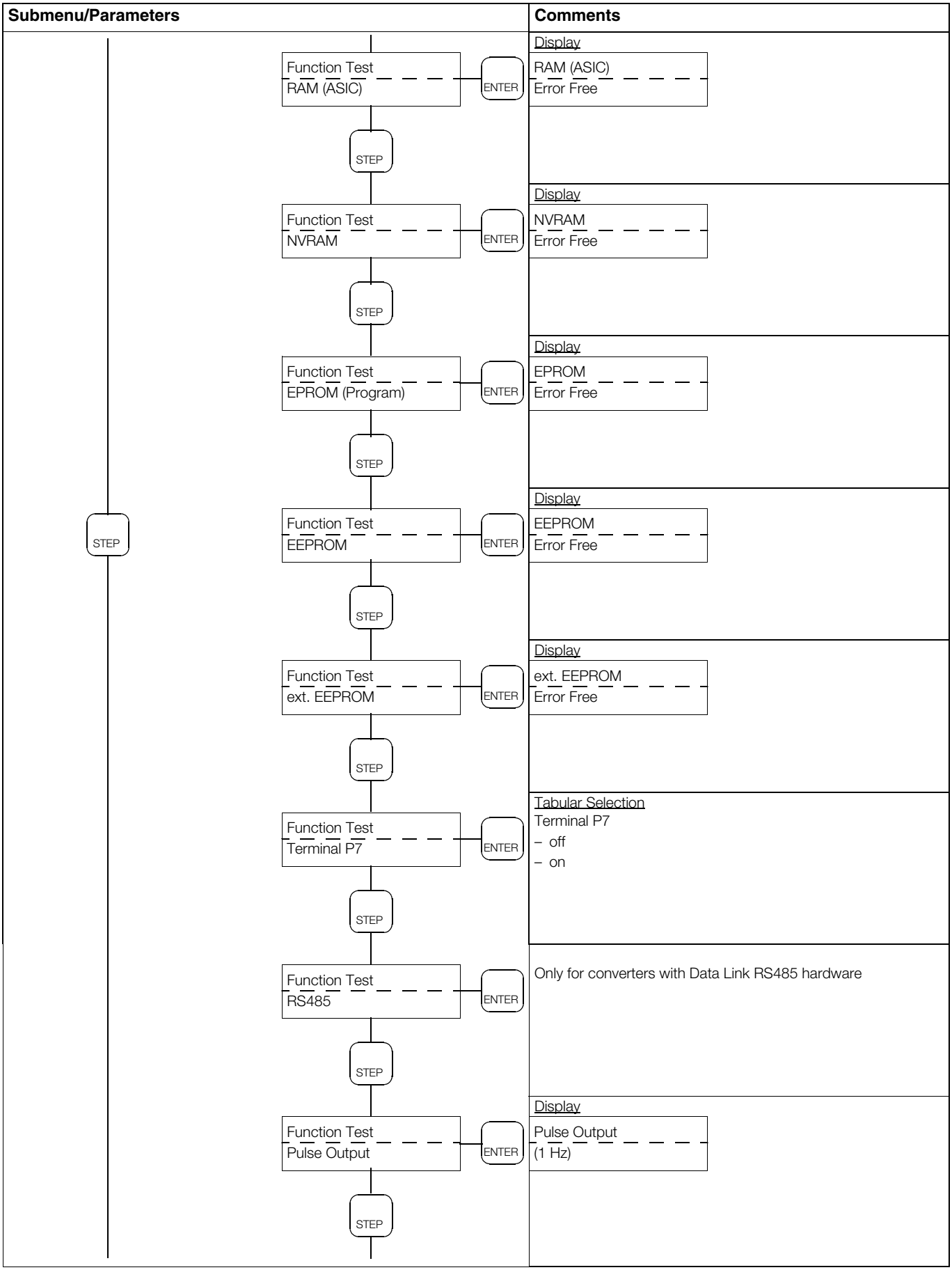
Footnote 1): Only for user programmable units

