

COPA-XE / MAG-XE

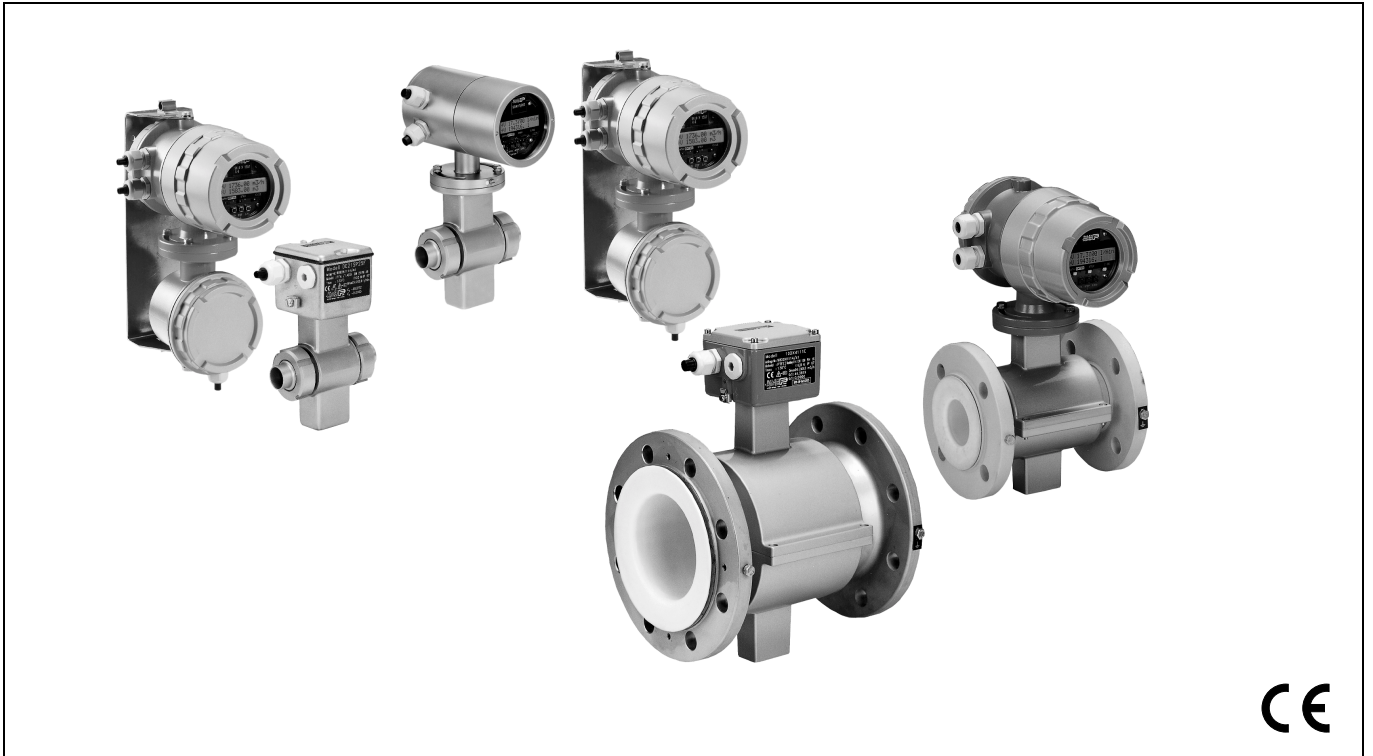
Electromagnetic Flowmeter with Pulsed DC Magnetic Field Excitation

Model DE41.. / DE43..
DE21.. / DE23..

Valid for Software Versions B.11 and higher

Instruction Bulletin

D184B105U02 Rev. 01 / 05.2000



You have purchased a high quality, modern instrument
from ABB Automation. We appreciate your purchase
and the confidence you have shown in us.

This Instruction Bulletin contains information relative to the assembly and
installation of the instrument and the specifications for this instrument design.
ABB Automation reserves the right to make hardware and software improvements
without prior notice. Any questions which may arise that are not specifically answered by
these instructions should be referred to our manufacturing plant in Göttingen, Germany
Tel. 49-0551/905-0 or to the Service person responsible for your account.

The interference resistance of this flowmeter system complies with
the NAMUR-Recommendation NE 21 5/93 and
EMC Guidelines 89/336/EWG
(EN 50081-1, EN 50081-2)
EN 50082-1, EN 50082-2

Introductory Safety Notes for the EMF Systems

Regulated Usage

The Electromagnetic Flowmeter [EMF] systems are designed to the latest state of the art and are safe to operate. The EMF is to be installed only in the specified applications.

Every usage which exceeds the specifications is considered to be non-specified. Any damages resulting therefrom are not the responsibility of the manufacturer.

The user assumes all risk for such usage.

The application specifications include the installation, start-up and service requirements specified by the manufacturer.

Assembly, Start-Up and Service Personnel

Please read this Instruction Bulletin and the safety notes before attempting installation, start-up or service.

Only qualified personnel should have access to the instrument.

The personnel should be familiar with the warnings and operating requirements contained in this Instruction Bulletin.

Assure that the connections are in accordance with the Interconnection Diagrams.

Ground the flowmeter system.

Observe the warning notes designated in this document by the symbol:



Hazardous Material Information

In view of the Disposal Law of 27 Aug. 86 (AbfG. 11 Special Wastes) the owner of special wastes is responsible for its care and the employer also has, according to the Hazardous Material Law of 01 Oct. 86 (GefStoffV, 17 General Protection Responsibility), a responsibility to protect his employees, we must make note that:

- a) All flowmeter primaries and/or flowmeter converters which are returned to ABB Automation Products for repair are to be free of any hazardous materials (acids, bases, solutions, etc.)
 - b) The flowmeter primaries must be flushed so that the hazardous materials are neutralized. There are cavities in the primaries between the metering tube and the housing. Therefore after metering hazardous materials the cavities are to be neutralized (see Hazardous Material Law -GefStoffV). For two piece housings the screws used to hold the sections together should be loosened. For flowmeter primaries $\geq 14''$ [DN 350] the drain plug at the bottom of the housing should be removed to provide access to the coil and electrode area for decontamination or flushing to neutralize the area.
 - c) For service and repairs **written confirmation** is required that the measures listed in a) and b) have been carried out.
 - d) Any costs incurred to remove the hazardous materials during a repair will be billed to the owner of the equipment
-



EG-Konformitätserklärung EC-Certificate of Compliance



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: 50XE4... / E4...
Model: 10DE2... / DE2...
10DE4... / DE4...

Richtlinie: EMV Richtlinie 89/336/EWG *
Directive: EMC directive 89/336/EEC *

Europäische Norm: EN 50081-1, 3/93 *
European Standard: EN 50082-2, 2/96 *

Richtlinie: Niederspannungsrichtlinie 73/23/EWG *
Directive: Low voltage directive 73/23/EEC *

Europäische Norm: EN 61010-1, 3/94 *
European Standard:

* einschließlich Nachträge
including alterations

Göttingen, 09.03.99

Unterschrift / Signature

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BZ-13-5108, Rev.0, E21664

Handelsregister / Court of Register: Göttingen
HRB Nr. 423

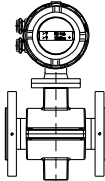
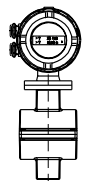
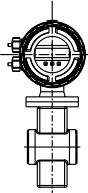
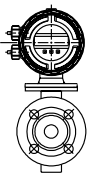
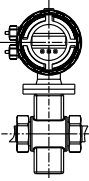

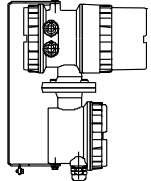
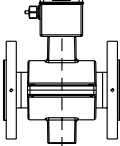

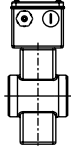
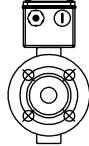
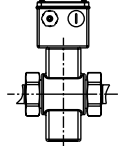
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1. Flowmeter Primary and Converter Coordination

This Instruction Manual describes the assembly and installation, the electrical interconnections and the configuration of the Flowmeter Systems COPA-XE and the Flowmeter Systems MAG-XE.

<p>Compact Design COPA-XE The μP-Converter and the flowmeter primary constitute a single mechanical entity.</p> <p>Aluminum Design: Models DE43F and DE43W Stn. Stl. Design: Model DE23_</p>	<p>Remote Design MAG-XE The μP-Converter is mounted remote from the flowmeter primary. Cable lengths up to 50 m may be used for conductivities above 5 μS/cm. The electrical interconnection between the converter and flowmeter primary are made in connection boxes using a single signal cable.</p> <p>Aluminum Design: Models DE41F and DE41W Stn. Stl. Design: Model DE21_</p>
<p>COPA-XE</p> <div style="display: flex; justify-content: space-around; align-items: center;">      </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <p>Flanged</p> <p>Wafer Design</p> <p>Multiple Process Connections Stn. Stl.</p> </div>	<p>MAG-XE</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: left;"> <p>19" Rail Mount Panel Mount</p>  </div> <div style="text-align: right;"> <p>Field Mount Hsg.</p>  </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;">      </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <p>Flanged</p> <p>Wafer Design</p> <p>Multiple Process Connections Stn. Stl.</p> </div>

1.1 Data Security

All data is stored in a NV-RAM when the power is turned off or during a power interruption. The parameter settings and flowmeter primary specific calibration data are stored in a serial EEPROM as well as in an external EEPROM. Therefore, after a converter and EEPROM exchange all the stored data can be readily uploaded into the new instrument.

! Important Start Up Note

- When the instrument is shipped the external EEPROM is plugged into its socket on the display board of the converter.
- Please check for correct coordination between the converter and flowmeter primary. The last digits of the flowmeter primary serial number as indicated on the Instrument Tag end in A1, A2 etc. while the corresponding end characters for the converter end in B1, B2, etc. A1 and B1 constitute a single entity.

Electromagnetic Flowmeter

COPA-XE / MAG-XE

1.2 Principle of Operation

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

The ABB AUTomation Products "EMF" has proven itself over many years and is the preferred flowmeter in the chemical industry, the pharmaceutical and cosmetic industries, municipal water and waste water treatment facilities and in the food and paper industries

1.3 Measurement Principle

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

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

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

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

1.4 Design

An electromagnetic flowmetering system consists of a flowmeter primary and a converter. The flowmeter primary is installed in the pipeline while the converter can be mounted locally or at a central location. In the Compact Design the flowmeter primary and converter constitute a single entity.

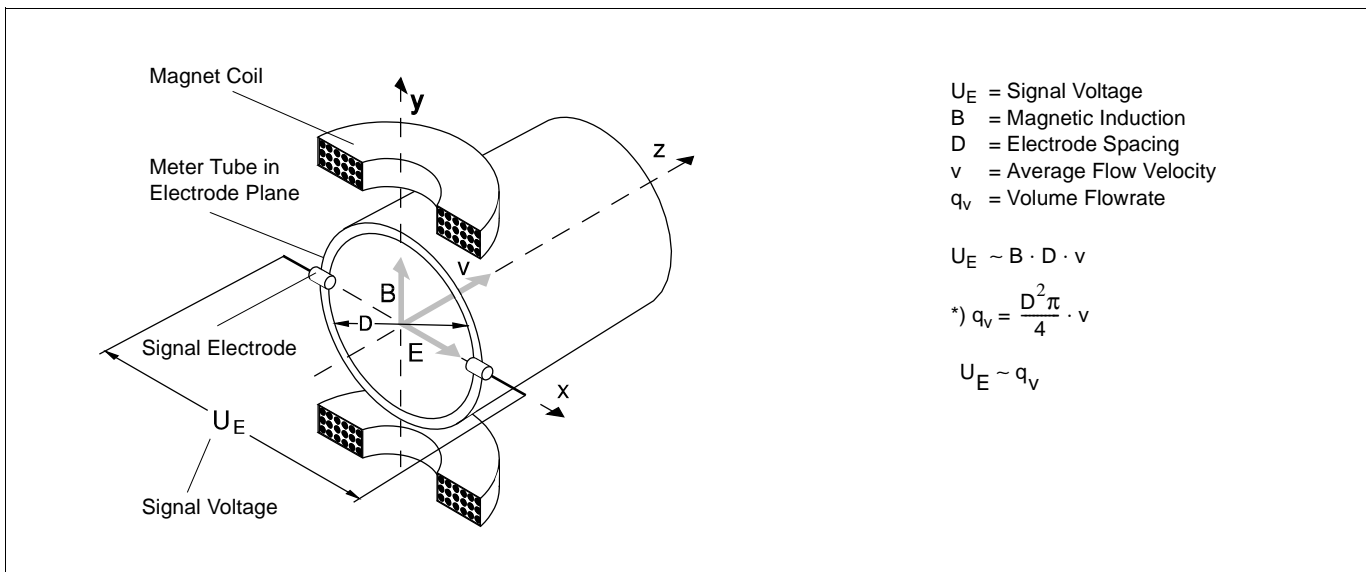


Fig. 1 Schematic of an Electromagnetic Flowmeter

2. Assembly and Installation

2.1 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.

2.2 Flowmeter Primary Installation Requirements

The flowmeter primary should not be installed in the vicinity of strong electromagnetic fields.

The electromagnetic flowmeter primary must be installed so that the metering tube is always filled with fluid. Valves or other shut off devices should be installed downstream from the EMF. A slight pipeline slope of approx. 3 % is desirable for preventing gas build up within the meter (Fig. 2).

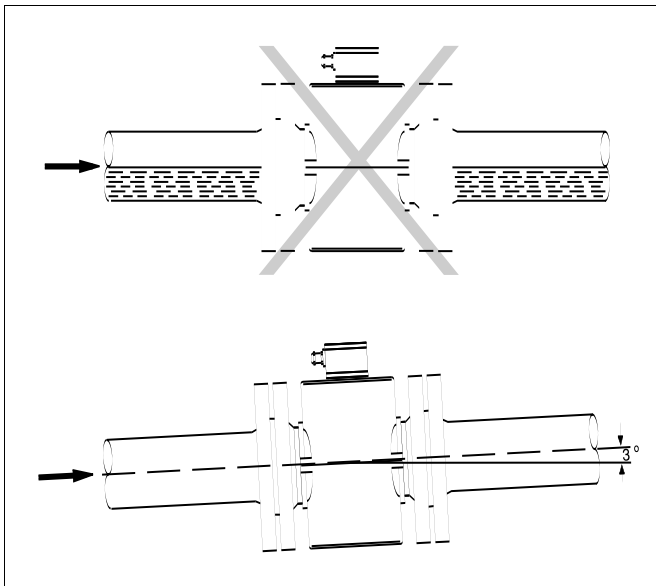


Fig. 2

Vertical installations are ideal when the fluid flows in an upward direction. Installations in drop lines, i.e. the fluid flows from the top to the bottom are to be avoided because experience has shown that it is not possible to guarantee that the pipeline will remain full and that an equilibrium condition between the upward flowing gas and the downward flowing liquid will not occur (Fig. 3).

The flowmeter primary should generally be installed so that the electrical connectors (Pg or NPT) point downward (Figs. 3 & 5).

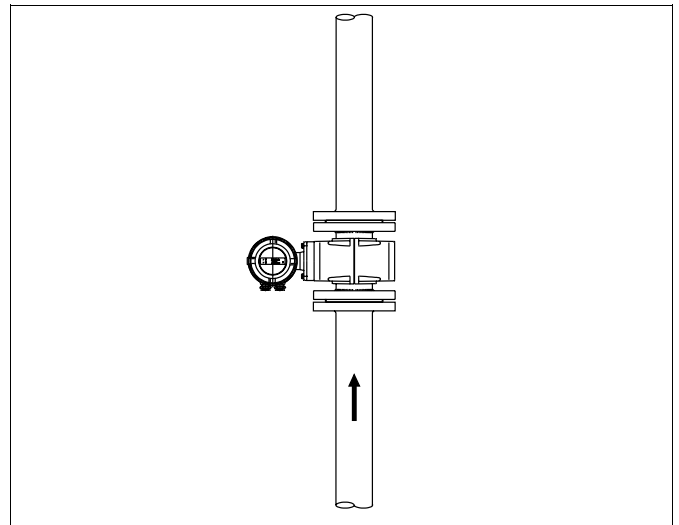


Fig. 3

In horizontal installations the imaginary line connecting the electrodes should be horizontal so that air or gas bubbles cannot influence the signal voltage. The electrode orientation is shown in Fig. 4.

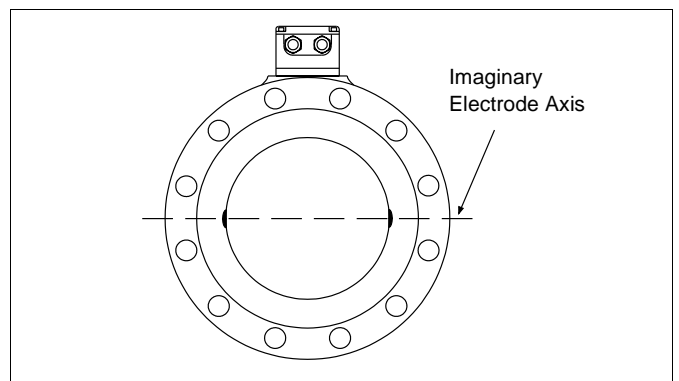


Fig. 4

For a free flow in- or outlet an invert should be provided to assure that the flowmeter primary is always filled with fluid (Fig. 5).

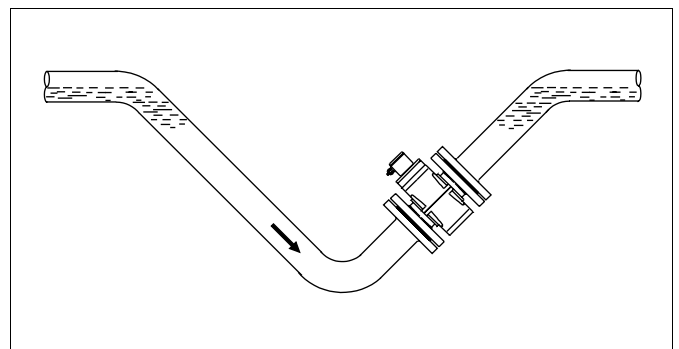


Fig. 5

Electromagnetic Flowmeter

COPA-XE / MAG-XE

In a free flow outlet (drop line) the flowmeter primary should not be installed in the highest point or in the discharge of the pipeline (metering spool could drain, air bubbles, Fig. 6).

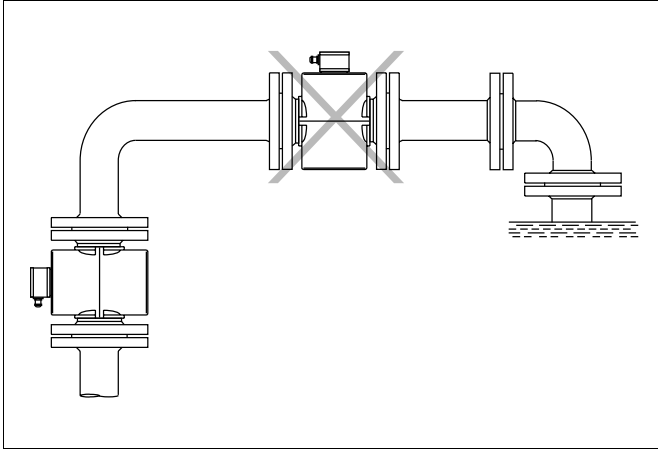


Fig. 6

The measurement principle is independent of flow profile as long as standing eddies do not extend into the measurement region (e.g. after double elbows, tangential inflows or half open valves upstream of the flowmeter primary). In such situations measures to condition the flow are required. Experience indicates that in most cases a straight upstream section with a length of $3 \times D$ and a downstream section of $2 \times D$ are sufficient (D = flowmeter primary size) (Fig. 7). In calibration stands the reference conditions of EN 29104 require straight lengths of $10 \times D$ upstream and $5 \times D$ downstream.