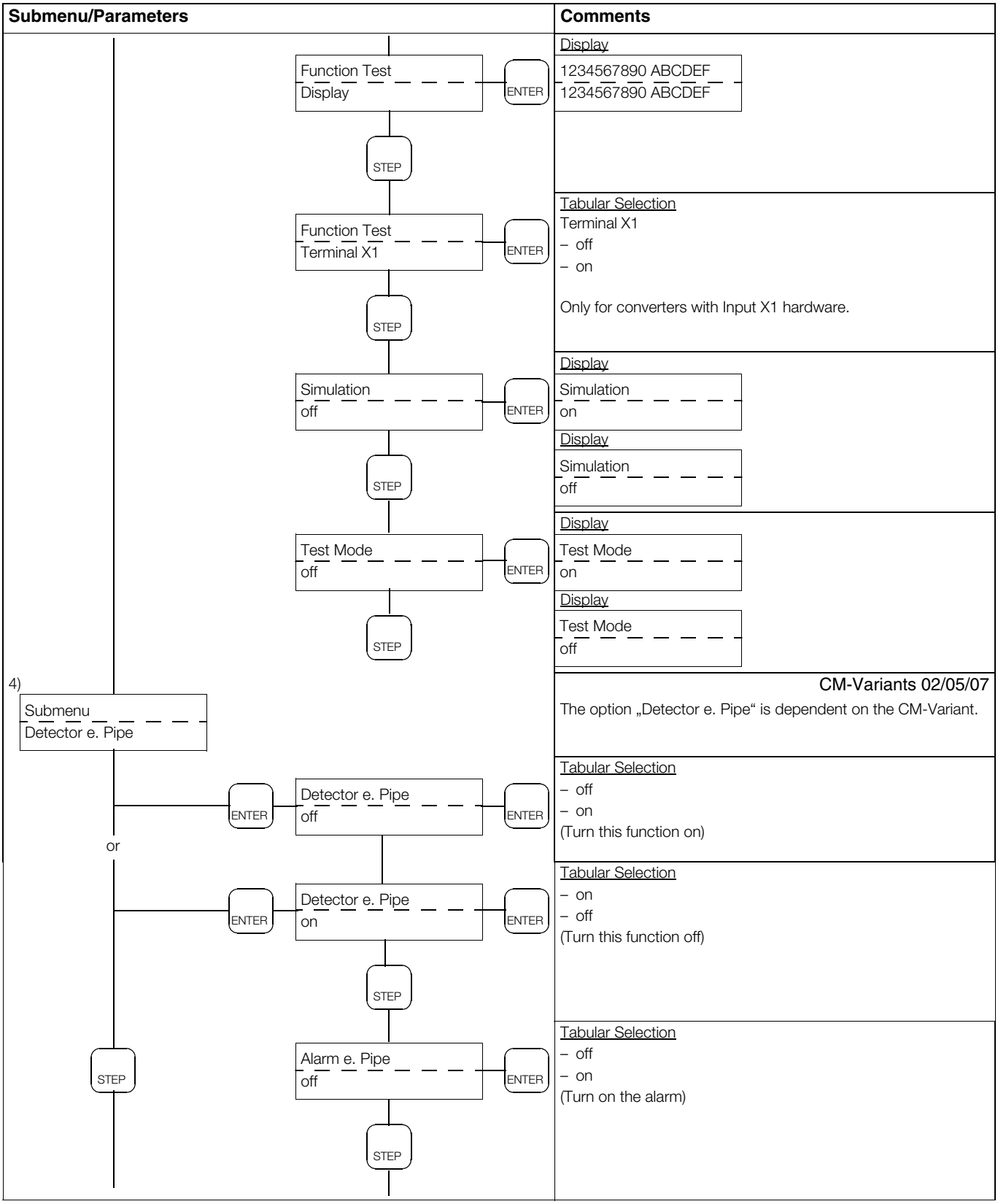
Submenu/Parameters	Comments
	The function assigned to the contact in- or output is dependent on the selections made for the operating mode (in submenu „Operating Mode“). CM-Variant 21 Display CM-Variant 21 Tabular Selection Use the Step-Key to select one of the following functions: – No Function – Valve Indicator – System Zero The function assigned to the contact in- or output is dependent on the selections made for the operating mode (in submenu „Operating Mode“) CM-Variants 02/05/07 Tabular Selection The output signal is synchronized to the magnetic field excitation from the converter. Improved reproducibility for short batch cycles can be achieved by synchronizing the opening of the magnet valve to the magnetic field excitation from the converter. Output signal for the forward flow direction (contact closed for forward). In the Operating Mode „Batch“, the end contact is opened when the batch quantity is reached. Output signal when errors are detected as a general alarm indicator Contact output not used If the Operating Mode „Filler 5 kHz“ is selected, the