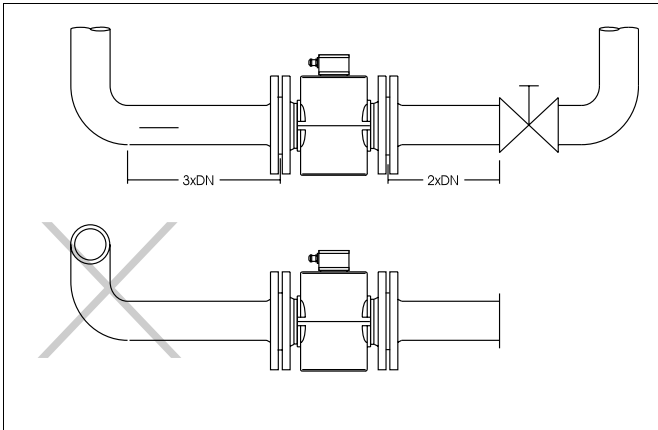


Fig. 7

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

A μ P-converter option offers an automatic empty pipe detector utilizing the existing electrodes.

For highly contaminated fluids a bypass line (Fig. 8) is recommended so that during a mechanical cleaning procedure operation of the process need not be interrupted.

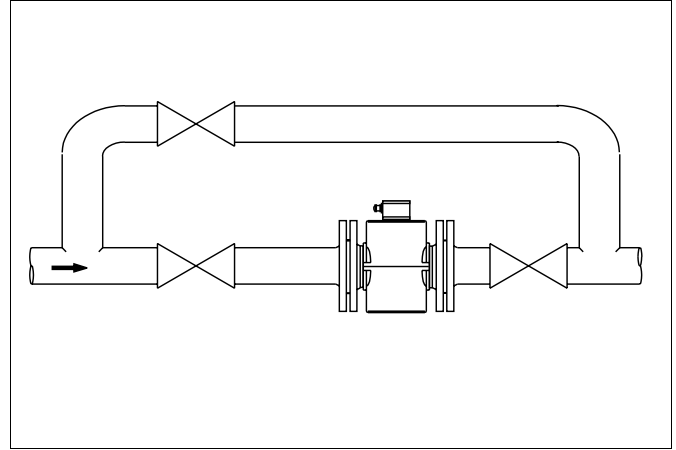


Fig. 8

For flowmeter primaries which are to be installed in the vicinity of pumps or other vibration generating equipment, the utilization of mechanical snubbers is advantageous (Fig. 9).

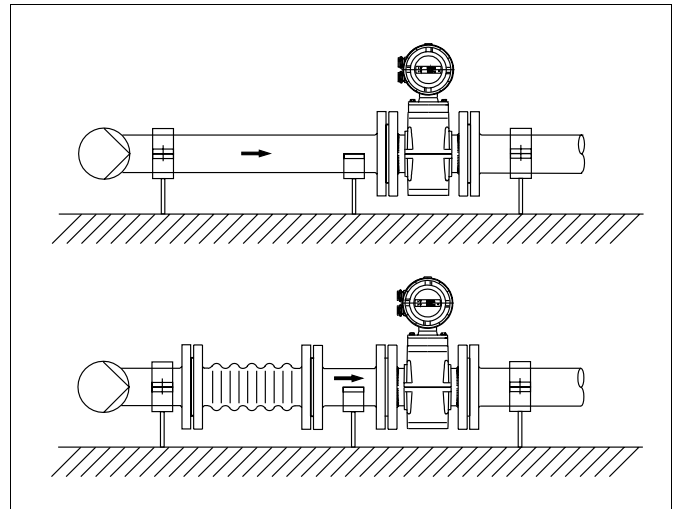


Fig. 9

2.2.1 Flowmeter Primary Installation

The electromagnetic flowmeter can be installed at any arbitrary location in the pipeline as long as the installation requirements (see 2.2) are satisfied.

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

Note:

Graphite should not be used to lubricate the flange or process connection gaskets because under certain circumstances an electrically conductive coating may form on the inside surface of the meter tube affecting operation. Vacuum shocks in the pipeline should be avoided to prevent damage to the liner (PTFE Liners).

Gasket Surfaces on the Mating Flanges

In every installation parallel mating flange surfaces should be provided and gaskets made from materials suitable for the fluid and the temperature should be installed. Only then can leaks be avoided. The flange gaskets for the flowmeter primary must be installed concentrically to achieve optimum measurement results.

Protection Plates

The protection plates are installed to prevent damage to the flowmeter primary liner during transport. Remove the protection plates only when ready to install the meter in the pipeline. Be careful not to cut or otherwise damage the liner in order to prevent leakage.

Torque Specifications for Flanges

The mounting bolts are to be tightened equally in the usual manner without excessive one-sided tightening. We recommend that the bolts be greased prior to tightening and that they be tightened in a criss-cross pattern as shown in Fig. 10. Tighten the bolts during the first pass to approx. 50 %, during the second pass to approx. 80 % and only during the third pass to 100 % of the max. torque value. The max. torque values should not be exceeded, see the following tables.

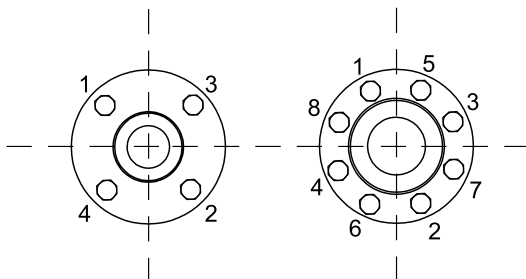


Fig. 10

Torque Specifications for Flanged Meters

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

Table 1

Torque Specifications for Wafer Design Flowmeters

Liner	Meter Size inch mm	Process Connection	Bolts	Torque max. Nm	PN bar	
PFA	1/8-1/4	3 - 6	Threaded flanges Wafer Design	4 x M12	2.3	40
PFA/ PTFE	3/8	10	Threaded flanges Wafer Design	4 x M12	7.0	40
	1/2	15		4 x M12	7.0	40
	3/4	20		4 x M12	11.0	40
	1	25		4 x M12	15.0	40
	1-1/4	32		4 x M16	26.0	40
	1-1/2	40		4 x M16	33.0	40
	2	50		4 x M16	46.0	40
	2-1/2	65		8 x M16	30.0	40
	3	80		8 x M16	40.0	40
	4	100		8 x M20	67.0	40

Table 2

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2.2.2 Installations in Larger Size Pipelines

The flowmeter can readily be installed in larger size pipelines through utilization of flanged transition sections (e.g. Flanged Reducers per DIN 28545). The pressure drop resulting from the reduction can be determined from the Diagram Fig. 11 by 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 flow rate:
The flow velocity can also be determined from the Flow Rate Nomograph.
3. The pressure drop can be read on the – Y-axis at the intersection of the flow velocity value and the "Diameter Ratio d/D " value on – X-axis in Fig. 11.

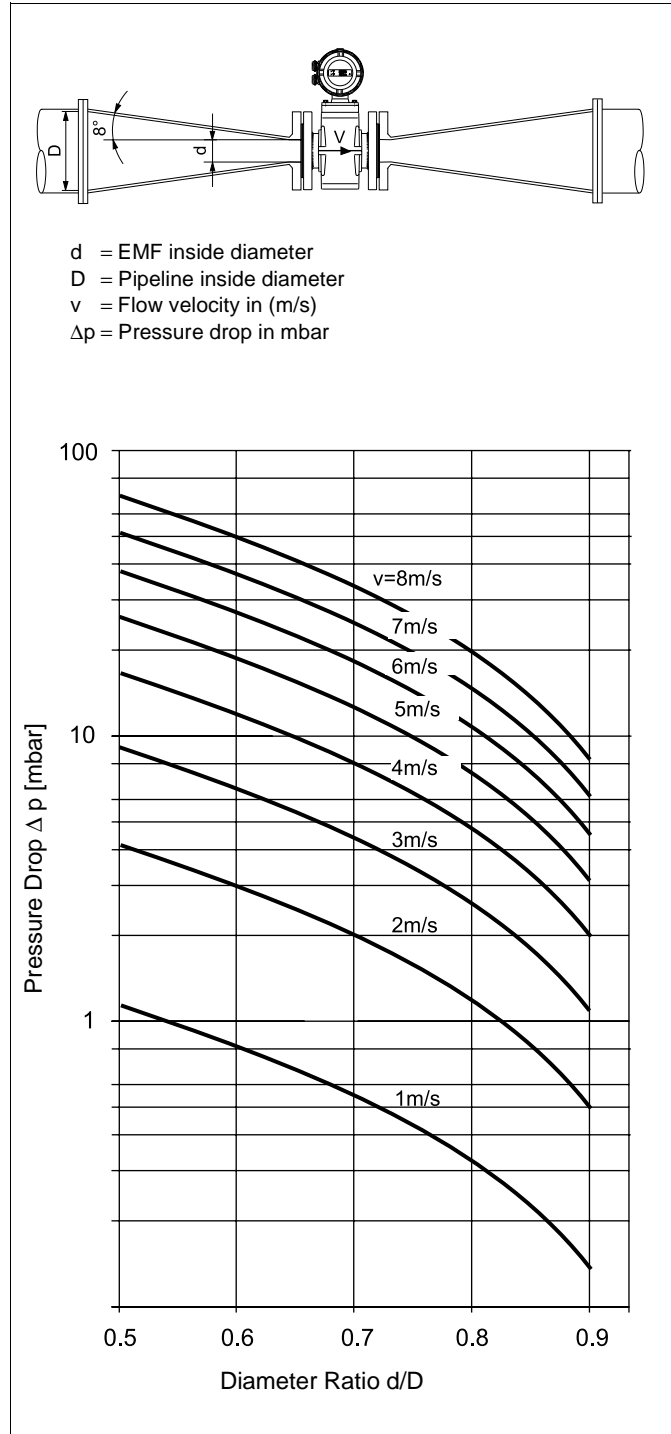


Fig. 11 Nomograph for EMF Pressure Drop Determinations Flanged Reducers with $\alpha/2 = 8^\circ$

2.2.3 Meter Sizes, Pressure Ratings, Flow Ranges

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

Flowrate Nomograph

The volume flowrate is a function of the flow velocity and the flowmeter size. The Flowrate Nomograph shows the flow range available for a particular flowmeter size as well as the flowmeter sizes suitable for a particular flowrate value.

Example:

Flowrate = 7 m³/h (maximum value = flow range end value).
 Suitable are flowmeter sizes 3/4" to 2-1/2" [DN 20 to DN 65] for a flow velocity of 0.5 to 10 m/s.

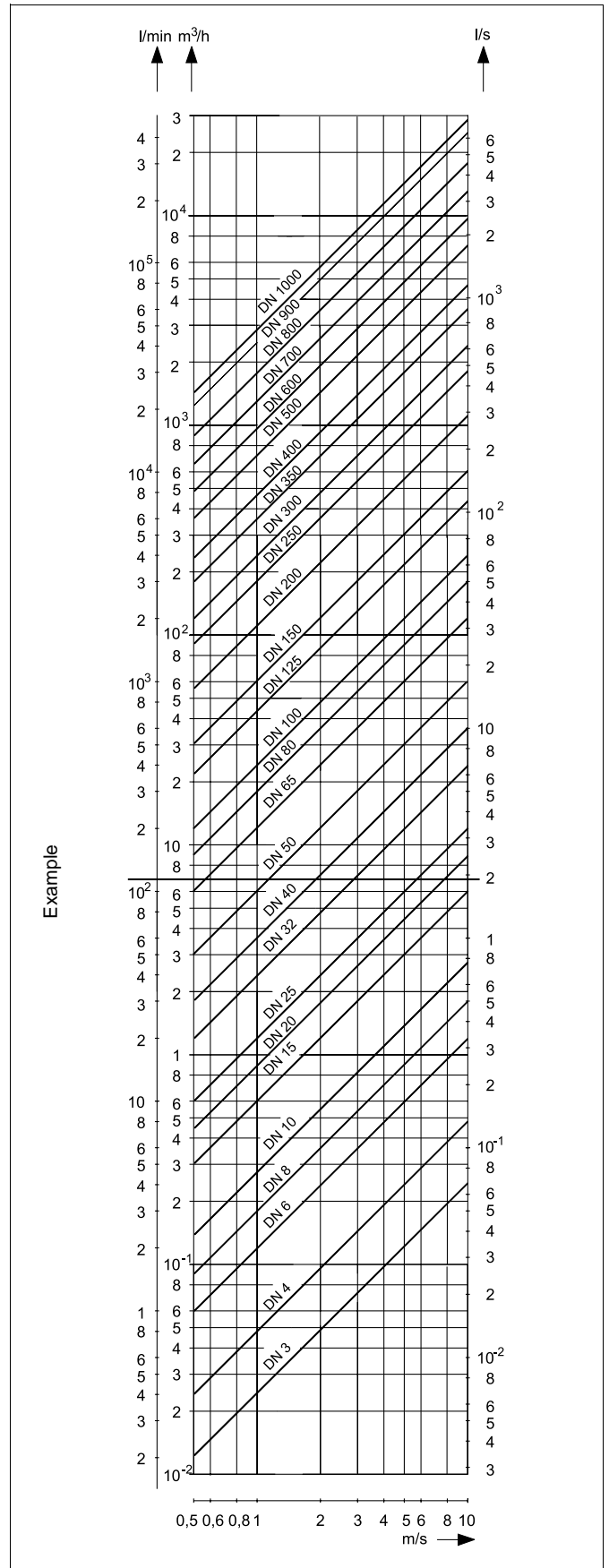


Fig. 12 Flowrate Nomograph 1/8" - 40" [DN 3 to DN 1000]

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3. Programming the Converter

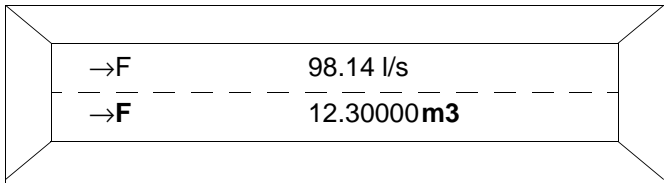
3.1 General Display Formats

After the power is turned on the Model Number of the converter is displayed in the first line and the software version together with its revision level in the second line. Then the process information values are displayed.

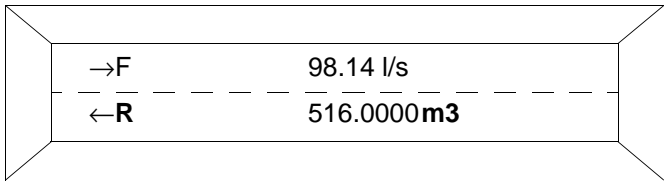
The present flow direction is indicated in the first line of the display (→F for forward or ←R for reverse) together with the instantaneous flow rate value in percent or direct reading engineering units. In the second line the totalizer value for the present flow direction is displayed to a max. of seven digits followed by the units.

The totalizer value, in the appropriated units, always represents the true value regardless of the pulse factor setting. This display combination is referred to in the text by the term process information.

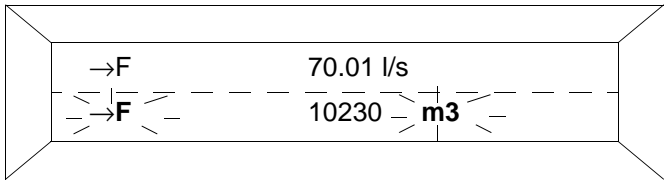
The totalizer value for the opposite flow direction can be displayed by pressing the STEP- or DATA key.



1st Line Forward direction instantaneous flowrate
2nd Line Forward direction totalizer value



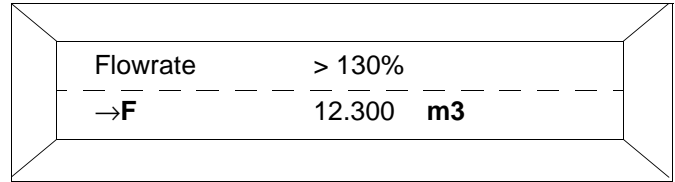
1st Line Forward direction instantaneous flowrate
2nd Line Reverse totalizer value (multiplex operation)



1st Line Forward direction instantaneous flowrate
2nd Line Totalizer overflow. → F and m3 blink.

A totalizer overflow occurs whenever the totalizer value reaches 9,999,999 units. When the totalizer value in one flow direction is greater than 9,999,999 units, the flow direction symbol (→ F or ← R) and the units (e.g. m3) blink in the 2nd line. A converter software counter can register a max. of 250 overflows. The overflow indication can be reset separately for each flow direction by pressing ENTER.

If an error is detected an error message is displayed in the 1st line.



This message is displayed alternately in clear text and then by its corresponding error code. The clear text message is only displayed for the error with the highest priority while all other detected errors are indicated by their error codes in the display.

Error Code	Clear Text	Cause
0	Empty pipe	Pipeline not full.
1	A/D saturated	A/D-Converter saturated.
2	Uref too small	Pos. or neg. reference too small.
3	Flowrate > 130 %	Flowrate greater than 130 %.
4	Zero return	Ext. zero return contact activated.
5	RAM defective	Data in RAM corrupted.
6	Totalizer	Totalizer value corrupted.
7	Urefp too large	Positive reference too large
8	Urefn too large	Negative reference too large
9	Excitation frequency	Supply power frequency or Driver/Digital board defective.
A	Max. Alarm	Max. alarm value exceeded.
B	Min. Alarm	Value below min. alarm value
C	Primary data	Error in external EEPROM or it is not installed.

Error Codes by Priority

In addition to the error message in the display an alarm signal is transmitted over an optocoupler output and the current output is set to 0 % or 130 % or 3.6 mA. The frequency output is always set to 0 % (does not apply to Error Code 6).

3.2 Data Entry

Data can be entered without removing the cover by utilizing the Magnet Stick.

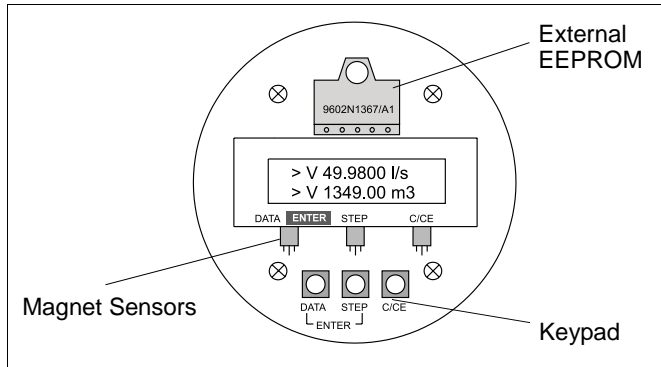


Fig. 13 Converter Keypad and Display

ENTER Function for Magnetic Stick Operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for more than 3 seconds.

The display blinks to indicate that the function is active.

The data entry is divided into two types:

- Direct numerical entries
- Entries from a menu table.



Note:

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



Note:

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

During data entry the converter remains on-line, the current and pulse outputs continue to indicate the existing operating values. The function of the individual keys is described below:

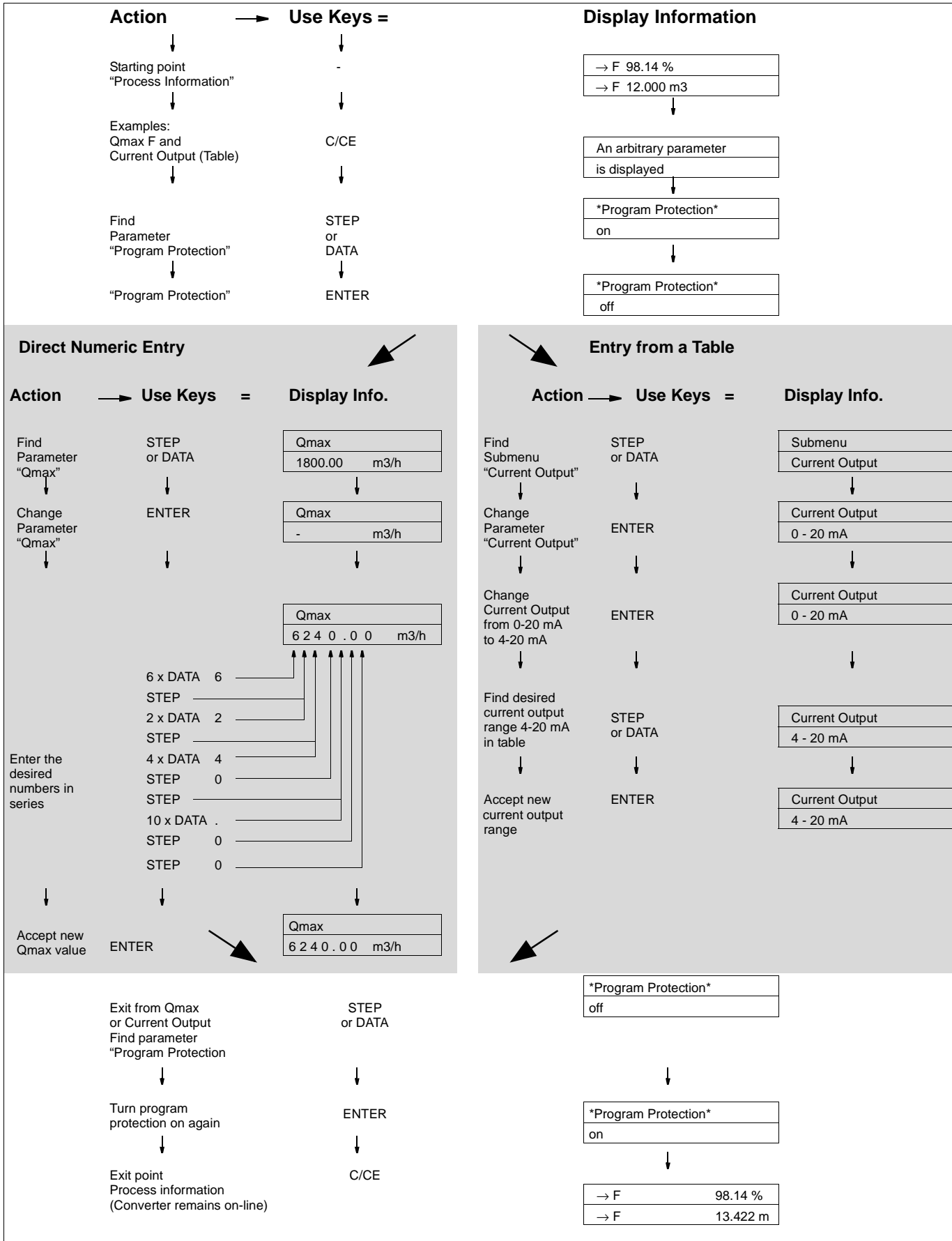
- | | |
|---------------------------------|---|
| <input type="checkbox"/> C/CE | <p>The C/CE key is used to toggle back and forth between the operating mode and the menus.</p> |
| <input type="checkbox"/> STEP ↑ | <p>The STEP-key is one of two arrow keys. STEP is used to scroll forward through the menus. All desired parameters can be accessed.</p> |
| <input type="checkbox"/> DATA ↓ | <p>The DATA-key is one of two arrow keys. DATA is used to scroll backward through the menus. All desired parameters can be accessed.</p> |
| <input type="checkbox"/> ENTER | <p>The ENTER function requires that both of the arrow keys STEP and DATA be pressed simultaneously.</p> |
| <input type="checkbox"/> STEP ↑ | <p>ENTER is used to turn the program protection on and off. Additionally, ENTER is utilized to access the values in the parameter to be changed and to accept the new values or selections.</p> |
| <input type="checkbox"/> DATA ↓ | |

The ENTER function is active only for 10 seconds. If no entries are made during this 10 second period the old value is redisplayed in the converter.

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3.3 Data Entry Instructions "Condensed Form"



3.4. Parameter Overview and Data Entry in “Condensed Form”

Submenu/Parameter	Entry Type	Comments
<div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;">* Program Prot. * on</div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 10px; display: inline-block; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">* Program Prot. * off</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">PP-Code? 0</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">* Program Prot. * off</div> </div>	<p style="text-align: center;">from table/numeric</p>	<p>Data can be entered only after the Program Protection has been turned off.</p> <p>on/off</p> <p>If a number other than “0” (factory setting) has been programmed for the Program Protection Code, the Program Protection can only be turned off after the correct PP-Code (1-255) has been entered.</p> <p>Parameters can only be changed after the Program Protection has been turned off.</p>
<div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;">Prog. Prot. Code</div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 10px; display: inline-block; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">Old PP-Code? 0</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">New PP-Code? 0</div> </div>	<p style="text-align: center;">numeric</p>	<p>After the Program Protection is turned off it is also possible to change the PP-Code.</p> <p>Enter old PP-Code 0 = Factory setting</p> <p>Enter new PP-Code (0-255)</p>
<div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;">Language English</div>	<p style="text-align: center;">from table</p>	<p>German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish. For HART-Protocol only German, English, French, Spanish</p>
<div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;">Submenu Primary</div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 10px; display: inline-block; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">Meter Size DN 250 10 In</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">Qmax DN 10 m/s 1800.00 m³/h</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">Span Cs 6.25 Hz 56.123 %</div> </div> <div style="margin-left: 40px;"> <div style="border: 1px solid black; padding: 2px; margin-left: 10px;">Zero Cz 6.25 Hz 0.1203 %</div> </div>	<p style="text-align: center;">from table</p>	<p>Present meter size See Instrument Tag on flowmeter primary</p> <p>Automatic setting based on the flowmeter size selection. Flow range end value can be set from 0.05 to 1.0 Q_{max DN}</p> <p>Flowmeter span value Cs for the selected excitation frequency, see Instrument Tag</p> <p>Flowmeter zero value Cz for the selected excitation frequency, see Instrument Tag</p>

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Submenu/Parameter	Entry Type	Comments
	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">Short model no. DE4</div>	Short Model Number of the flowmeter primary.
	<div style="border: 1px solid black; padding: 2px;">Order no. 9810N1234/A1</div>	Flowmeter Order Number. This number is identical to the one on the Instrument Tag of the flowmeter primary and on the sticker on the external EEPROM plugged into the display board.
<div style="border: 1px solid black; padding: 2px;">Qmax 400.000 m3/h</div>		Flow range for forward and reverse flow directions. Min. flow range setting 0 - 0.5 m/s Max. flow range setting 0 - 10 m/s The flow range end value (0.5 - 10 m/s) is set in this parameter. The units selection is made in the Submenu Units.
<div style="border: 1px solid black; padding: 2px;">Pulse 1.0000 /m3</div>		For int. and ext. flow totalization, range 0.001-1000 pulses per selected flow unit, max. count frequency 5 kHz. The units selection is made in the Submenu Units.
<div style="border: 1px solid black; padding: 2px;">Pulse Width 30.000</div>	numeric	For external pulse output. Pulse width can be set between 0.1 ms and 2000 ms.
<div style="border: 1px solid black; padding: 2px;">Low Flow Cutoff 1.000 %</div>	numeric	Range 0-10 % of the flow range setting, applies to the display indication and all outputs. If the flowrate is below the low flow cut-off value, the flowrate measurements are stopped.
<div style="border: 1px solid black; padding: 2px;">Damping 10.0000 s</div>	numeric	Range 0.5 - 99.9999 s, Response time for the current output to reach 99 % of a flowrate step change
<div style="border: 1px solid black; padding: 2px;">Filter on</div>	numeric	On / off Standard is off. If the output signal is noisy, turn filter on and set damping time > 2.4s.
<div style="border: 1px solid black; padding: 2px;">Density 2.54300 g/cm3</div>	numeric	Range 0.01 - 5 g/cm3. For mass flow rate display and totalization in g, kg, t, uton or pounds.
<div style="border: 1px solid black; padding: 2px;">System-Zero 3.5 Hz</div>		Zero value display
<div style="border: 1px solid black; border-radius: 50%; padding: 5px; width: 30px; margin: 0 auto;">ENTER</div>	<div style="border: 1px solid black; padding: 2px;">Adjust manual</div>	Manual entry
<div style="border: 1px solid black; border-radius: 50%; padding: 5px; width: 30px; margin: 0 auto;">ENTER</div>	<div style="border: 1px solid black; padding: 2px;">Adjust automatic</div>	Valves must be closed. Flowmeter must be full and flow must be at zero. The automatic zero adjustment is initiated by pressing ENTER.

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Submenu/Parameter	Entry Type	Comments
Submenu Units	from table/numeric	<p>Exit the submenu</p> <p>C/CE</p> <p>ml/s, ml/min, ml/h, l/h, l/min, l/day, lbs/s, lbs/min, lbs/h, uton/min, uton/h, uton/day, l/s, l/min, l/h, hl/s, hl/min, hl/h, m3/s, m3/min, m3/h, igps, igpm, igph, mgd, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, kgal/s, kgal/min, kgal/h</p> <p>ml, l, hl, m3, ical, gal, mgal, bbl, bls, kg, t, g, l, lb, uton, kgal</p> <p>If the desired units are not included in the table, it is possible to configure a user defined unit, based on liters. The value shown, 3785.41, is the conversion factor for kgal (Factory setting).</p> <p>Four character name for the user configured unit.</p> <p>Programmable unit for mass (with density) or volumetric flow (without density)</p>
Submenu Alarm	from table/numeric	<p>Exit the submenu</p> <p>C/CE</p> <p>All detected errors (Errors 0-9, A, B, C) are stored. The error register can be cleared by pressing ENTER.</p> <p>Limit alarm, range 0 - 130 % of the flow range setting. Can be set in steps of 1 %, switching hysteresis 1 %.</p> <p>Limit alarm, range 0 - 130 % of the flow range setting. Can be set in steps of 1 %, switching hysteresis 1 %.</p>
Submenu Prog. In-/Output	from table	<p>Contact output, Terminal P7/G2 selections (for Profibus terminals Ux/P7): General alarm¹⁾, empty pipe¹⁾, F/R signal, no function, MAX-Alarm¹⁾, MIN-Alarm¹⁾, MAX/MIN-Alarm¹⁾</p> <p>¹⁾ Contact input can be configured to "Open or Close".</p> <p>Contact input, Terminal X1/G2 selections: External zero return, external totalizer reset, external totalizer stop, no function. For HART-Protocol the external totalizer stop function is not available. The contact input is not available for Profibus.</p>

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Submenu/Parameter	Entry Type	Comments
<div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Submenu Current Output </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 2px 5px; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 5px;"> Current Output 0 - 20 mA </div> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> lout at Alarm 130 % </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Submenu Data Link </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 2px 5px; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 5px;"> Communication ASCII </div> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Instr. Address 004 </div>	<p>from table</p> <p>from table/numeric</p>	<p>This menu is not displayed for Profibus DP or ASCII-Communication. For the HART-Protocol the current output is fixed at 4-20 mA! If an Instrument Address greater than 0 is set in the Submenu Data Link for HART Protocol, the instrument operates in the Multidrop Mode. The current output is fixed at 4-20 mA.</p> <p>Selections: 0-20 mA / 4-20 mA, 0-10 mA / 2-10 mA, 0-5 mA / 0-10 mA, 10-20 mA / 4-12 mA, 12-20 mA</p> <p>Current output settings during an alarm condition, 0%; 3.8 mA or 130%. For Error 3 (Flowrate > 130%), always 130%</p> <p style="text-align: center;"> C/CE Exit the submenu </p> <p>The Submenu Data Link is only visible when that option has been ordered and recognized by the converter. See ASCII-, HART- or Profibus-Communication Instruction Bulletins for the appropriate option for more detailed information.</p> <p>Profibus DP, Profibus PA, ASCII, ASCII2w.</p> <p>Communication Profibus PA (available if meter with this option has been ordered) With Profibus PA communication the menu-structure will be as follows:</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Communication Profibus PA </div> <p>This is for information purposes only. There is no further parameter-setting possible. Instrument address is 126 (Default Value). The address can be changed by Profibus communication on the bus.</p> <p>HART protocol communication (available if meter with this option has been ordered) With HART-protocol communication the menu-structure will be as follows:</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Communication HART </div> <p>This is for information purposes only. There is no further parameter-setting possible.</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Instr. address 000 </div> <p>For HART-protocol, Instrument address: 0-15. (Multidrop-Mode for addresses greater than 0)</p> <p>Communication Profibus DP or ASCII-Communication (available if meter with this option has been ordered) With Profibus DP or ASCII communication the menu-structure will be as follows:</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Communication Profibus DP </div> <p>Profibus DP, ASCII or ASCII2w are selectable.</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px;"> Slave-Adr. 008 </div> <p>The instrument address on the Profibus DP can be set accessing this menu or by Profibus DP communication on the bus itself. The instrument address has to be set using 3 digits (e.g. 065). Range of addresses: 0-126. Default Value: 126</p>



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Submenu/Parameter	Entry Type	Comments
<div style="border: 1px solid black; padding: 2px; width: fit-content;">Function Param.-Profib. DP</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">Submenu Function Test</div>	 <div style="border: 1px solid black; padding: 2px; width: fit-content;">Baudrate 4800 Baud</div> from table/numeric	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Function Param.-Profib. DP</div> <p>This is for information purposes only. There is no further parameter-settings possible. For detailed description refer to special manual „data link description for Profibus DP“.</p> <p>If ASCII or ASCII2w communication is choosen, the menu „Instr. Address“ will be displayed instead of the menu „Slave - Adr“ and the menu „function“. Additional the menu „Baudrate“ will be displayed with ASCII or ASCII2w communication.</p> <p>If multiple instruments are connected to a single bus (RS485 with ASCII protocol), each instrument must have a different address. Accessing the menu „Instr. address“ the instrument address can be set. (Range: 0-99). The Baudrate setting has to be made in the menu „Baudrate“ (110 bis 28800 Baud).</p>
		<p>Baudrate: Setting range 110-28800 Baud.</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 2px; width: fit-content;">ENTER</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Function Test Iout</div>	<div style="border: 1px solid black; border-radius: 10px; padding: 2px; width: fit-content;">C/CE</div> <p>Exit the submenu</p> <p>Function test current output, Enter data in mA. Function test pulse output. For additional information see Sect. 4.17</p>
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Function Test RAM (ASIC)</div>	<p>Automatically function test internal assemblies. Test. RAM (ASIC), NVRAM, EPROM (Program), EEPROM, ext. EEPROM. Also tests additional functions: terminals P7/G2, switch S201, display, terminals X1/G2, Simulation and Test Mode. For additional information see Sect. 4.17</p>
<div style="border: 1px solid black; padding: 2px; width: fit-content;">Submenu Empty Pipe Det.</div>	from table/numeric	<p>Off = Detector turned off On = When flowmeter is empty, message displayed. The following menus are visible when the Empty Pipe Detector is turned “on”.</p> <p>Current output value when an empty pipe is detected: For 0-20 mA, 0 or 26 mA can be selected. For 4-20 mA, 3.8 or 26 mA can be selected. For Error 3 Flowrate > 130 % the current is always set to 26 mA.</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 2px; width: fit-content;">ENTER</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Empty Pipe Det. on</div>	<p>On = When flowmeter is empty, signal on contact P7/G2 or Ux/P7 Off = When flowmeter is empty, <u>no</u> signal to contact.</p>
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Iout at E. Pipe 130 %</div>	<p>Threshold 2.300 Hz</p>
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Alarm Empty Pipe on</div>	<p>Fill flowmeter with fluid. Set adjustment value to +2000 Hz. Empty flowmeter, the adjustment value must be greater than the threshold value.</p>
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Threshold 2300 Hz</div>	
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Adjust Empty Pipe Det.</div>	

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Submenu/Parameter	Entry Type	Comments
Submenu Totalizer	from table/numeric	 Exit the submenu
ENTER	Totalizer → V reset	The forward direction totalizer value is reset by pressing ENTER. If the overflow value is > 0, then only reset overflow → F is displayed.
	Totalizer → V 4697.00 m3	Preset the totalizer (totalizer value can be set) 2nd Display line = present value
	Overflow → V 250	Overflow counter, max 250, 1 overflow = pulse totalizer > 9,999,999 units (display value is reset and overflow counter incremented by 1).
	Totalizer ← R reset	See forward totalizer
	Totalizer ← R 625.000 m3	See forward totalizer
	Overflow ← R 004	See forward overflow counter
	Total. Function Standard	Standard = separate totalization of the forward and reverse flow values, each on its own totalizer. Difference totalizer = forward and reverse flows are totalized and displayed as a single value.
Submenu Display	from table	 Exit the submenu
ENTER	1. Line Q [%]	Selections for the 1st display line: flow rate in %, direct reading engineering units, mA, totalizer, totalizer forward, totalizer reverse, TAG-Number or bargraph
	2. Line Totalizer	See 1st Line
	1. Line multipl. Q [Bargraph]	In addition to the values displayed in the 1st line it is possible to display another value in multiplex operation: Flow rate in %, eng'g units, mA, totalizer, totalizer forward, totalizer reverse, TAG-Number, bargraph or off. Display alternates every 10 secs.
	2. Line multipl. off	See 1st line multiplex.

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Submenu/Parameter	Entry Type	Comments
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> Submenu Operating Mode </div>	from table <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 2px 5px; margin-right: 5px;">ENTER</div> <div style="border: 1px solid black; padding: 2px; margin-left: 5px;"> Operating Mode Standard </div> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> Flow Direction Forward/Reverse </div> <div style="border: 1px solid black; padding: 2px;"> Direction Indic. normal </div>	<div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 2px 5px; margin-right: 5px;">C/CE</div> <div style="margin-left: 5px;">Exit the submenu</div> </div> <p>Standard/Fast Standard: continuous flow rate metering Fast: accelerated signal processing (short time batch operation or pulsating flows)</p> <p>Selection of the flow direction forward/reverse or forward only.</p> <p>Normal/Inverse Reverse the flow direction indicators Normal = forward, inverse = reverse</p>
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> Load data from Ext. EEPROM </div>	from table	When a converter is exchanged all the data are automatically uploaded from the external EEPROM when the power is turned on. A command to store all the data in the external EEPROM is also available.
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> Store data in Ext. EEPROM </div>	from table	After start-up the parameter settings should be stored in the external EEPROM.
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> Model Number 03/99 Part Number B.10 </div>		Display of the software version being used. 03/99 = Date of the release B.10 = Revision level
<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> TAG Number </div>		An alphanumeric TAG-number with up to 16 characters, including upper and lower case letters, can be entered to identify the meter location. For HART-Protocol the TAG-Number is limited to 8 characters. Any lower case letters are also automatically converted to upper case letters.
<div style="border: 1px solid black; padding: 2px;"> Service-Code </div>	numeric	Only for ABB Automation Products.