contact input operates as an ext. Start/Stop contact. The function „System Zero“ initiates an automatic adjustment of the system zero. The output signals are set to zero by the ext. Zero Return function.



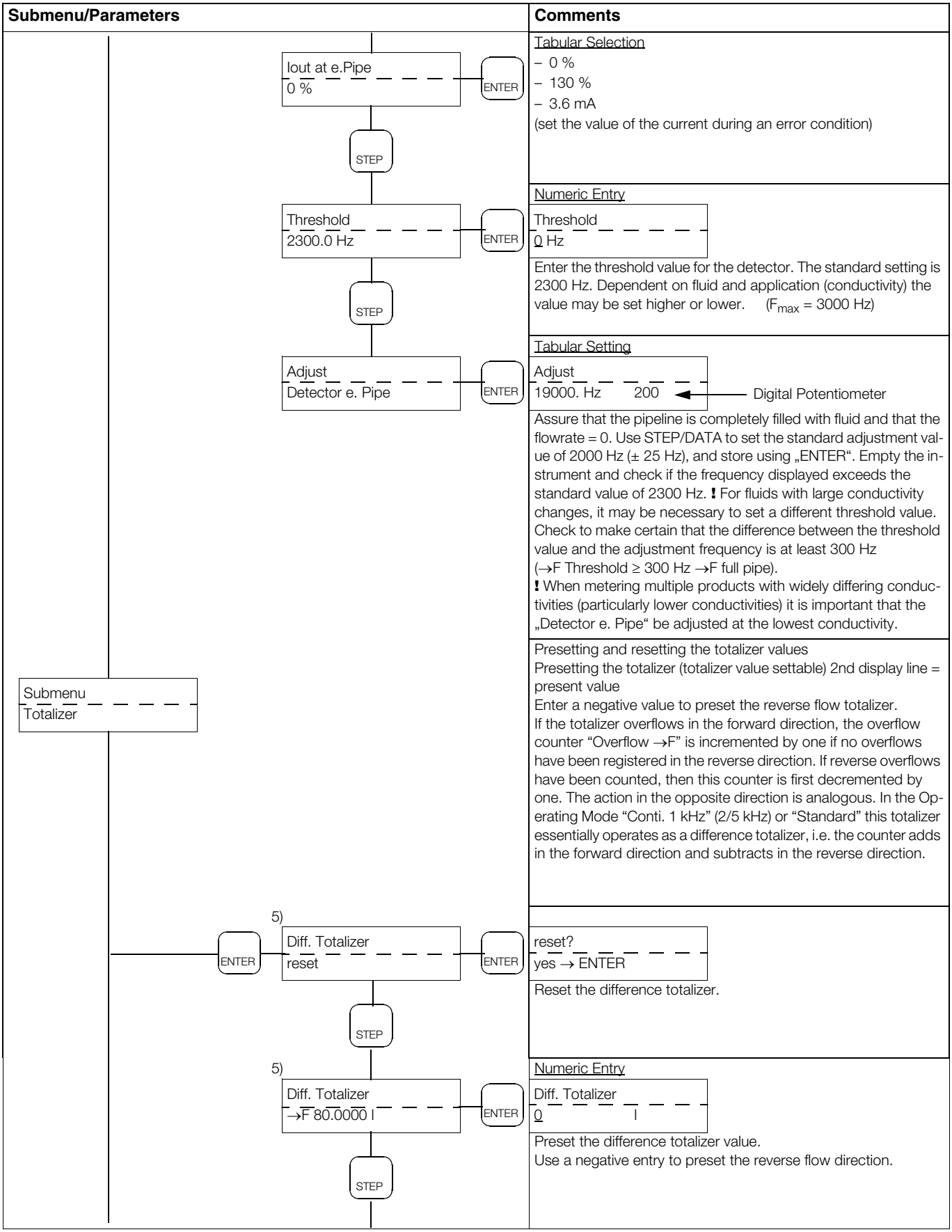
Submenu/Parameters	Comments
	Contact input not used.
	CM-Variant 02 The option „Data Link“ is dependent on the CM-Variant.
	Tabular Selection Selection of the Communication-Protocol – ASCII 2w – ASCII
	Numeric Entry Entry of the Instrument Address. The address of the 1st instrument must always be „0“.
	Tabular Selection Selection of the Baudrate – 1200 Bd – 2400 Bd – 4800 Bd – 9600 Bd
	CM-Variants 05/07 The option „Current Output“ is dependent on the CM-Variant.
	Tabular Selection Selection of the current output range – 0-20 mA – 4-20 mA – 0-10 mA – 2-10 mA – 0-5 mA – 0-10-20 mA – 4-12-20 mA
	Tabular Selection Selection of the value for the current output during an error. – 0 % – 130 % – 3.6 mA
	This test set can be used to test the functions in the converter, the in-/and outputs and the wiring before start-up.
	Only for converters with current output hardware.