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4. Parameter Entry

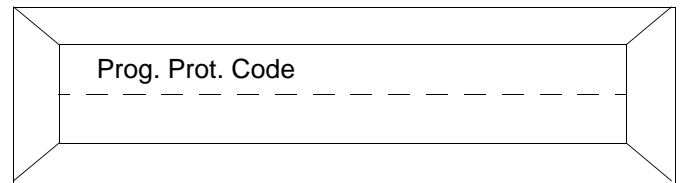
- 4.1 Program Protection
- 4.2 Language
- 4.3 Submenu Primary
- 4.3.1 $Q_{\max DN}$ for the Meter Size at 10 m/s
- 4.4 Q_{\max}
- 4.5 Pulse Factor Forward and Reverse
- 4.6 Pulse Width
- 4.7 Low Flow Cutoff
- 4.8 Damping
- 4.9 Filter (Noise Reduction)
- 4.10 Density
- 4.11 System Zero
- 4.12 Submenu "Units"
- 4.12.1 Units Qmax
- 4.12.2 Units Flow Totalizer
- 4.12.3 User Programmable Units
 - 4.12.3.1 Units Factor
 - 4.12.3.2 Unit Name
 - 4.12.3.3 Programmable Units
- 4.13 Submenu Alarm
 - 4.13.1 Error Register
 - 4.13.2 Setting the MAX-Alarm
 - 4.13.3 Setting the MIN-Alarm
- 4.14 Submenu "Programmable In/Output"
 - 4.14.1 Contact Output Terminals P7/G2
 - 4.14.1.1 General Alarm
 - 4.14.1.2 Empty Pipe
 - 4.14.1.3 Forward/Reverse Direction Signal
 - 4.14.1.4 No Function
 - 4.14.1.5 MAX-Alarm
 - 4.14.1.6 MIN-Alarm
 - 4.14.1.7 MAX/MIN-Alarm
 - 4.14.2 Terminals X1/G2
 - 4.14.2.1 External Zero Return
 - 4.14.2.2 External Totalizer Reset
 - 4.14.2.3 External Totalizer Stop
 - 4.14.2.4 No Function
- 4.15 Submenu "Current Output"
 - 4.15.1 Current Output
 - 4.15.2 Iout at Alarm
- 4.16 Submenu "Data Link"
 - 4.16.1 Communication
 - 4.16.2 Instrument Address
 - 4.16.3 Baudrate
- 4.17 Submenu "Function Test"
- 4.18 Submenu "Empty Pipe Detector"
 - 4.18.1 Detector on/off
 - 4.18.2 Alarm "Empty Pipe"
 - 4.18.3 Iout for Empty Pipe
 - 4.18.4 Threshold
 - 4.18.5 Adjust "Empty Pipe Detector"
- 4.19 Submenu "Totalizer"
 - 4.19.1 Reset Totalizer and Overflow Values Fwd., Rev.
 - 4.19.2 Totalizer Function
 - 4.19.2.1 Totalizer Function Standard
 - 4.19.2.2 Totalizer Function Difference Totalizer
- 4.20 Submenu "Display"
 - 4.20.1 Display 1st Line
 - 4.20.2 Display 2nd Line
 - 4.20.3 1st Display Line Multiplex

- 4.20.4 2nd Display Line Multiplex
- 4.21 Submenu "Operating Mode"
 - 4.21.1 Operating Mode "Standard/Fast"
 - 4.21.2 Flow Direction
 - 4.21.3 Flow Direction Indicators
- 4.22 Load Data from External EEPROM
- 4.23 Store Data in External EEPROM
- 4.24 Software Version
- 4.25 TAG-Number
- 4.26 Service Code Number

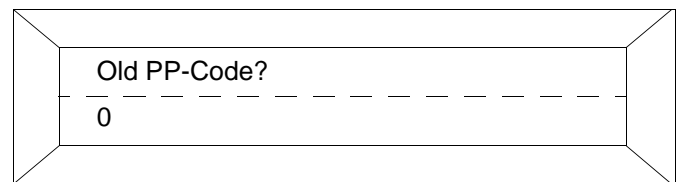
4.1 Program Protection

Parameters can be changed after the power has been turned on only when the program protection is turned off. There are two procedures for turning the program protection off:

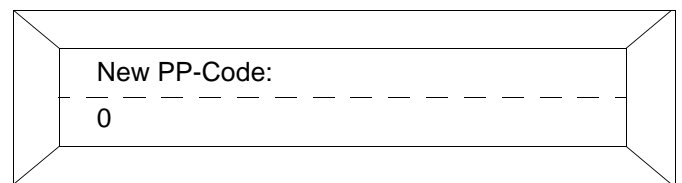
1. If the Program Protection Code (PP-Code) is set to "0" (Factory setting), then the program protection can be turned off by pressing ENTER.
2. If the Program Protection Code is set to any other value (1-255), then this number must be entered before the program protection can be turned off. It is possible to change the Program Protection Code after the program protection is turned off.



For security reasons the old PP-Code number must be entered after pressing ENTER before the PP-Code can be changed.



After the value has been entered press ENTER.



Enter the new PP-Code number (1-255) and accept by pressing ENTER. The newly entered PP-Code is now valid for turning the program protection off.

Note:

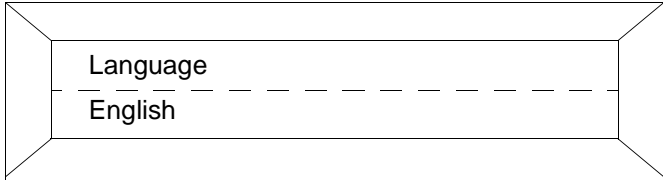
During data entry the values entered are checked for plausibility and if necessary, rejected, and an appropriate message displayed.

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4.2 Language Entry from table

It is possible to select one of nine languages for the display texts. The desired language can be selected using the ARROW keys.



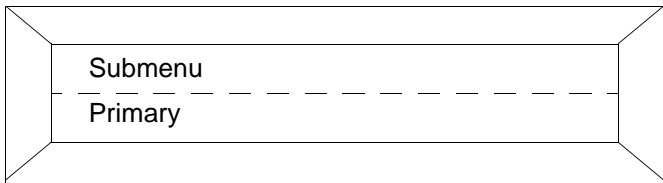
The following languages are available:

Language

German, English, French, Italian, Spanish, Finnish, Dutch, Danish, Swedish.

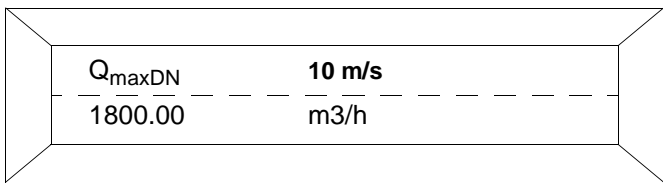
For HART Protocol only German, English, French and Spanish are available.

4.3 Submenu Primary



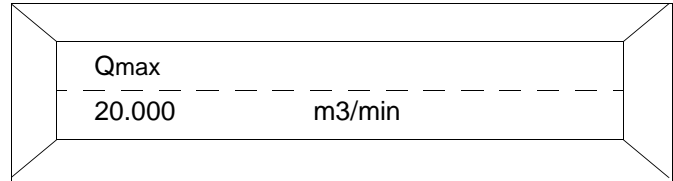
This submenu includes the various parameters specific to the flowmeter primary including meter size. They cannot be changed. Included are Meter Size, Span Cs, Zero Cz, Short Model Number and the Order Number. These data also are stamped on the Instrument Tag of the flowmeter primary. They must be identical!

4.3.1 $Q_{\max DN}$ of the Meter Size at 10 m/s



$Q_{\max DN}$ is the maximum flowrate for the flowmeter size and is equivalent to a flow velocity of 10 m/s. $Q_{\max DN}$ is automatically set based on the flowmeter primary size selected.

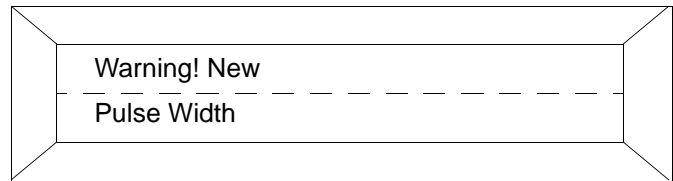
4.4 Qmax Numeric entry



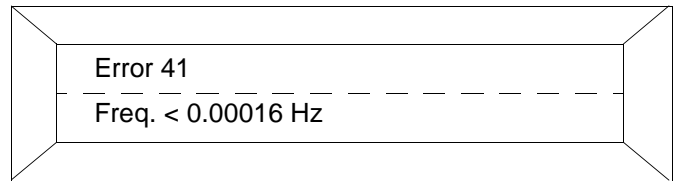
The flow range end value Q_{\max} , applies to both flow directions. The flow range end value can be set between $0.05 Q_{\max DN}$ and $1.0 Q_{\max DN}$.

The selection is made with the STEP and DATA keys. The units are selected in Submenu "Units".

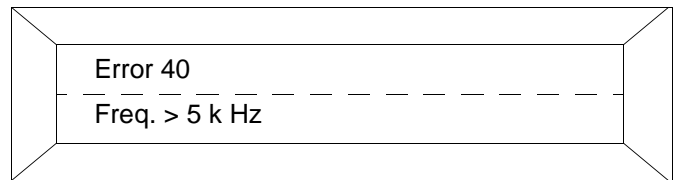
The values for the totalizer functions are checked based upon the selections for the pulse factor (0.01 to 1000 pulses/unit), the pulse width (0.1 ms to 2000 ms), the totalizer units (e.g. ml, l, m3) or mass units (e.g. g, kg, t) together with the density correction factor. If any of these parameters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



If the output frequency is too small the following message is displayed:

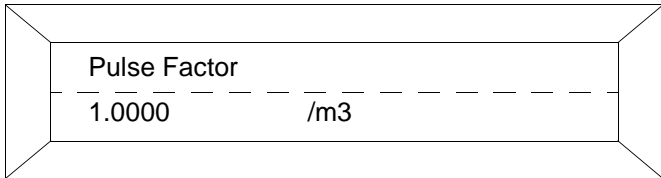


If the output frequency is too large the following message is displayed:

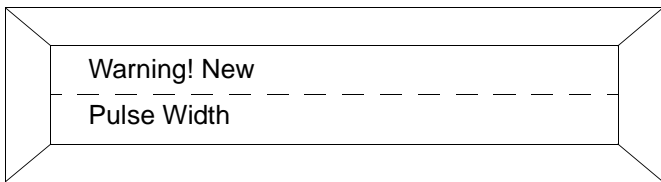


4.5 Pulse Factor Forward and Reverse Numeric entry

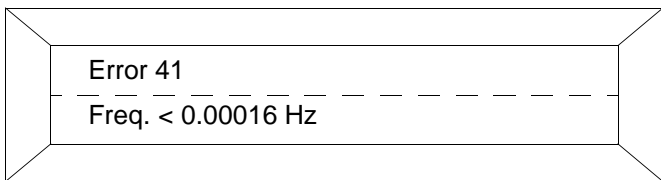
The pulse factor is equivalent to the number of pulses for one measured flow unit for the external output terminals V8/V9, or terminals Ux/V8 and for the internal flow totalizer.



If the pulse factor value is changed, the totalizer value is maintained in the units selected. The pulse factor can be set in the range from 0.001 to 1000 pulses/unit. The pulse factor entered is checked against the selections for the flow range, the pulse width (0.1 ms to 2000 ms), the totalizer units (e.g. ml, l, m3) or mass units (e.g. g, kg, t) together with the density correction factor. If any of these parameters are changed, the pulse width cannot exceed 50 % of the period of the output frequency at 100% flowrate (on/off ratio 1:1). If the pulse width entered is greater it is automatically reduced to 50 % of the period and the following message is displayed:



If the output frequency is too small the following message is displayed:



4.6 Pulse Width Numeric entries

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

Example:

Flow range= 100 l/min (Qmax = 100 %, flow range end value)

Totalizer = pulses/liter

$$f = \frac{100 \text{ pulses/min}}{60 \text{ s}} = 1.666 \text{ Hz}$$

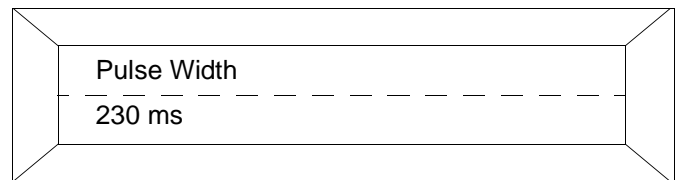
and to cover the case when the flow range end value is exceeded by 30 %

$$f = 1.666 \text{ Hz} \cdot 1.3 = 2.166 \text{ Hz (1/s)}$$

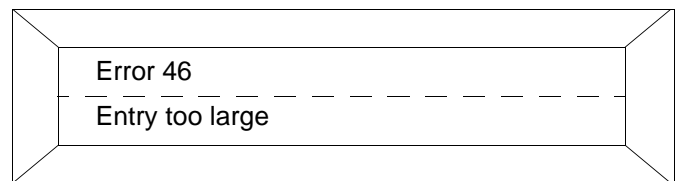
On/off ratio of 1:1 (pulse on width = off width)

$$t_p = \frac{1}{2.166 \text{ s}^{-1}} \cdot 0.5 = 230 \text{ ms}$$

It would also be possible to set any value < 230 ms. Counters usually require a pulse width ≥ 30 ms.



The converter automatically checks the pulse width setting. If its limit is exceeded, the new value is not accepted and the following error message is displayed.



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4.6.1 Supplementary Pulse Output Information

When connecting an active or passive counter the allowable current and pulse frequency limits must be considered.

Examples:

A 24 V electromechanical counter is to be connected:
 The max. output frequency may not exceed 4 Hz., i.e. a maximum of 4 pulses/second maximum (≤ 14400 pulses/hour) at a pulse width ≤ 50 ms. A current between 20 and 150 mA can be applied across the resistance of the counter. The 24 V pulse drops off exponentially under load, i.e. at a voltage of 16 V the pulse width is $T_{16V} \leq 25$ ms for a parameter setting for the pulse width of ≤ 50 ms and a on/off ratio $\geq 1:4$ ($T_{ON}:T_{OFF}$).

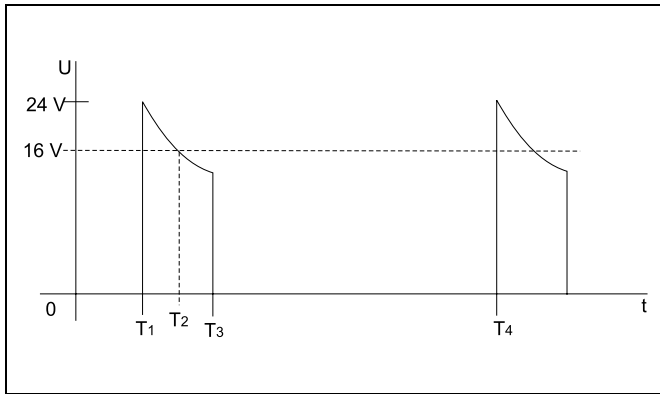


Fig. 14

$$T_{16V} = T2 - T1 (\leq 25 \text{ ms}) \quad T_{Pulse} = T3 - T1 (T_{ON} \leq 50 \text{ ms})$$

$$T_{OFF} = T4 - T3 \quad R_L = 24 \text{ F/I}$$

$$I = 20 \text{ mA} - 150 \text{ mA}$$

A 24 V passive counter is to be connected:
 The max. output frequency is 5 kHz.

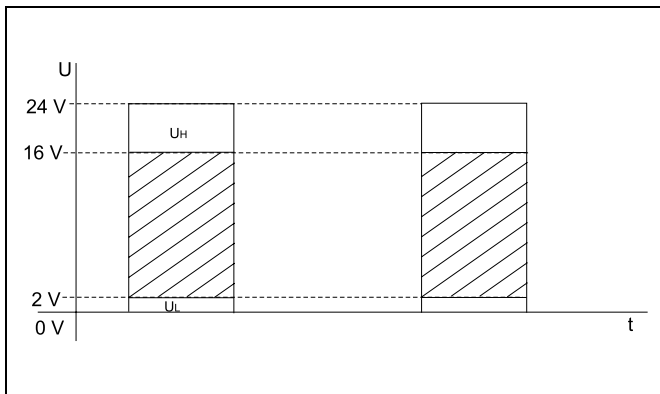


Fig. 15

Voltage

$$0 \text{ V} \leq U_L \leq 2 \text{ V}$$

$$16 \text{ V} \leq U_H \leq 24 \text{ V}$$

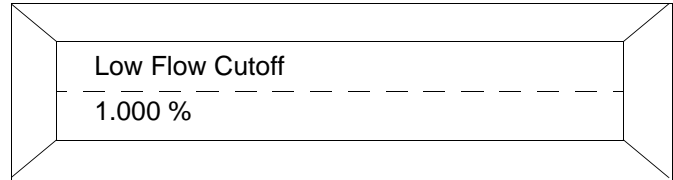
Current

$$2 \text{ mA} \leq I \leq 20 \text{ mA}$$

4.7 Low Flow Cutoff Numeric entries

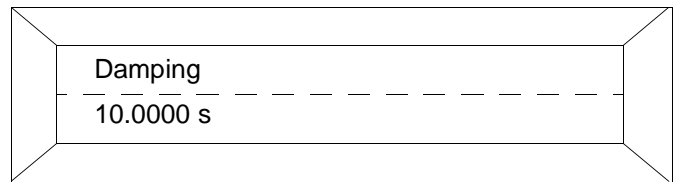
The low flow cutoff value can be set between 0 and 10.0 % of the flow range end value. Between zero flow and the low flow cutoff limit the flow is not integrated. The current output is set to its zero value.

A 1 % hysteresis is incorporated in the low flow cutoff limit.



4.8 Damping Numeric entries

The damping can be set in the range from 0.5 to 99.9999 s. The entry refers to the response time for the output to reach 99 % of its final value for a step change in the flowrate. It is effective for the indicated values in the display and the current output.



4.9 Filter (Noise Reduction) Entry from table

A digital filter is included in the converter especially for pulsating or noisy flow signals. It smooths the indications in the display and the current output. When the filter is turned on the damping value setting can be reduced. The converter response time is not affected.

The "Filter" mode is selected using the STEP or DATA keys and turned on by pressing ENTER. The filter is active when a damping time > 2.4 s is set. For HART-Protocol there is no relationship between the Filter and the Damping settings.

Noise Reduction Response

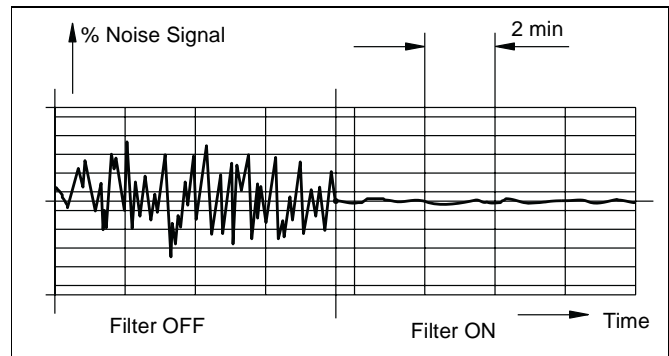
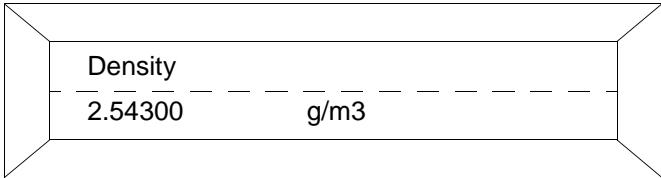


Fig. 16 Noise Reduction

The output signal of the converter is shown with the filter OFF and ON.

4.10 Density Numeric entry

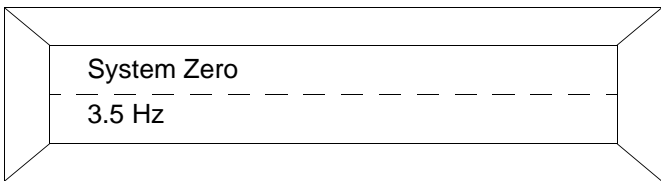
When the flowrate indication and the totalization are to be in mass units, g, kg, t pounds or uton, a fixed density value can be entered for the calculations. The conversion to mass flowrate can be set in the range from 0.01 to 5.00000 g/cm³.



4.11 System Zero Numeric entries

After the installation has been completed the zero should be adjusted at the converter. The flowrate is to be reduced to zero. The adjustment can be made automatically by the converter. A manual entry is also possible. The zero value is set to 0 Hz when the C/CE key is pressed. A measured output frequency value can then be entered as the correction value. Select the parameter "System Zero" and press ENTER.

For security the following message is displayed:



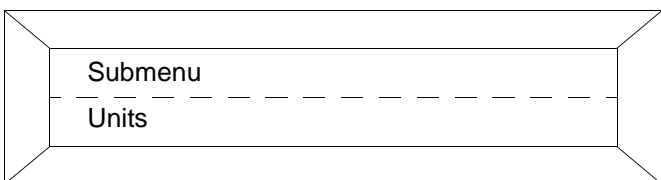
The choice between "manual" and "automatic" can be made using the STEP or DATA keys. The converter initiates the automatic adjustment procedure when ENTER is pressed. The values in the display count down from 255 to 0. The adjustment procedure is repeated 4 times. The final zero value must be within the limits set in the converter of ± 50 Hz. If the value is outside of the limits the zero adjustment is not completed. The value determined by the converter is displayed in the 2nd line.

4.12 Submenu Units

The following parameters are included in this submenu:

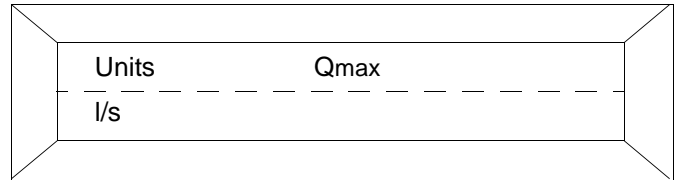
- Engineering **Units Qmax**
- Engineering **Units Qmax**
- Engineering units with **Units Factor**, user programmable
- **Unit Name**, user programmable and
- **Prog. Units** with/without density correction.

The last three entry parameters are required for any new user units which are not included in the program or in the table in Sect. 4.12.1. When this function is utilized the factory set unit "kgal" is cleared.



4.12.1 Units Qmax Entry from table

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



Units	Qmax
Liter	l/s l/min l/h
Hectoliter	hl/s hl/min hl/h
Cubic meter	m ³ /s m ³ /min m ³ /h m ³ /d
Imperial gallon	igps igpm igph igpd
U.S. million gallons per day	mgd
U.S. gallon	gpm gph
Barrels, Brewery	bb/s bb/min bb/h
Barrels, Petrochemical	bls/day bls/min bls/h bbl/d
Kilogram	kg/s kg/min kg/h kg/d
Ton	t/s t/min t/h t/d
Gram	g/s g/min g/h
Milliliter	ml/s ml/min ml/h
Megaliter	MI/min MI/h MI/day
Pound (454 g)	lbs/s lbs/min lbs/h
US-Ton	uton/min uton/h Uton/day

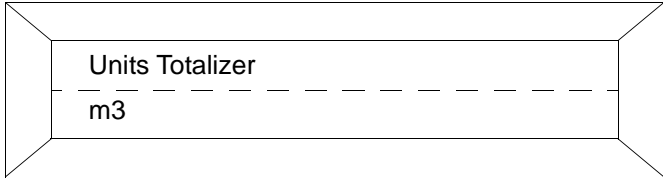
The units selected apply to Q_{maxDN}, Qmax and to the instantaneous flowrate values in the display when they are displayed in direct reading engineering units.

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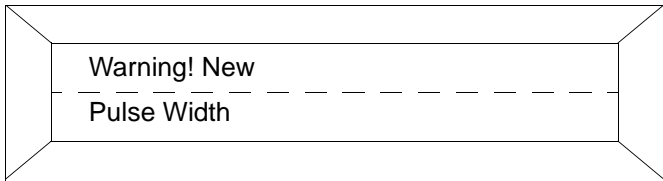
4.12.2 Units Totalizer Entry from table

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

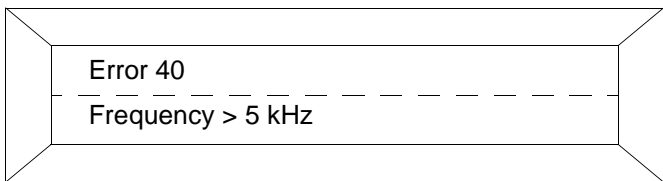


Units: ml, Ml, lb, uton, kgal, l, hl, m3, igal, gal, mgal, bbl, bls, kg, t, g.

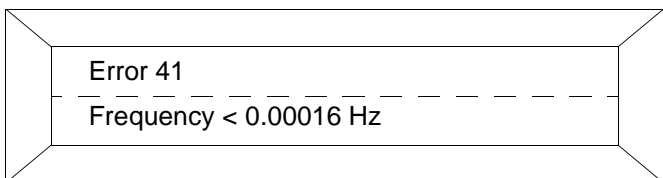
The engineering units selected for the totalizer values are checked by the converter as a function of the flow range, the pulse factor (0.01 to 1000 pulses/unit), the pulse width (0.1 ms to 2000 ms) and the density correction factor when mass units (g, kg, t) have been selected. If any of these parameters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



If the output frequency is too large the following message is displayed:



If the output frequency is too small the following message is displayed:



4.12.3 User Programmable Units

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

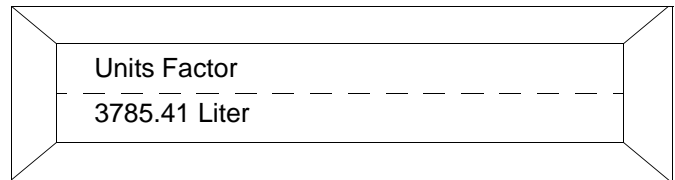
- Units factor
- Unit name
- Programmable units with/without density

Note:

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

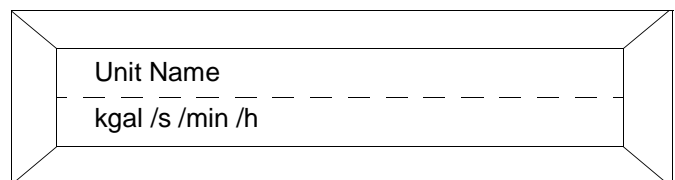
4.12.3.1 Units Factor Numeric entry

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



4.12.3.2 Unit Name Entry from table

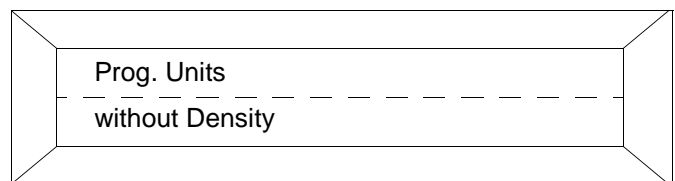
The selection is made with the STEP and DATA keys. Scroll through the alphabet forward with DATA. The lower case letters appear first followed by the upper case letters. Pressing the STEP key shifts the entry location. A maximum of four characters can be entered.



The time units /s, /min and /h can be selected for the entered engineering unit.

4.12.3.3 Programmable Units Entry from table

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

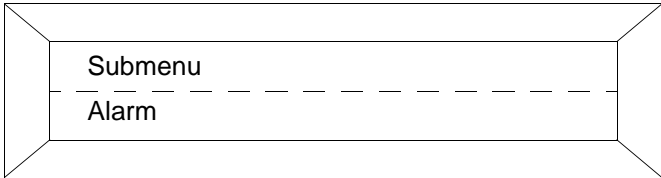


4.13 Submenu Alarm

Entry from table

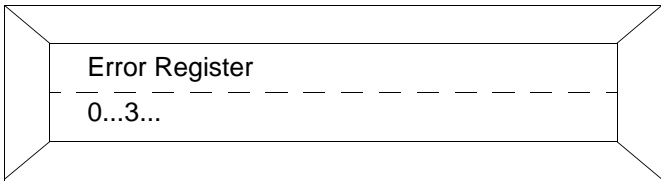
The functions incorporated in this menu can be selected using the STEP and DATA keys after ENTER is pressed.

Error Register	(4.13.1)
MAX-Alarm	(4.13.2)
MIN-Alarm	(4.13.3)

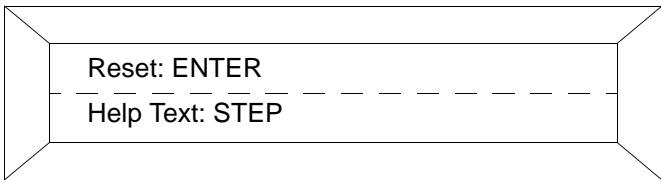


4.13.1 Error Register

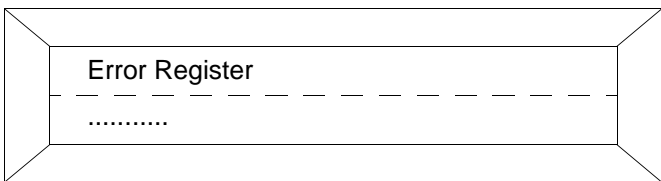
All detected errors (Error 0 to 9, A to C) are stored in this register. All detected errors will remain stored until the register is manually reset (using the ENTER key). In the example, Error 0 (Empty Pipe) and Error 3 (Flowrate > 130 %) have been registered since the last reset.



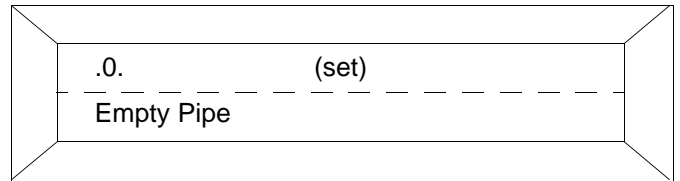
The following display appears after pressing ENTER:



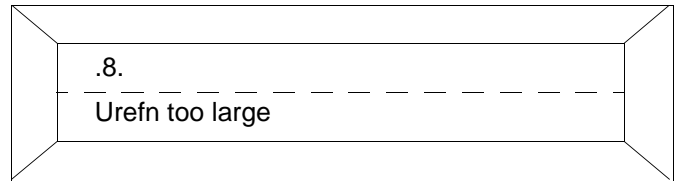
After pressing ENTER the error register is cleared.



Press the STEP key to access the help text which displays a clear text description for each error code.

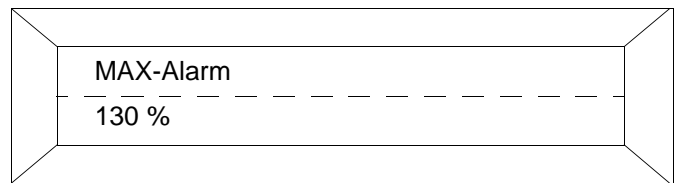


Error 0 = Empty pipe



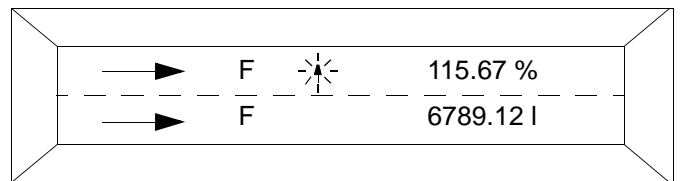
Error 8 = negative reference voltage too large
Exit the help text information by pressing C/CE.

4.13.2 Setting the MAX-Alarm



The limits for the desired MAX-Alarm value can be set in 1 % steps from 0 % to 130 %. This value applies to both the forward and reverse flow directions.

When MAX-Alarm is selected the contact is actuated when the flowrate exceeds the limit value set. If this occurs, an upward pointing blinking arrow is displayed.



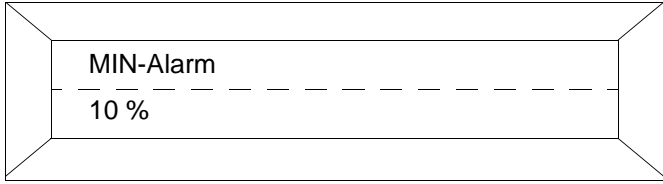
MAX-Alarm limit value = 110 %

For flowrates >110 % a upward pointing blinking arrow is displayed next to the flow direction indicator in the 1st line. If the MAX-Alarm value is set to 0 %, the option is turned off and no alarm arrow is displayed when the flowrate exceeds the value.

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4.13.3 Setting the MIN-Alarm

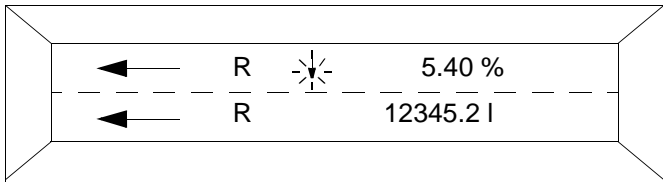


The limits for the desired MIN-Alarm value can be set in 1 % steps from 0 % to 130 %. This value applies to both the forward and reverse flow directions.

Note:

The limit values for the MAX- and MIN-Alarms incorporate a hysteresis of 1 %.

When MIN-Alarm is selected the contact is actuated when the flowrate drops below the limit value set. If this occurs, a downward pointing blinking arrow is displayed.



MIN-Alarm limit value = 10 %

For flowrates < 10 % a downward pointing blinking arrow is displayed next to the direction indicator in the 1st line. If the MIN-Alarm value is set to 0 %, the option is turned off and no alarm arrow is displayed when the flowrate drops below the value.

4.14 Submenu "Prog. In-/Output" Entry from table

In this submenu various in- and output functions can be programmed for the contact terminals P7/G2 or X1/G2.

Output functions: Terminals P7/G2

Input functions: Terminals X1/G2.

For Profibus-Communication the contact input terminals (X1/G2) are not available and the output functions are assigned to terminals Ux/P7.

4.14.1 Contact Output Terminals P7, G2 (Ux, P7 for Profibus)

The functions which can be assigned to the output contact terminals P7, G2 are listed below:

General alarm (Errors 0-9, A, B)	(4.14.1.1)*
Empty pipe	(4.14.1.2)*
F/R direction signal	(4.14.1.3)
No function	(4.14.1.4)
MAX-Alarm	(4.14.1.5)*
MIN-Alarm	(4.14.1.6)*
MAX/MIN-Alarm	(4.14.1.7)*

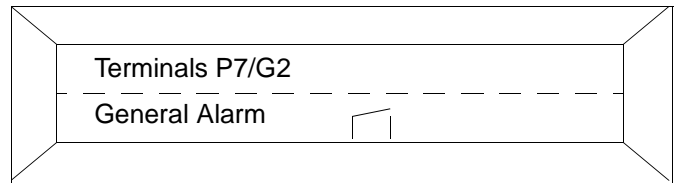
Warning

*Can be configured to open or close. The selection is made using the STEP/DATA keys.

Open function, i.e. the contact opens when actuated.

Close function, i.e. the contact closes when actuated.

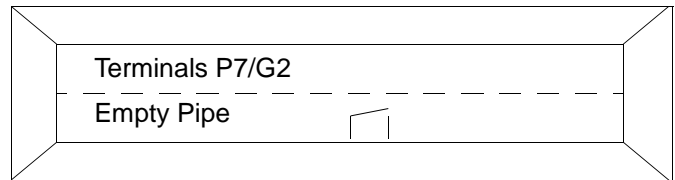
4.14.1.1 General Alarm (Errors 0 to 9, A, B) Entry from table



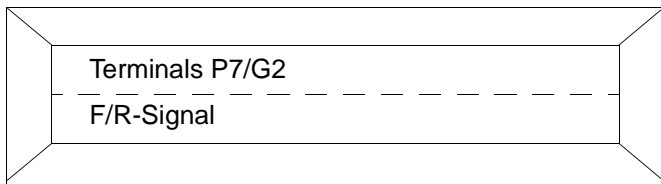
All errors detected (Errors 0 to 9, A, B) are signalled at the terminals. During an error conditions the terminals P7, G2 (Ux, P7 for Profibus) are activated, in this case, opened.

4.14.1.2 Empty Pipe Entry from table

When the parameter "Empty Pipe Detector" (Sect. 4.18.1) is turned on, the current output is set to 3.8 mA, 0 % or 100 % when an empty pipe condition is detected and the totalization halted. The empty pipe contact is activated, in this case, opens, and the messages "Empty Pipe" and "Error 0" are displayed.

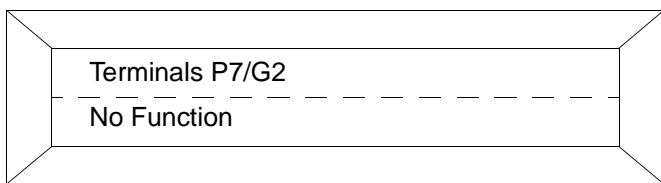


4.14.1.3 Forward/Reverse Direction Signal Entry from table



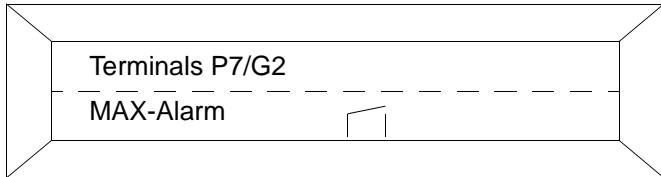
The forward and reverse direction is indicated by an arrow in the display and signalled over the contact terminals P7, G2 (Ux, P7 for Profibus).

4.14.1.4 No Function



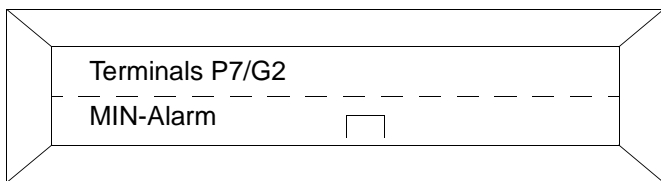
When "No Function" is selected there is no signal over Terminals P7, G2 (Ux, P7 for Profibus).