Footnote 2): Only with Data Link RS485 hardware
Footnote 3): Only for Operating Modes Standard Conti, Conti 1/2/5 kHz.

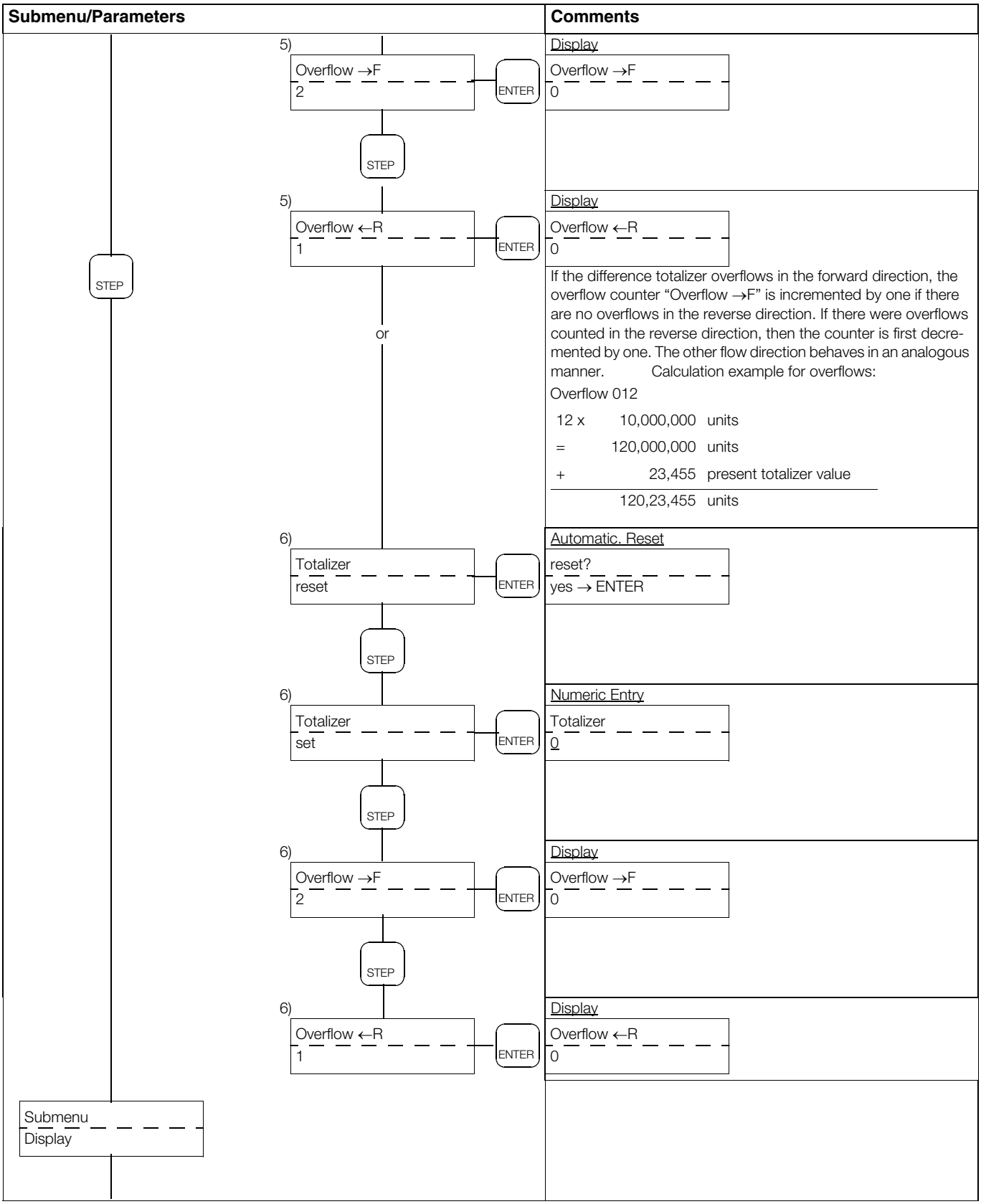

Submenu/Parameters
Comments
STEP
Function Test
RAM (ASIC)
ENTER
Display
RAM (ASIC)
Error Free
STEP
Function Test
NVRAM
ENTER
Display
NVRAM
Error Free
STEP
Function Test
EPROM (Program)
ENTER
Display
EPROM
Error Free
STEP
Function Test
EEPROM
ENTER
Display
EEPROM
Error Free
STEP
Function Test
ext. EEPROM
ENTER
Display
ext. EEPROM
Error Free
STEP
Function Test
Terminal P7
ENTER
Tabular Selection
Terminal P7
– off
– on
STEP
Function Test
RS485
ENTER
Only for converters with Data Link RS485 hardware
STEP
Function Test
Pulse Output
ENTER
Display
Pulse Output
(1 Hz)
STEP



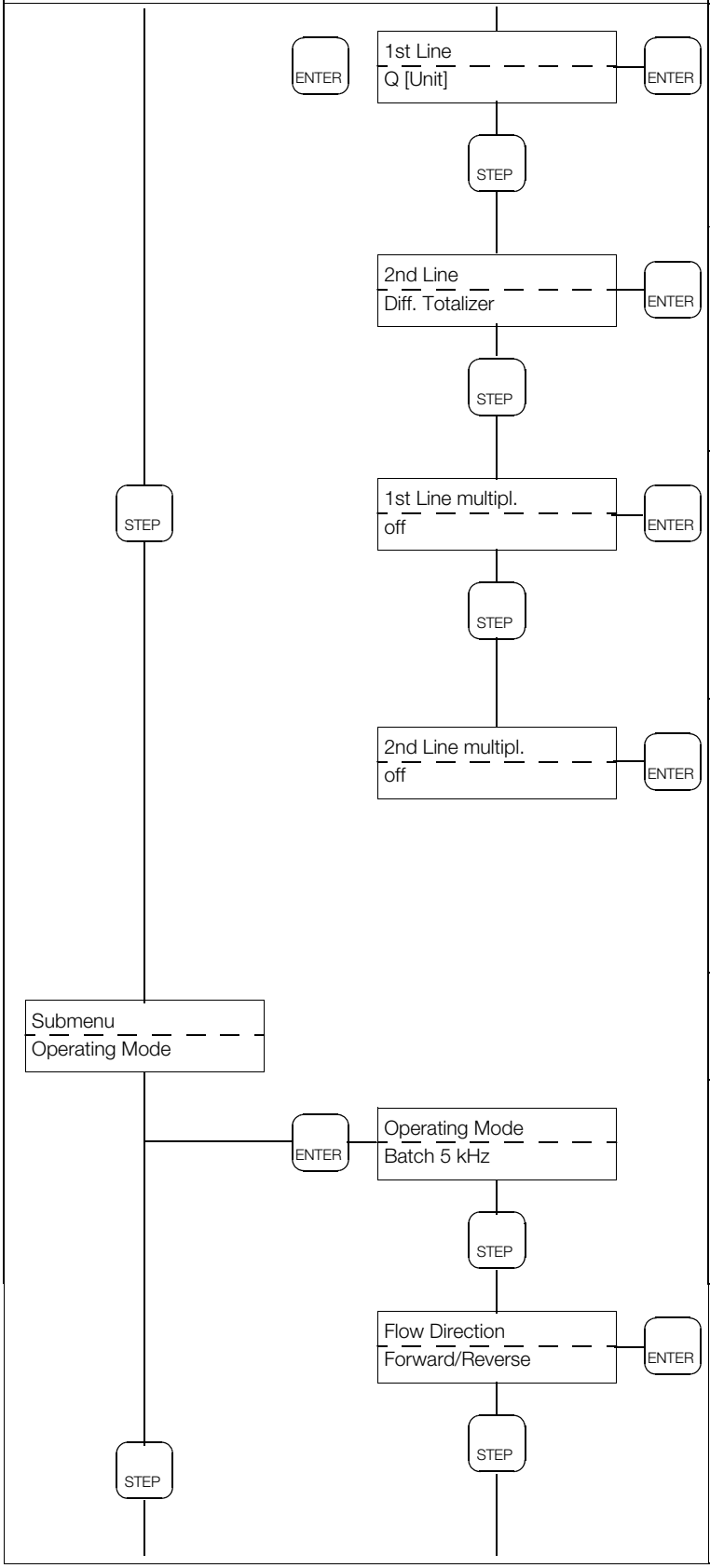
Footnote 4): Only for Operating Mode „Standard Conti“



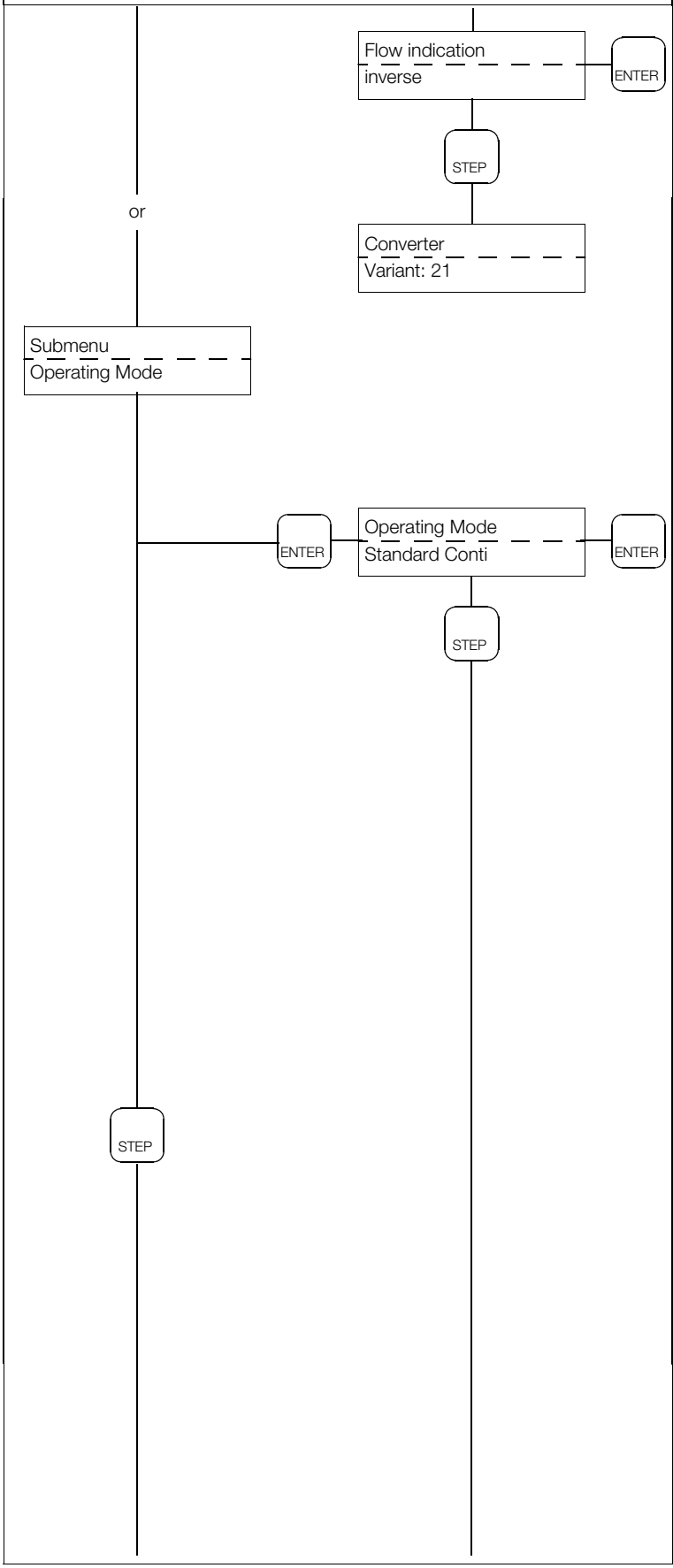
Footnote 5): In „Standard“ and „Batch“ Operating Modes