4.14.1.5 MAX-Alarm Entry from table



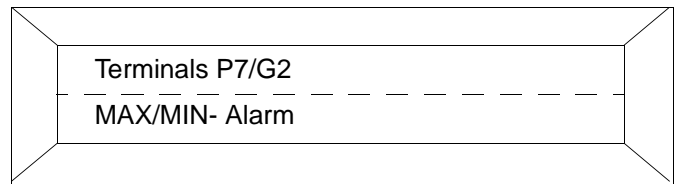
When this output function is selected a signal is sent to the terminals when the flowrate exceeds the limit value set, in this case the contact opens. Setting MAX-Alarm see Sect. 4.13.2.

4.14.1.6 MIN-Alarm Entry from table



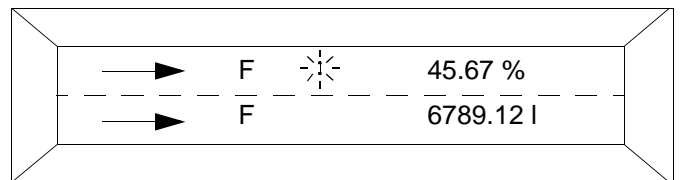
When this output function is selected a signal is sent to the terminals when the flowrate drops below the limit value set, in this case the contact closes. Setting MAX-Alarm see Sect. 4.13.3.

4.14.1.7 MAX/MIN-Alarm Entry from table



When MAX/MIN-Alarm is selected a signal is indicated on the terminals P7, G2 (Ux, P7 for Profibus) when the flowrate is outside of the limit values set in MAX-Alarm and MIN-Alarm, i.e. when the flowrate is greater than the MAX-Alarm value or less than the MIN-Alarm value.

In this mode it is also possible to indicate when the flowrate is within the two limit values set in MIN- and MAX-Alarm. In this configuration the MAX-Alarm value must be set smaller than the MIN-Alarm value. When the flowrate is within this range, a signal is indicated in the display and on the terminals P7, G2 (Ux, P7 for Profibus).



MAX-Alarm = 20 %

MIN-Alarm = 80 %

A blinking double arrow indicates that the flowrate is between 20 and 80 %.

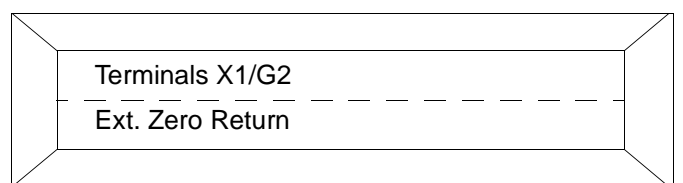
4.14.2 Terminals X1/G2 (not available for Profibus)

The functions which can be assigned to the input contacts can be selected using the STEP/DATA keys:

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

These functions are not available for Profibus-Communication.

4.14.2.1 External Zero Return Entry from table

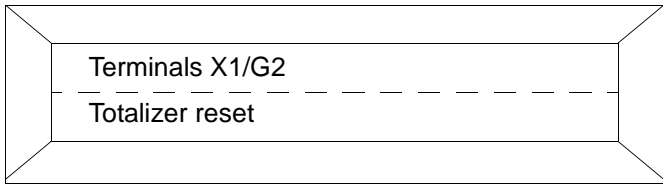


This input function can be selected for terminals X1/G2 to turn off the outputs (current and pulse) when the flowmeter is empty or during a cleaning cycle (CIP).

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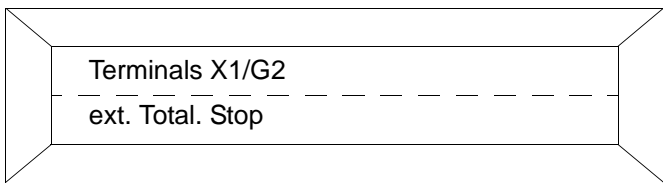
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4.14.2.2 External Totalizer Reset Entry from table



The input contact X1/G2 can be utilized to reset the forward and reverse flow totalizers and the overflow counters (not available for Profibus).

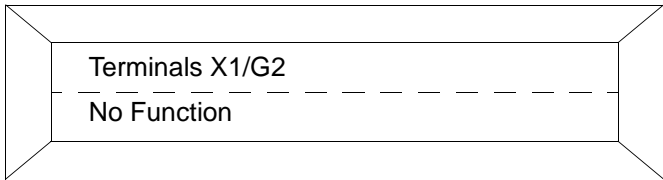
4.14.2.3 External Totalizer Stop



When the input is activated the flow integration is halted and the message "Totalizer Stop" is displayed instead of the totalizer values. This function is not available for HART-Protocol.

4.14.2.4 No Function Entry from table

The input contact is inactive when "No Function" has been selected.

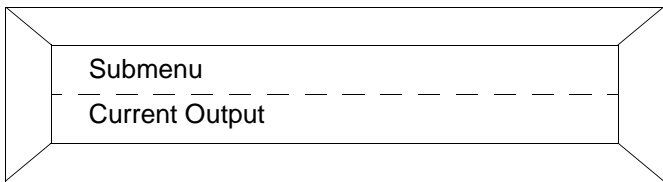


4.15 Submenu Current Output (not available for Profibus DP or ASCII protocol)

The following parameters are set in the submenu Current Output:

Current Output range and Iout at Alarm.

For Profibus DP-Communication even though this menu is displayed, it has no function because a current output is not available.

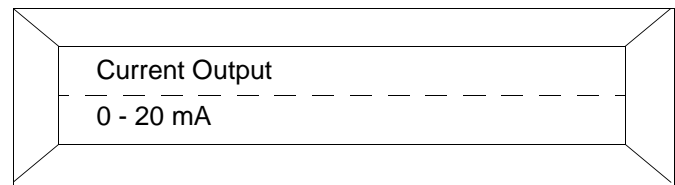


4.15.1 Current Output Range Entry from table

The current output ranges listed below can be selected using the STEP and DATA keys. For HART-Protocol the current output range is fixed at 4-20 mA and cannot be changed.

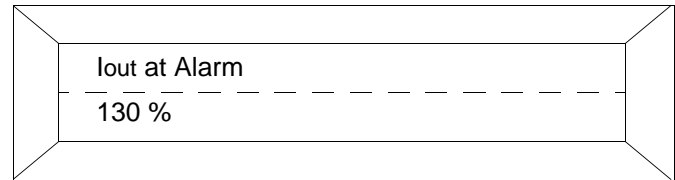
Current Output

- 0 - 20 mA
- 4 - 20 mA
- 0 - 10 mA
- 2 - 10 mA
- 0 - 5 mA
- 0 - 10, 10 - 20 mA
- 4 - 12, 12 - 20 mA



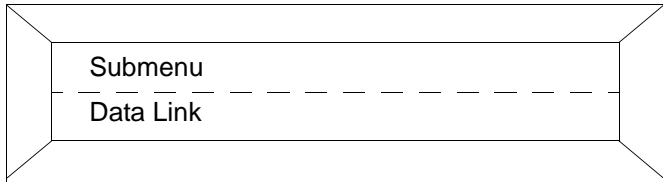
4.15.2 Iout at Alarm Entry from table

During an error condition the contact output can be actuated by the converter, an error message can be displayed and the output current set to a fixed value. The values available for selection are 3.8 mA, 0 % or 130 % of the selected current range. For Error 3, Flowrate > 130 %, the current output is always set to 130 % of the selected current output range.



4.16 Submenu Data Link

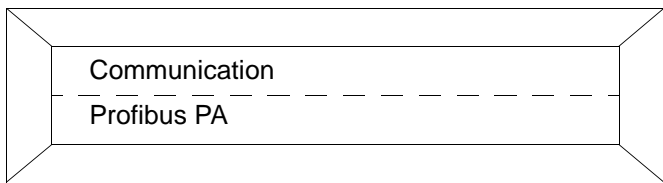
In this submenu the Communication protocol, the Instrument Address and the Baudrate are set. This menu is only visible when the "Data Link" option was ordered.



4.16.1 Communication Profibus PA

(available if meter with this option has been ordered)

With Profibus PA communication the menu-structure will be as follows:



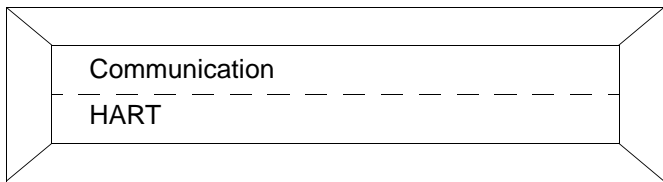
This is for information purposes only. There is no further parameter-settings possible.

Instrument address is 126 (Default Value). The address can be changed by Profibus communication on the bus.

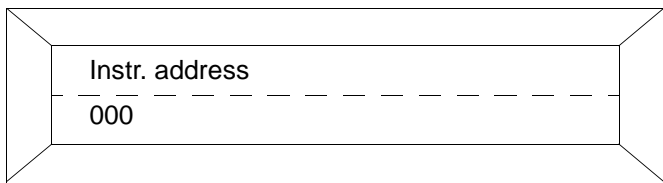
4.16.2 HART protocol communication

(available if meter with this option has been ordered)

With HART protocol communication the menu-structure will be as follows:



This is for information purposes only. There is no further parameter-settings possible.

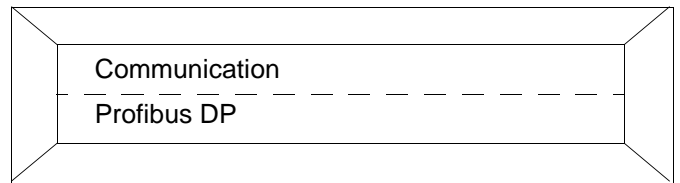


For HART-protocol, Instrument address: 0 – 15. (Multidrop-Mode for addresses greater than 0).

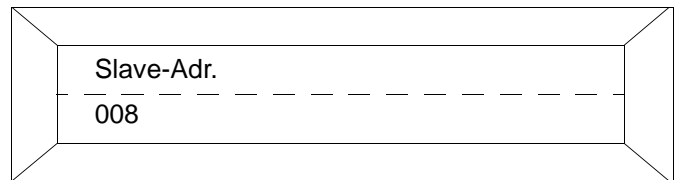
4.16.3 Communication Profibus DP / ASCII

(available if meter with this option has been ordered)

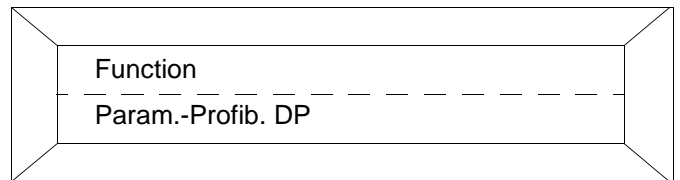
With Profibus DP or ASCII protocol communication the menu-structure will be as follows:



Profibus DP, ASCII or ASCII2w are selectable.



The instrument address on the Profibus DP can be set accessing this menu or by Profibus DP communication on the bus itself. The instrument address has to be set using 3 digits (e.g. 065). Range of addresses: 0 - 126. Default Value: 126



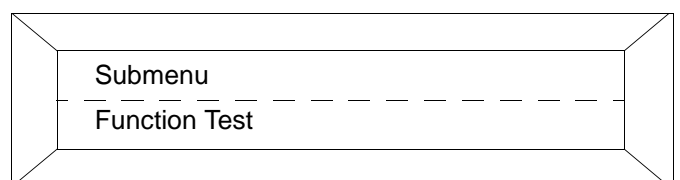
This is information purposes only. There is no further parameter-settings possible. For detailed description refer to special manual „data link description for Profibus DP“.

If ASCII or ASCII2w communication is chosen, the menu „Instr. Address“ will be displayed instead of the menu „Slave - Adr“ and the menu „function“. Additional the menu „Baudrate“ will be displayed with ASCII or ASCII2w communication.

If multiple instruments are connected to a single bus (RS485 with ASCII protocol), each instrument must have a different address. Accessing the menu „Instr. address“ the instrument address can be set. (Range: 0-99). The Baudrate setting has to be made in the menu „Baudrate“ (110 bis 28800 Baud).

ASCII2w means ASCII-Communication on a 2-wire configuration. The communication is then half-duplex (either send or receive data).

4.17 Submenu Function Test Numeric entry only for Iout and Fout



The Function Test offers 13 functions to test the instrument independent of the instantaneous flowrate. **In the Function Test mode the converter is no longer on-line** (current and pulse outputs do not indicate the existing operating conditions). The individual test routines can be selected using the STEP and DATA keys.

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I_{Out}, RAM (ASIC), NVRAM, EPROM (Program), EEPROM, External EEPROM, Terminals P7/G2, Switch S201 (not available for certified designs), Display, Pulse Output, Terminals X1/G2, Simulation and Test Mode.
The function tests can be terminated by pressing C/CE.

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



Note:

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

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

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

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

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

Select **Alarm Contact** and press ENTER. The alarm contact can be toggled on and off using the STEP or DATA keys. Monitor terminals P7 and G2 with an ohmmeter.

Select **Terminals P7/G2** and press ENTER. The contact can be toggled on and off using the STEP or DATA keys. Monitor terminals P7 and G2 with an ohmmeter.

Select **S201** and press ENTER. The status of switch S201 On/Off and the jumpers, BR 201 ... 5, are identified by a star * for the "function selected" by the software when the Code Number has been entered.

Select **Pulse Output** and press ENTER. A frequency of 1 Hz with a 500 ms pulse width is applied to the pulse output.

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

Terminal X1

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

Terminal X1

Select **Totalizer Reset** and press ENTER. Apply a 24 V DC voltage to terminals X1 and G2. Plus polarity to X1. The converter indicates On/Off.

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

Test Mode

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

Only for HART-Protocol:

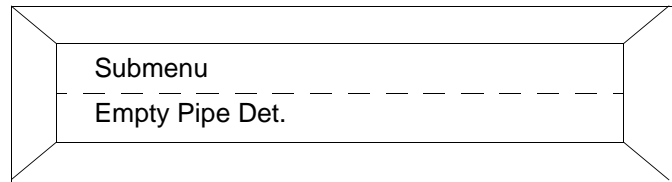
HART-Command

In this test the commands addressed to this converter are displayed.

4.18 Submenu "Empty Pipe Detector"

If the fluid level can drop below the electrodes at zero flow then the function "Empty Pipe Detector" can be used to automatically turn off all the output signals.

In the submenu "Empty Pipe Detector" all the parameters required to set this function can be found.



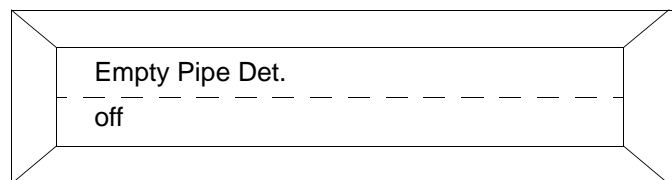
4.18.1 Detector On/Off

Entry from table

The empty pipe detector option can be turned on and off using the STEP and DATA keys.

When the detector is turned on and the converter does not display the alarm message "Empty Pipe" when an empty pipe condition exists, then it is necessary to adjust the detector for the process conditions, i.e. adjustment made when the flowmeter is full.

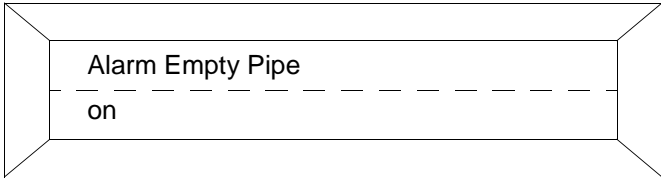
Select the parameter Adjust "Empty Pipe Detector".



4.18.2 Alarm Empty Pipe

Entry from table

Select the "On/Off" position using the STEP or DATA key and accept by pressing ENTER. When the empty pipe alarm function is turned on, the system alarm is activated during an empty pipe condition. When the pipe is empty the error messages "Empty Pipe" and "Error 0" are displayed.

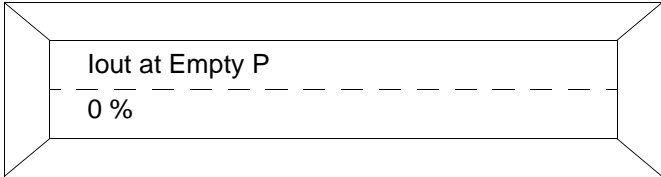


4.18.3 Iout at Empty Pipe

Entry from table

When the empty pipe detector and the alarm are turned on and the pipe is empty, the current output is set to 0, 2/4 mA or 3.8 mA and pulse totalization is halted. Flowrate > 130 % sets the current output to 26 mA and the totalization continues. The alarm output is activated and the messages "Empty Pipe" and "Error 0" are displayed.

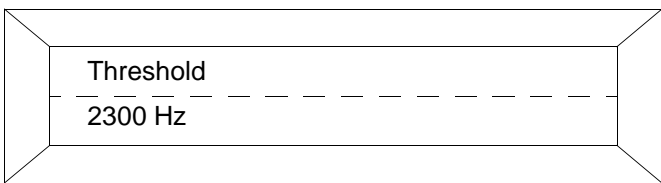
The desired current output value to be set for an empty pipe condition can be selected using the STEP or DATA keys and accepted by pressing ENTER.



4.18.4 Threshold

Numeric entry

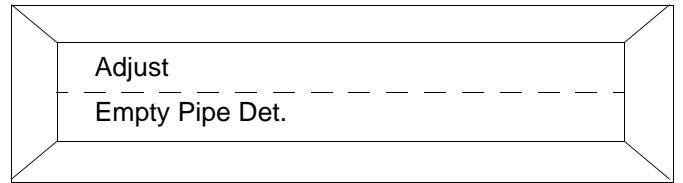
The threshold value must be set to 2300 Hz using the ARROW keys and accepted by pressing ENTER.



4.18.5 Adjust Empty Pipe Detector

Entry from table

The converter displays its adjustment value in the 2nd line. The pipeline must be full. Use the ARROW keys to adjust the value to 2000 Hz ± 25 Hz. Accept this value by pressing ENTER. Empty the pipeline. The adjustment value must increase above 2300 Hz (Threshold).

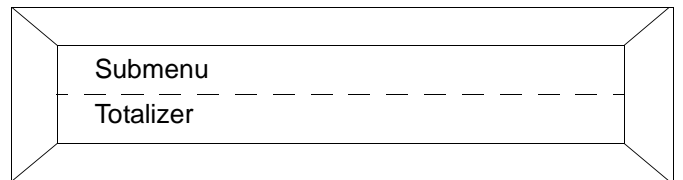


Note:

To assure proper operation of the function "Empty Pipe Detector" the fluid conductivity must be at least 20 µS/cm and the minimum meter size 3/8" [DN 10].

4.19 Submenu Totalizer

The following functions are included in this submenu:

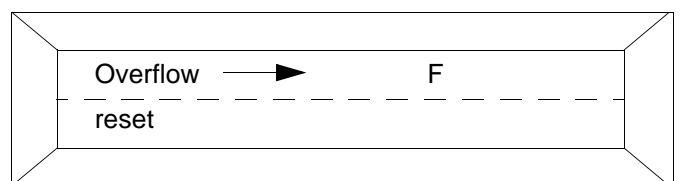
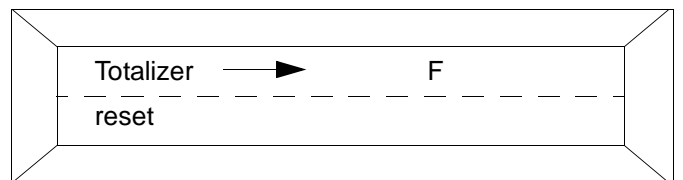


Reset totalizer and overflow values
 Totalizer function
 Reset mains interrupt

4.19.1 Reset Totalizer and Overflow Values Forward and Reverse, Preset Totalizer

Numeric entries/Entries from table

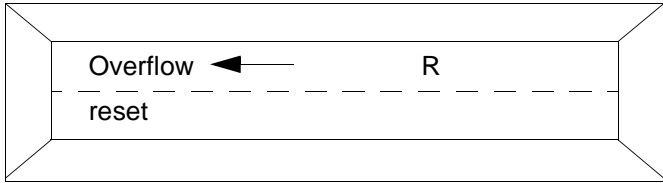
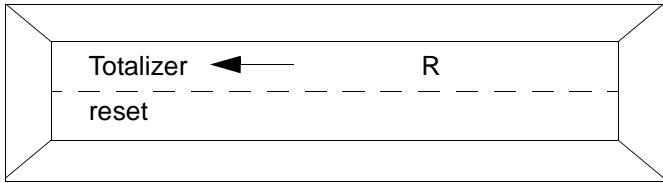
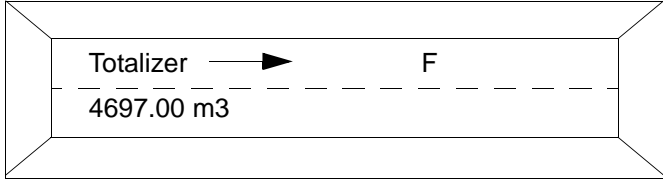
The totalizer and overflow values can be reset independently for each flow direction, forward and reverse, by pressing ENTER. The overflow counter (if any overflows have been registered) is cleared first. Pressing ENTER once more clears the totalizer value. If the totalizer has overflowed the forward or reverse direction indicators and the units in the process display blink. The internal totalizer can overflow up to 250 times software wise. At each overflow (totalizer value > 9,999,999 units) the totalizer value is reset and the overflow counter incremented by one. If more than 250 overflows have been registered the message "Overflows > 250" is displayed.



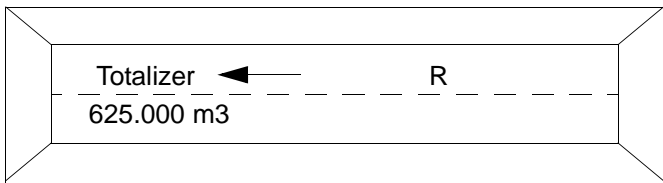
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The totalizer for the "forward" can also be preset. In this manner it is possible to transfer the totalizer values when a converter is exchanged. Select the parameter with the STEP and DATA keys, the present totalizer value is displayed in the 2nd line. After pressing ENTER the desired totalizer value can be entered, and accepted by pressing ENTER.



The totalizer for the "reverse" flow direction can also be reset. See "Totalizer Forward".



Overflow Calculation Example

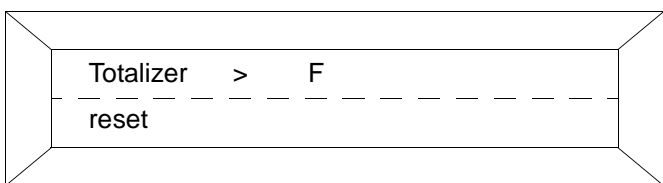
Overflow 012

$$\begin{array}{r} 12 \times 10,000,000 \text{ units} \\ = 120,000,000 \text{ units} \\ + 23,455 \text{ present totalizer value} \\ \hline 120,023,455 \text{ units} \end{array}$$

Max. Totalizer Value

$$\begin{array}{r} 250 \times 10,000,000 \text{ units} \\ = 2,500,000,000 \text{ units} \end{array}$$

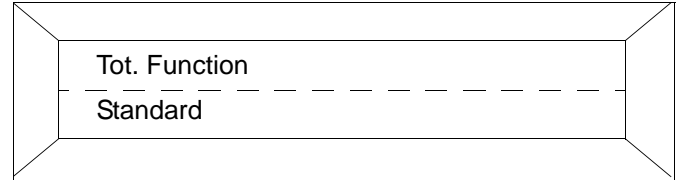
If the function "External Totalizer reset" has been selected, the totalizer and overflow values can be reset from contact X1/G2. The following message is displayed:



4.19.2 Totalizer Function Entry from table

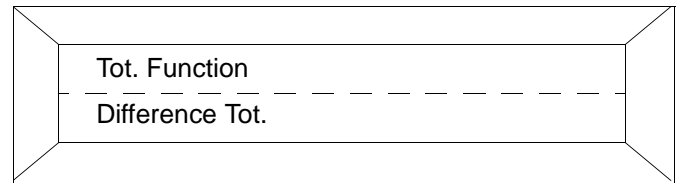
There are two operating modes for the totalizer: Standard totalizer and difference totalizer.

4.19.2.1 Totalizer Function Standard



When "Totalizer Function Standard" is selected the totalizer pulses for the forward and reverse flow directions are counted independently on two totalizers. When the flow direction is forward, only the forward totalizer integrates the flow. The selection is made with the STEP and DATA keys and accepted by pressing ENTER.

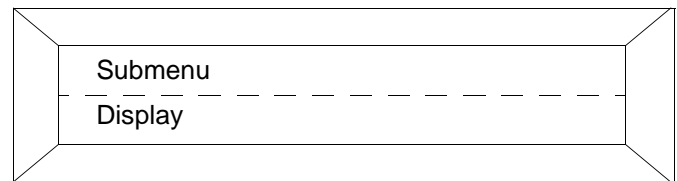
4.19.2.2 Totalizer Function Difference Totalizer



In the difference totalizer mode a single totalizer is utilized for both flow directions. The flow in the forward flow direction is added and the flow in the reverse direction subtracted. The pulse output is not affected by this selection.

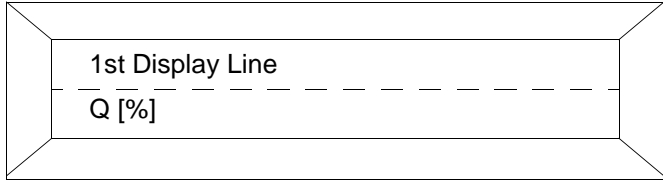
4.20 Submenu Display Entry from table

In this submenu the process display for both lines can be configured.



4.20.1 Display 1st Line Entry from table

After pressing ENTER the display mode for the instantaneous flowrate can be selected using the STEP or DATA keys.



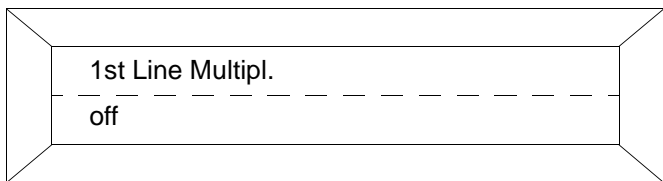
Display Selections:

Q [%]	Flowrate in %
Q [Units]	Flowrate in engineering units
Bargraph	Flowrate in a bargraph presentation
Totalizer	Totalized flow value for forward and reverse flow directions or forward only

4.20.2 Display 2nd Line Entry from table

The values displayed in the 2nd line can also be individually configured. See 1st display line for selections.

4.20.3 Multiplex 1st Display Line Entry from table



After pressing ENTER the STEP/DATA keys can be used to select an additional value to be displayed in the 1st line in a multiplex mode. The values alternate automatically in a 10 second cycle.

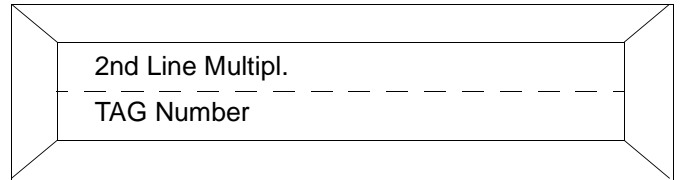
Multiplex Display Selections

Q [%]	Flowrate in %
Q [Units]	Flowrate in engineering units
Bargraph	Flowrate in a bargraph presentation
Totalizer	Totalized flow value for forward and reverse flow directions or forward only
Off	No multiplex display values

4.20.4 Multiplex 2nd Display Line Entry from table

The 2nd display line can also operate in the multiplex mode.

For display selections see Multiplex 1st Display Line.



4.21 Submenu Operating Mode Entry from table

The STEP or DATA keys can be used to select one of two available operating modes, Standard/Fast, as well as the flow direction and the flow direction indication.

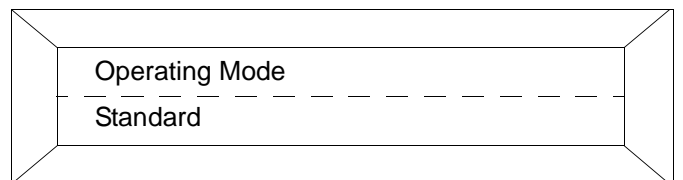
4.21.1 Operating Modes Standard/Fast Entry from table

The operating mode "Standard" is used for continuous flow metering.

The operating mode "Fast" is used for short time batch operations > 3 s and for piston pump operation when the converter incorporates a higher excitation frequency capability.

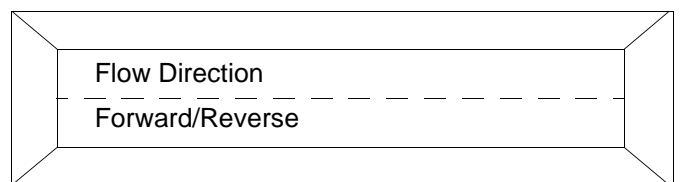
In this operating mode the improved reproducibility for short time batch and piston pump applications is achieved by accelerated signal measurements.

Press ENTER to accept the selection.



4.21.2 Flow Direction (Forward and Reverse) Entry from table

After pressing ENTER the STEP or DATA keys can be used to select forward and reverse metering or forward metering only. If forward is selected, then the flowmeter measures only when the flow is in the forward direction. The totalizer values are the integrated flow are for this direction. The reverse flow is not measured or totalized. There are no reverse pulses available on terminals V8, V9, or Ux/V8.



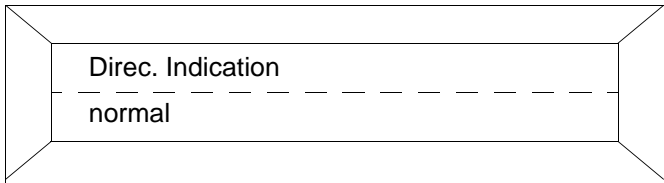
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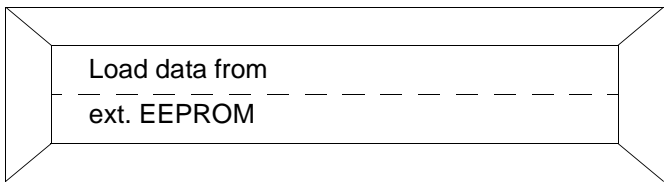
4.21.3 Flow Direction Indicators Entry from table

The arrow on the flowmeter primary defines the direction of the fluid flow for the forward direction. If this direction is indicated in the process information display as reverse, select the parameter "Inverse" in the direction indication menu to change the display indicator to forward.

The ARROW keys can be used to select the appropriate parameter in the "Direction Indication" submenu and accepted by pressing ENTER.



4.22 Load Data from External EEPROM



When a converter is exchanged the data are automatically uploaded from the external EEPROM when the supply power is turned on. It is also possible to upload the data at any time by simply pressing a key.

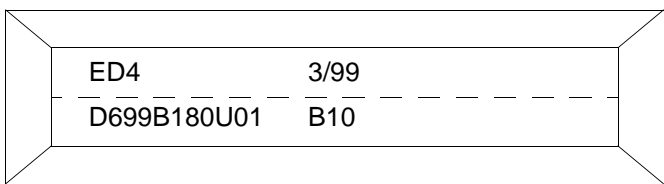
4.23 Store Data in External EEPROM

After the initial start-up (at the site) the function "Store data in ext. EEPROM" must be called once in order to copy all the meter location specific data into the external EEPROM. If a parameter is subsequently changed which should be saved, this procedure should be repeated. Call the parameter and initiate the procedure by pressing ENTER.

4.24 Software Version

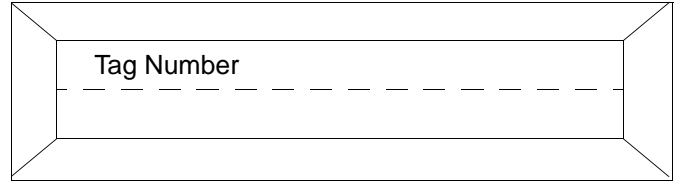
The Model Number of the converter is displayed in the 1st line while in the 2nd line the part number of the software is displayed.

These parameters cannot be changed. An example of a display is shown.



3/99 = Release date
B10 = Revision level

4.25 TAG-Number (Instrument Address for Profibus-Communication) Numeric entry

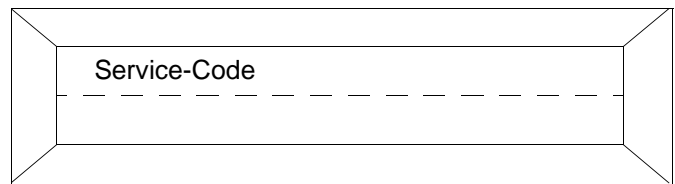


After pressing ENTER an alphanumeric Tag Number with up to 16 characters, upper and lower case letters and numbers, can be entered to identify the meter location.

Scroll, using the DATA key, first through the lower case letters followed by the numbers 0-9, the upper case letters and then the symbols - / : . * _ . Use the STEP key to shift to the next position and use the DATA key to enter the desired character. Repeat this procedure until all the desired characters have been entered and accept by pressing ENTER.

For Profibus-Communication the Instrument Address is to be entered in this submenu. Factory setting: 127

4.26 Service Code Number Numeric entry



The code number provides access to the adjustment routines. Only for ABB Automation Products Service personnel.

5. Error Message

The following list of the error messages includes explanations for the Error Codes displayed
Error Codes 0 to 9, A, B, C do not occur during data entry.

Error Code	Detected System Error	Corrective Measures
0	Pipeline not full.	Open shut off devices; fill pipeline; adjust Empty Pipe Detector
1	A/D-Converter	Reduce flowrate, throttle shut off devices.
2	Positive or negative reference too small.	Check connection board and converter;
3	Flowrate greater than 130 %.	Reduce flowrate, change flow range
4	External zero return contact activated.	Zero Return activated by pump or field contact.
5	RAM defective 1. Error 5 appears in display 2. Error 5 appears only in Error Register	Program must be reinitialized; Contact ABB Automation Products Service department; Information: Corrupted data in RAM, converter automatically executes a reset and uploads data from EEPROM.
7	Positive reference too large	Check signal cable and magnetic field excitation.
8	Negative reference too large.	Check signal cable and magnetic field excitation.
6	Error > F Error totalizer < R Error totalizer Excitation frequency defective	Reset forward totalizer or preset new values in totalizer. Reset reverse totalizer or preset new values in totalizer. Forward, reverse or difference totalizer defective. Reset forward/reverse totalizer. Check line frequency for Supply Power 50/60 Hz or for AC/DC Supply Power
9	MAX-Alarm limit value	Error in the Digital-Signal board. Reduce flowrate
A	MIN-Alarm limit value	Increase flowrate
B	Primary data invalid	The data for the primary in the external EEPROM are invalid. Compare data in submenu "Primary" with data listed on the Instrument Tag. If the values agree, use "Store Primary" to reset the error message. If the data are not identical, then it is necessary to first reenter the primary data and then complete by using "Store Primary". Contact ABB Automation Products-Service
C		
10	Entry >1.00 Q _{maxDN} >10 m/s.	Reduce Q _{max} range.
11	Entry <0.05 Q _{maxDN} <0.5 m/s.	Increase Q _{max} range.
16	Entry >10 % Low Flow Cutoff.	Reduce entry value.
17	Entry < 0 % Low Flow Cutoff.	Increase entry value.
20	Entry ≥ 100 s Damping.	Reduce entry value.
21	Entry <0.5 s Damping.	Increase entry value, (as a function of the excitation frequency)
22	Entry >99 Instrument Address.	Reduce entry value.
38	Entry >1000 Pulses/Unit.	Reduce entry value.
39	Entry < 0.001 Pulses/Unit.	Increase entry value.
40	Max. pulse frequency exceeded, scaled pulse output.	
	Pulse factor (5 kHz).	
41	Min. pulse frequency below limit <0.00016 Hz.	Reduce pulse factor. Increase pulse factor
42	Entry >2000 ms Pulse Width.	Reduce entry value.
43	Entry <0.1 ms Pulse Width.	Increase entry value.
44	Entry >5.0 g/cm ³ Density.	Reduce entry value.
45	Entry <0.01 g/cm ³ Density.	Increase entry value.
46	Entry too large	Reduce pulse width entry value
54	Primary Zero > 50 Hz	Check ground and ground signals. Adjustment can be made if the flowmeter primary is filled with fluid and the flowrate is zero.
56	Entry >3000 Threshold Empty Pipe Detector.	Reduce entry value, check adjust "Empty Pipe Detector".
74/76	Entry > 130 % MAX - or MIN-Alarm	Reduce entry value
91	Data in EEPROM corrupted	Data in internal EEPROM invalid, for corrective measures see Error Code 5.
92	Data in ext. EEPROM corrupted	Data (e.g. Q _{max} , Damping) in external EEPROM invalid, access possible. Occurs when function "Store data in ext. EEPROM" was not called. The error message can be cleared using the function "Store data in ext. EEPROM"
93	Ext. EEPROM corrupted or not installed	No access possible, component defective. If the component is not installed, then it is necessary that the ext. EEPROM which belongs to the flowmeter primary be installed.
94	Ext. EEPROM version incorrect	The data base is not correct for the present software version. Calling the function "Load data from ext. EEPROM" initiates an automatic update of the external data. The function "Store data in ext. EEPROM" clears the error message.
95	External Primary Data incorrect	See Error Code C.
96	EEPROM version incorrect	Data base in the EEPROM has a different version than the installed software. Clear the error by calling the function "Update".
97	Primary incorrect	The flowmeter primary data in the internal EEPROM are invalid. The error can be cleared by calling the function "Load Primary", (See Error Code C).
98	EEPROM corrupted or not installed	No access possible, component defective. If the component is not installed, then it is necessary that the ext. EEPROM which belongs to the flowmeter primary be installed.
99	Entry too large	Reduce entry value
99	Entry too small	Increase entry value

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6. Fuse Locations, Identification of the Converter Design, ext. EEPROM Socket