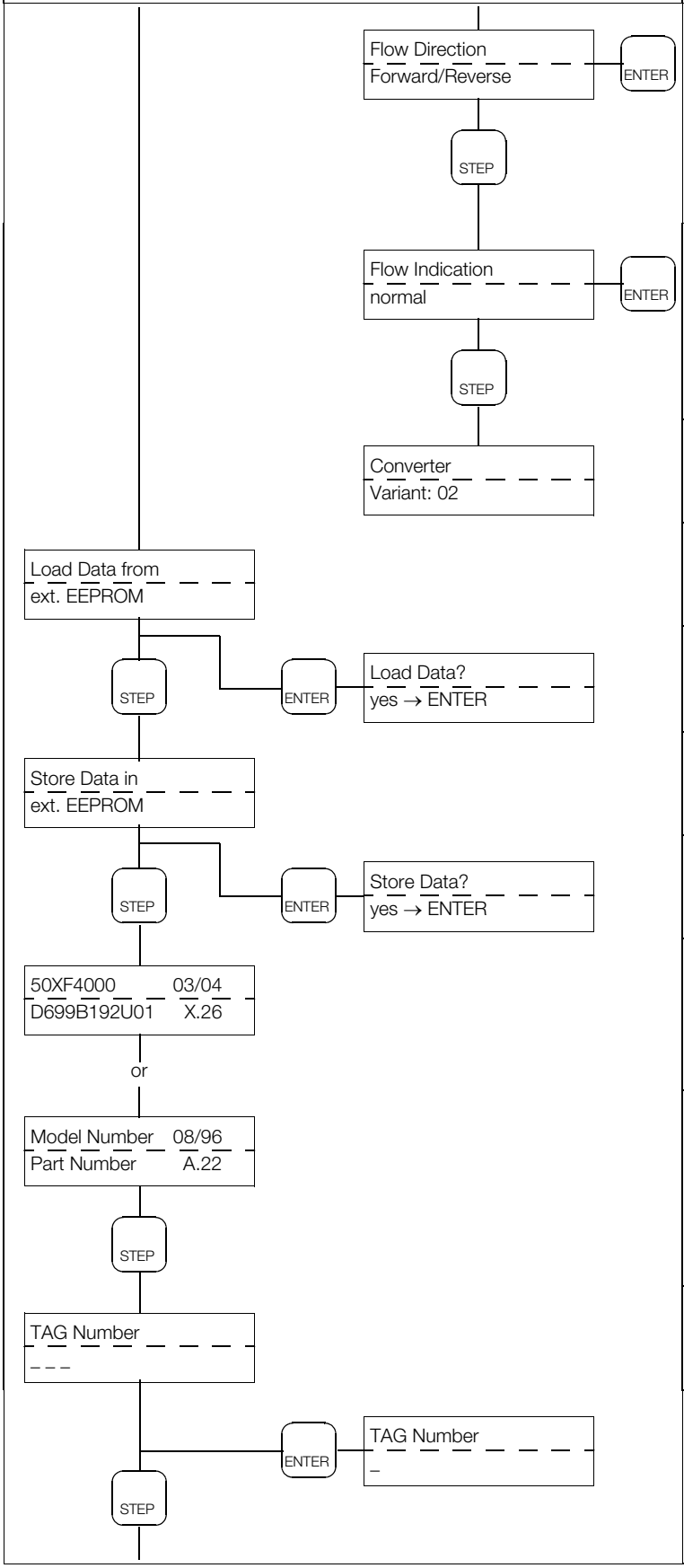


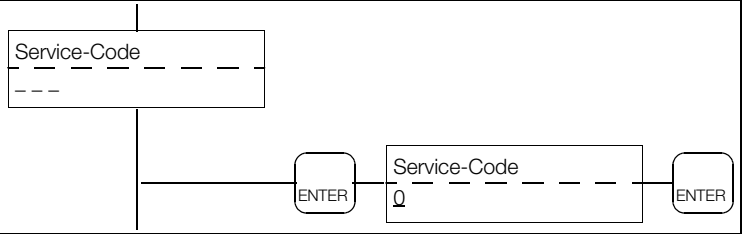
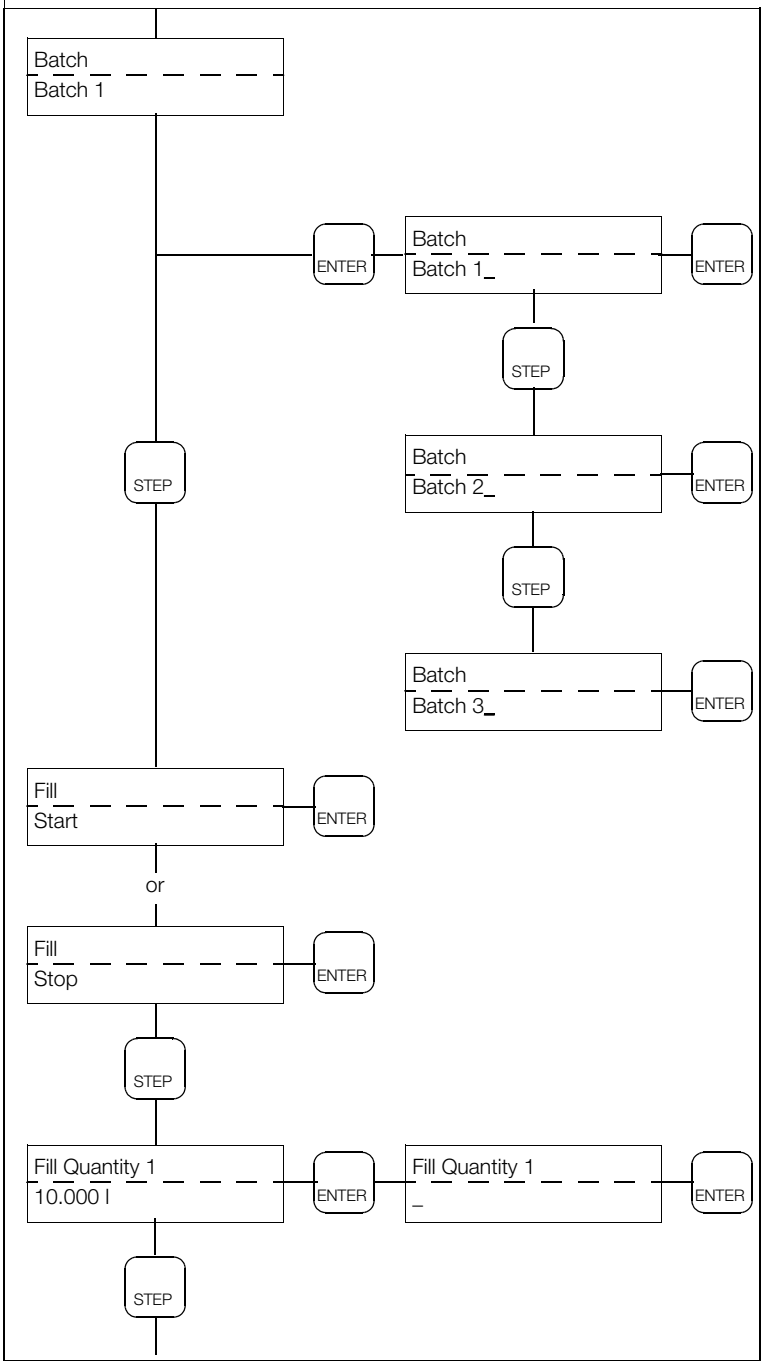
Footnote 5): In „Standard"- and „Batch" Operating Modes
Footnote 6): In Operating Mode „Filler 5 kHz"

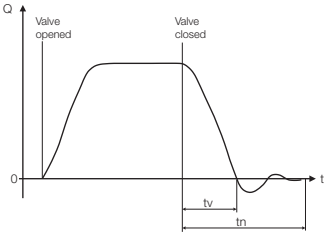


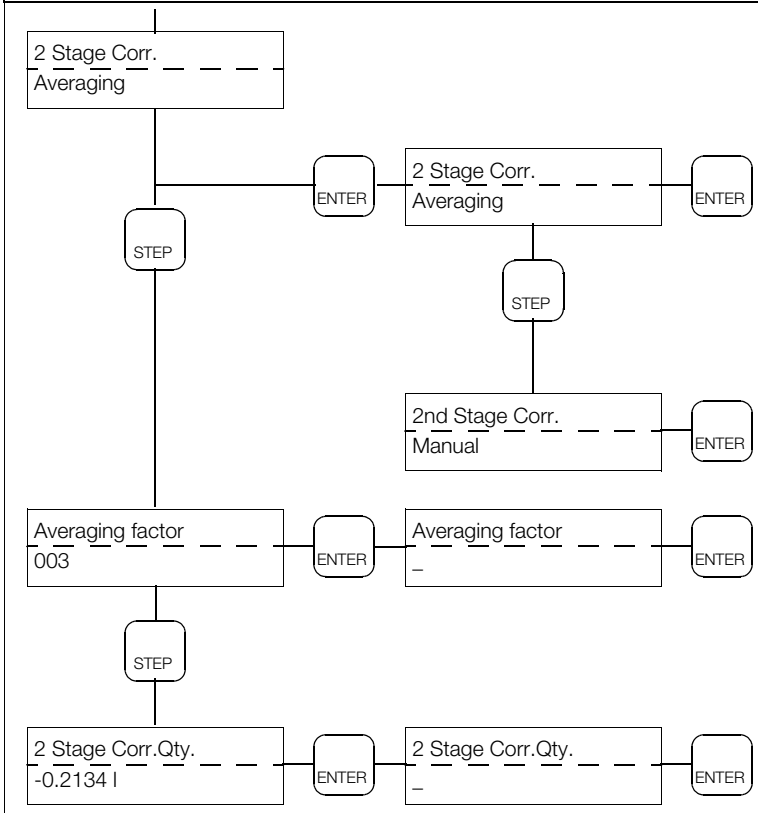
Submenu/Parameters	Comments
	Tabular Selection (Assigning the values to display in 1st Line) 1st Line – Q [Unit]_ – Difference totalizer_ – TAG Number_ – Q [Bargraph]_ – Blank line_ – Q [%]_
	Tabular Selection (Assigning the values to display in 2nd Line) 2nd Line – Difference totalizer_ – TAG Number_ – Q [Bargraph]_ – Blank line_ – Q [%]_ – Q [Unit]_
	Tabular Selection Assigning the multiplexed value to display in 1st Line. Display cycles every 10 Sec. 1st Line multipl. – off_ – Q [%]_ – Q [Unit]_ – Difference totalizer_ – TAG Number_ – Q [Bargraph]_
	Tabular Selection Assigning the multiplexed value to display in 2nd Line. Display cycles every 10 Sec.). 2nd Line multipl. – off_ – Q [%]_ – Q [Unit]_ – Difference totalizer_ – TAG Number_ – Q [Bargraph]_
	The Operating Mode is fixed for user specified CM-Variants!
	CM-Variant 21 Display
	Tabular Selection – Forward/Reverse – Forward Select if the totalizer is to integrate flow in both forward and reverse directions or only in the forward direction.

Submenu/Parameters	Comments
	Tabular Selection – inverse – normal The setting depends on the installation orientation of the flowmeter primary. As standard, the instrument should be installed so that it normal operation is in the forward flow direction (flow direction into the connection plugs).
	Display
	CM-Variants 02/05/07 Tabular Selection The Operating Mode settings are located in the Service Code Number section. During the „Batch Operating Modes“ the reference voltage measurements are usually made between two batch cycles. In the „Conti Operating Modes“ the reference voltage measurement is made at specific time intervals.
	– Operating Mode “Standard Conti” should be selected for continuous flow metering. The pulse factor can be user programmed. Fmax = 5 kHz. The output P7/G2 transmits a F/R-Signal (Forward/reverse direction signal).
	– Operating Mode „Standard-Batch“. For batch and filler processes with user programmable pulse output (Fmax = 5 kHz).
	– Operating Mode „Batch 1 kHz“. For batch and filler processes with a fixed 1 kHz frequency output at Qmax (Qmax = 100 % Flowrate = 1 kHz)
	The pulse factor is calculated so that an output frequency of 1 kHz exists at 100 % Flowrate (= Qmax). For batch operation the synchronous output should be selected for the valve control.
	– Operating Mode „Batch 2 kHz“. Similar to Operating Mode „Batch 1 kHz“, except max. output frequency = 2 kHz.
	– Operating Mode „Batch 5 kHz“. Similar to Operating Mode „Batch 1 kHz“, except max. output frequency = 5 kHz.
	– Operating Mode „Conti 1 kHz“. For continuous flowrate metering. The pulse factor is calculated so that an output frequency of 1 kHz exists at 100 % Flowrate (= Qmax).
	– Operating Mode „Conti 2 kHz“. Similar to Operating Mode „Conti 1 kHz“, except max. output frequency = 2 kHz.
	– Operating Mode „Conti 5 kHz“. Similar to Operating Mode „Conti 1 kHz“, except max. output frequency = 5 kHz.
	– Operating Mode „Filler 5 kHz“. ! Not available for „CM-Variant 05“ ! For Stand-Alone filler operation. For continuous flowrate metering. The pulse factor is calculated so that an output frequency of 5 kHz exists at 100 % flowrate. The output P7/G2 has the function of an End Contact, the input X1/G2 has the function of a Start Contact. During the fill cycle the input X1/G2 has the function of a Stop Contact.

Submenu/Parameters	Comments
	Tabular Selection – Forward/Reverse – Forward Select if the flowrate should be integrated in both flow directions, forward and reverse or only in the forward direction. If the forward only option is selected and a reverse flow is present, the flow direction indicator „← R“ in the display blinks and the flowrate indication is 0 %.
	Tabular Selection – normal – inverse If the flow direction indicators differ from the actual flow direction because of the installation orientation of the flowmeter primary, this function (inverse) can be used to switch the flow direction indicators..
	Display
	When exchanging a converter the data stored in the external EEPROM is automatically uploaded. It is also possible to upload the data upon command from the external EEPROM.
	Automatic Upload using ENTER. A prerequisite is that the meter location parameters had previously been stored (See the following parameter).
	After start-up has been completed, the new meter location parameters should be stored in the external EEPROM.
	Automatic Download using ENTER.
	CM-Variant 21 Display
	CM-Variants 02/05/07 Display Displays the Model Number of the instrument and identifies the installed software version and the EPROM Part Number 08/96 Date of the release A.22 Revision level
	Numeric Entry An alphanumeric TAG-Number with a max. of 16 characters can be entered to identify the meter location using numbers and upper and lower case letters

Submenu/Parameters	Comments
	Only for ABB Automation Products Service personnel. Numeric Entry After a correct Service-Code No. is entered, the instrument specific parameters and calibration data can be accessed. Only for ABB Automation Products Service or ABB authorized personnel.
If the Operating Mode „Filler 5 kHz“ is selected then the following parameters will also be displayed. They a located between the submenu „Primary“ and the parameter „Qmax“.	
	CM-Variants 02/05/07 Tabular Selection There are 3 sets of parameters available for 3 different fill quantities: Batch 1, Batch 2, Batch 3. Each parameter set includes the fill quantity, calibration and maximum fill time. Select the parameter set for fill quantity 1. Select the parameter set for fill quantity 2. Select the parameter set for fill quantity 3. Display As a function of the present operating status of the instrument the available function is displayed and can be activated with ENTER. Numeric Entry Entry of the quantity to be filled. Only positive entries may be made. The units are those selected in parameter „Unit Totalizer“ in submenu „Unit“.

Submenu/Parameters	Comments
Calibration 1 1.2345 % ENTER → Calibration 1 _ ENTER STEP	Numeric Entry A separate „Calibration“ can be programmed for each batch. The entry range is ± 10 %.
Max. Fill Time 1 10.500 s ENTER → Max. Fill Time 1 _ ENTER STEP	Numeric Entry A separate „Max. Fill Time“ can be programmed for each batch. After the time has expired the fill cycle is automatically terminated. The entry range is 0-2600 s. These last 3 parameters are also available for Fill Quantity 2 and 3.
Max. Fill Time 3 20.000 s ENTER → Max. Fill Time 3 _ STEP	Settings for parameter sets 2 and 3 See „Parameter set Fill Quantity 1“
Measure Qn to 2 Stage time tn ENTER → Measure Qn to 2 Stage time tn ENTER STEP Measure Qn to Valve shut tv ENTER STEP	Tabular Selection The second stage flow can be determined using two different methods, up to: - second stage time tn - valve closed time tv 
2 Stage time tn 0.5000 s ENTER → 2 Stage time tn _ ENTER STEP	Numeric Entry The second stage flow time tn defines how long the flowrate should continue to be metered after the End Contact opens. The range for the second stage flow time is 0 - 10 s. It must be greater than the valve closing time.
Valve shut tv 0.3300 s ENTER → Valve shut tv _ ENTER STEP	Automatic Measurement or Numeric Entry Is determined by the computer itself. The valve closure time is defined as the time from the opening of the End Contact until the flowrate reaches < 1 %.
2 Stage Qty Qn 0.2345 l STEP	Display The second stage quantity Qn is the quantity of flow which is measured from the time the End Contact is activated until the valve closes within the Second Stage Time or the Valve Closed Time.

Submenu/Parameters	Comments
	Tabular Selection Selection of the type of calculation which is to be used for the second stage quantity correction The second stage correction quantity is an average value calculated from the number of fill cycles entered in the parameter “Averaging Factor” Entry of a fixed second stage correction quantity Numeric Entry The averaging factor defines the number of fill previous cycles which are to used to calculate the second stage correction quantity. Range 2-5. Automatic Determination or Numeric Entry The calculated second stage correction quantity determined either automatically (Averaging) or entered as a fixed correction quantity (Manual). Entries must be negative.

12 Certificates

12.1 EC-Declaration of Conformity (DGRL 97/23/EG)

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:*	FXE4000, FXM2000, FSM4000, FXL4000, FXT4000, FXF2000 (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 17.09.2004

ppa .....
(J. Harr, Standortleiter APR Göttingen)

2310 BZ-25-0006 Rev 02

12.2 EC-Certificate of Compliance (EMC Directive)

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:*	DF2300
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50081-2, 3/94 * EN 50082-1, 3/93 * EN 50082-2, 2/96 *

* einschließlich Nachträge
including alterations

Göttingen, 12.05.2000

Unterschrift / Signature

BZ-13-5025, Rev.1, 1699

ABB Automation Products GmbH

Postanschrift: D-37070 Göttingen	Telefon: +49(0)551 905-0 Telefax:	Sitz der Gesellschaft: Göttingen Registergericht:	Vorsitz des Aufsichtrates: Bengt Pihl Geschäftsführung:	Commerzbank AG Frankfurt Konto: 589 635 200 BLZ: 500 400 00
Besucheranschrift: Dransfelder Str. 2 D-37079 Göttingen	+49(0)551 905-777 http://www.abb.de/automation USt-IdNr.: DE 115 300 097	Göttingen Handelsregister: HRB 423	Uwe Alwardt (Vorsitz) Burkhard Block Erik Huggare	

ABB has Sales & Customer Support
expertise in over 100 countries worldwide.

www.abb.com

ABB optimiert kontinuierlich ihre Produkte,
deshalb sind Änderungen der technischen Daten
in diesem Dokument vorbehalten.

Printed in the Fed. Rep. of Germany (12.05)

D184B084U02 Rev. 01

ABB Ltd.
Oldends Lane, Stonehouse
Gloucestershire, GL 10 3TA
UK
Phone: +44(0)1453 826661
Fax: +44(0)1453 829671

ABB Inc.
125 E. County Line Road
Warminster, PA 18974
USA
Phone: +1 215 674 6000
Fax: +1 215 674 7183

ABB Automation Products GmbH
Dransfelder Str. 2
37079 Göttingen
GERMANY
Phone: +49 551 905-534
Fax: +49 551 905-555

CCC-support.deapr@de.abb.com