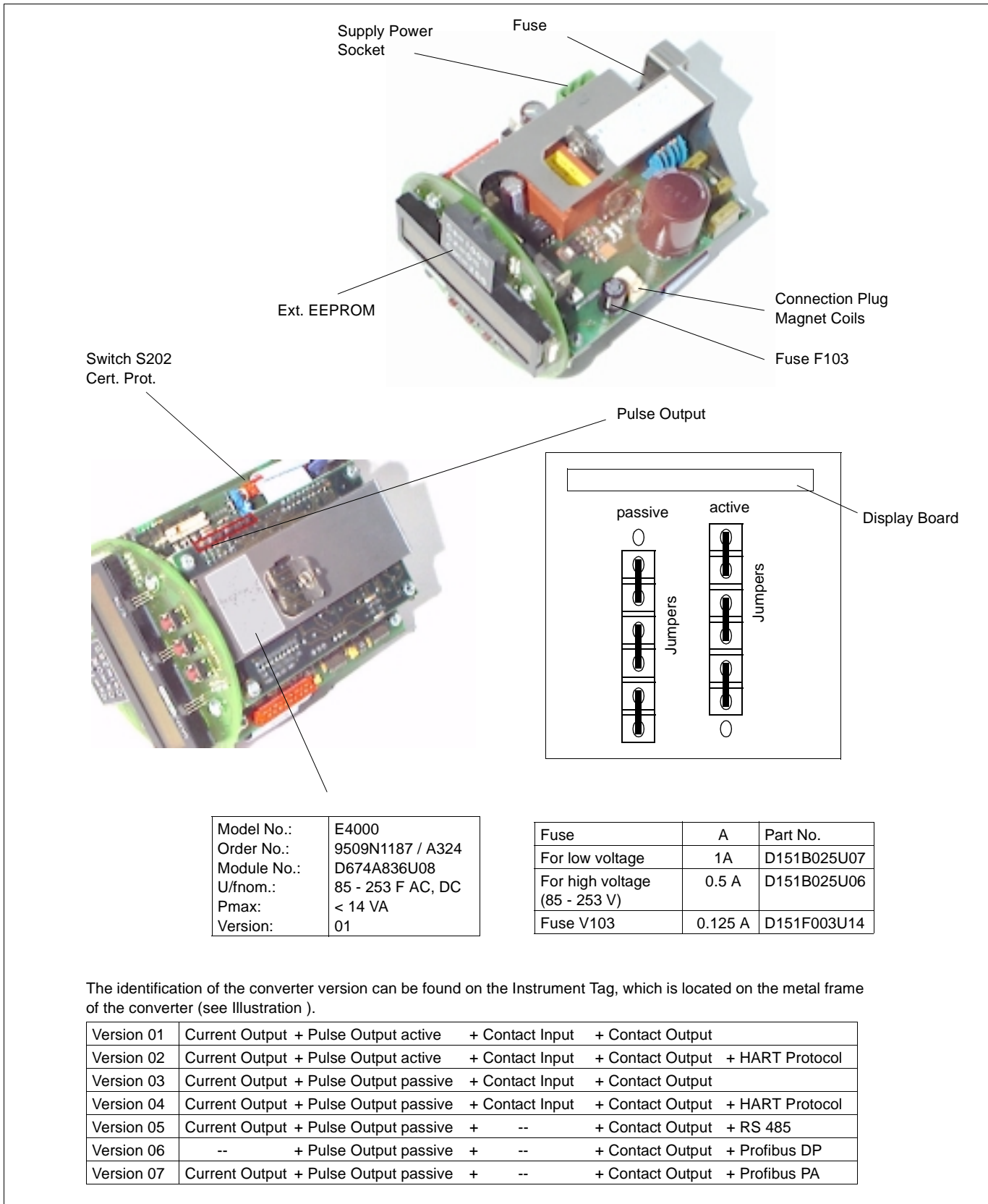
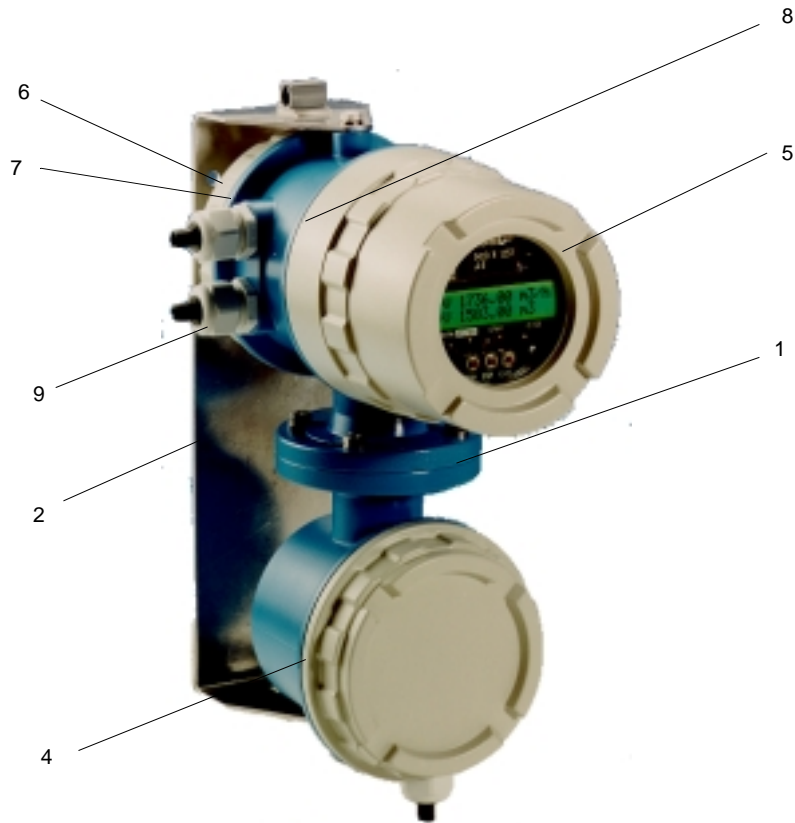


Fig. 17 Converter Module COPA-XE/MAG-XE

7. Replacement Parts List

7.1 Replacement Parts for Converter Housing

Items 5-8 also apply to the Compact Design housings.



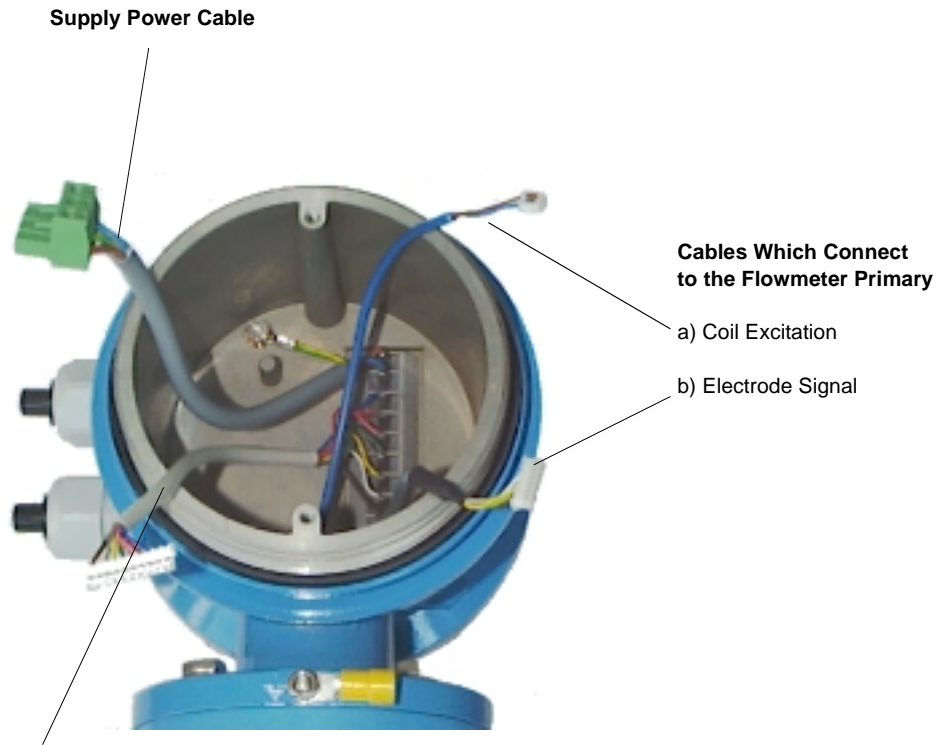
No.	Description	Part No.
1	O-Ring 56, 74 x 3.53	101A806
2	Bracket, compl.	D614L619U01
3	Cover for connection box	D379D134U02
4	O-Ring 101, 19 x 3.53	D101A020U01
5	Cover with window	D541A023U01
6	Cover "small"	D379D134U02
7/8	O-Ring 101, 19 x 3.53	D101A020U01
9	Cable connector Pg 13.5 or M20 x 1.5	D150A008U02 D150A004U14

Fig. 18

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7.2 Replacement Parts List (Cable Assembly)



Cable Assembly for Connecting the Converter Module and Terminal Strip (In-/Outputs)

(There are various cable assembly versions, see Table)

Replacement Parts List, Cable Assemblies for In-/Outputs	Part No.
Cable assembly for standard outputs incl. HART (Versions 1-4)	D677A294U01
Cable assembly for designs with RS 485 (ASCII Protocol) (Version 5)	D677A294U04
Cable assembly for designs with Profibus DP (Version 6)	D677A294U05
Cable assembly for designs with Profibus PA (Version 7)	D677A294U06

The Part No. for the cable assemblies includes the cables for the in- and outputs and include Crimp-Plug and the connection terminals (soldered) labeled.

Fig. 19

7.3 Replacement Parts for Flowmeter Primary

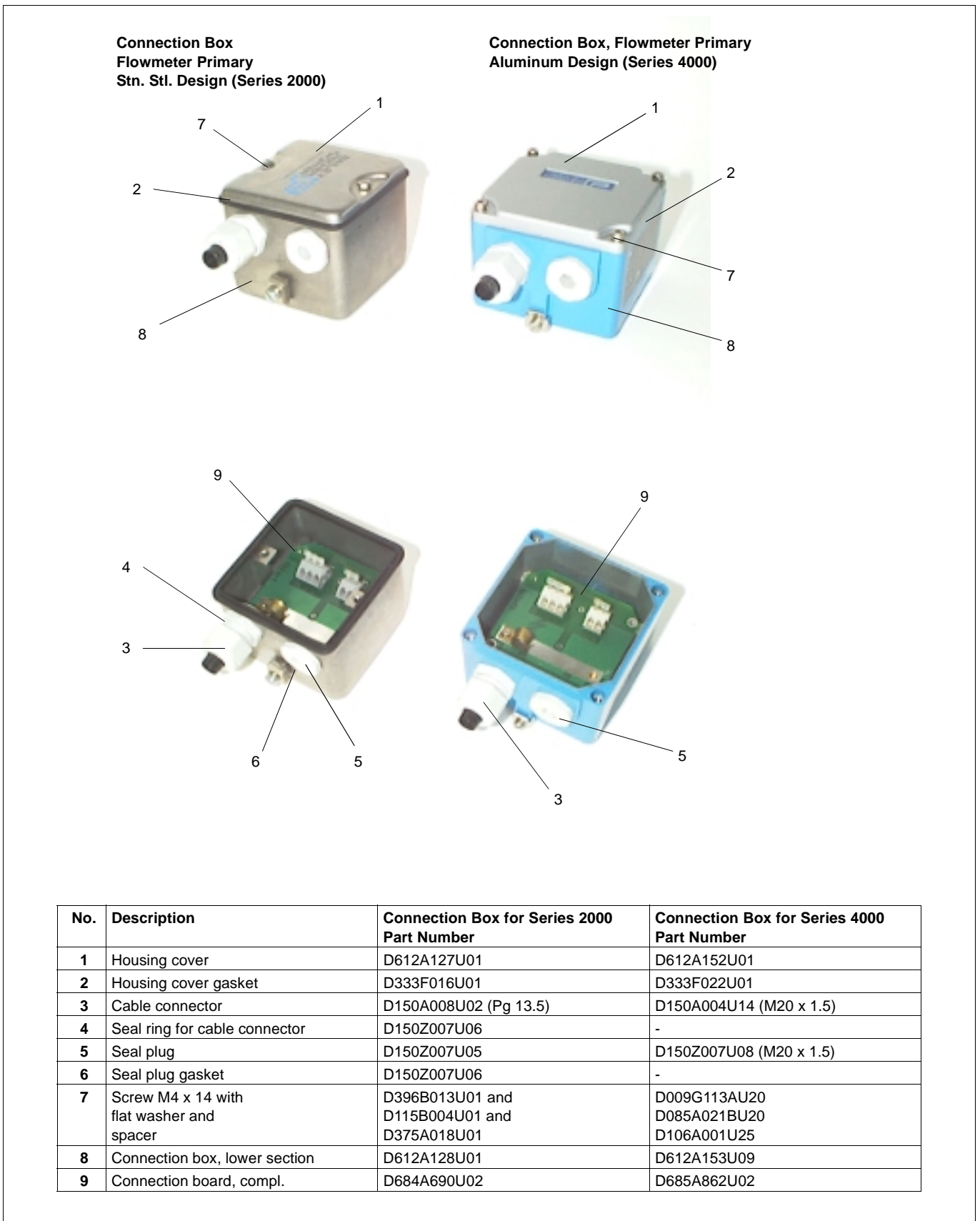


Fig. 20

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8. Accuracy

Reference Conditions per EN 29104

Fluid Temperature

20°C ± 2K

Supply Power

Nominal voltage per Instrument Tag Un ± 1% and
Frequency ± 1%

Straight Pipe Installation Requirements

Upstream > 10 x D

Downstream > 5 x D

D = Flowmeter primary size

Warm Up Phase

30 min

Analog Output Effects

Same as pulse output plus ± 0.1 of rate

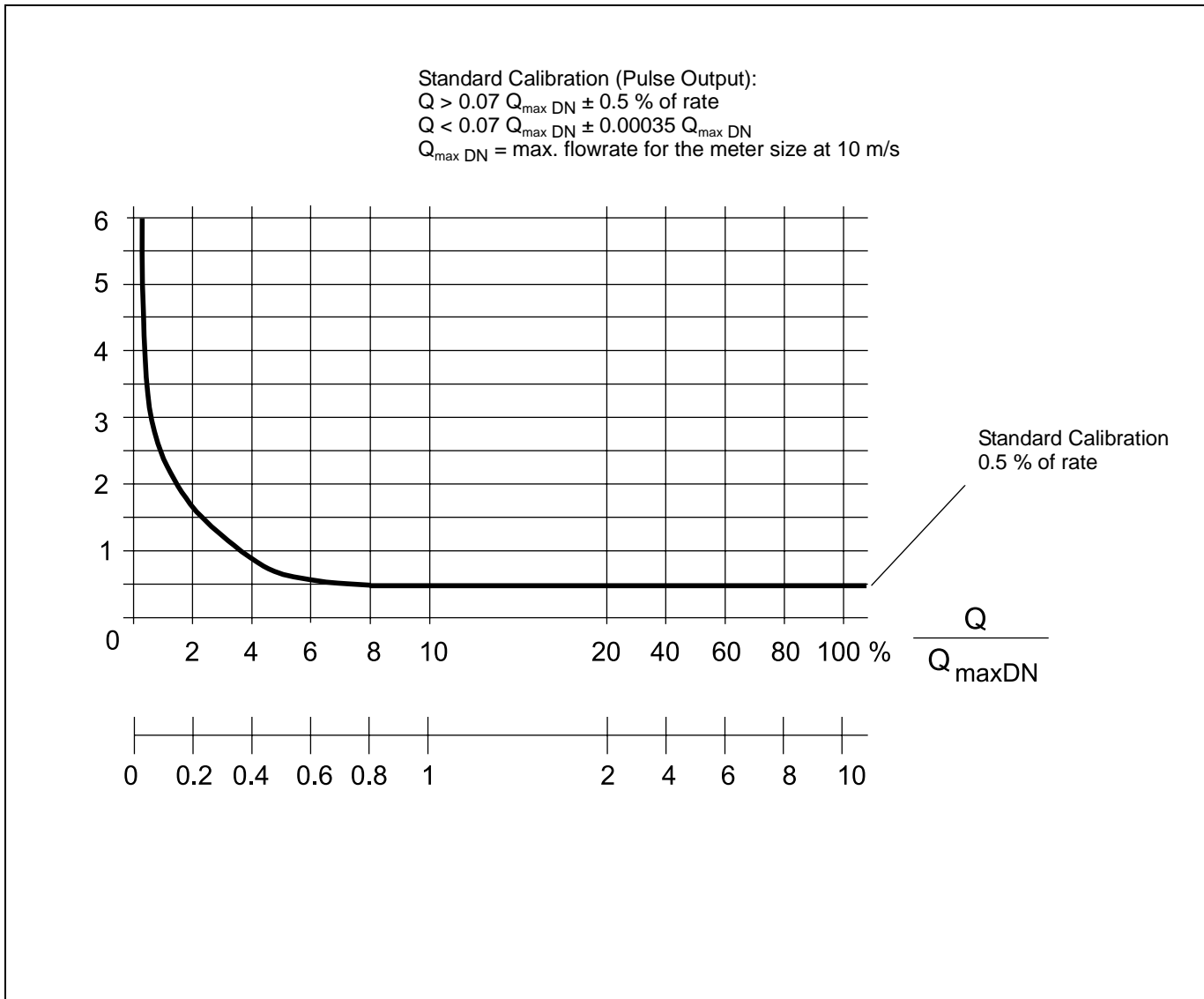


Fig. 21 Metering System accuracy COPA-XE / MAG-XE

9. Safety Relevant Section of the Instruction Bulletin

9.1 Grounding the Flowmeter Primary

The grounding procedure described is to be observed. In accordance with DIN VDE 0100, Part 540 a 2.5 mm² Cu wire is to be connected between the ground screw on the flowmeter primary (on the flange and on the converter housing) to ground. A ground connection at the converter is essential to meet the EMC requirements. For technical reasons it is also important that the ground potential be the same as the potential of the pipeline. An additional ground connection at the connection terminals is not required.

When a plastic pipeline is used or the pipeline is insulated, the ground connection is made to a grounding plate or to a grounding electrode. When the stray voltages exist in the pipeline it is recommended that a grounding plate be installed at both ends of the flowmeter primary.

Three grounding possibilities are described below. In cases a) and b) the fluid is in electrical contact with the pipeline. In case c) it is isolated from the pipeline.

a) Metal pipe with fixed flanges

- 1) Drill blind holes in the flanges of the pipeline (18 mm deep)
- 2) Thread holes, (M6, 12 mm deep).
- 3) Attach the ground strap to the flange using a screw (M6), spring washer and flat washer and connect it to the ground connection on the flowmeter primary.
- 4) Connect a 2.5 mm² CU wire between the ground connection on the flowmeter primary and a good ground.

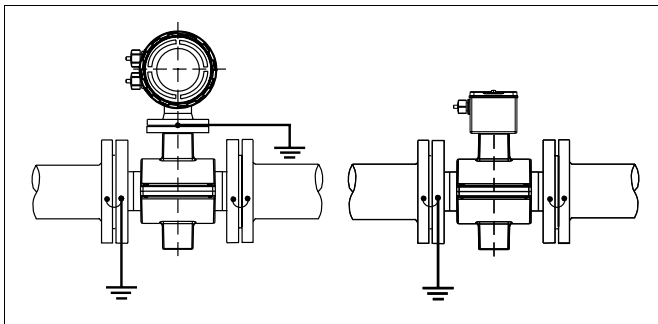


Fig. 22 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Flanged

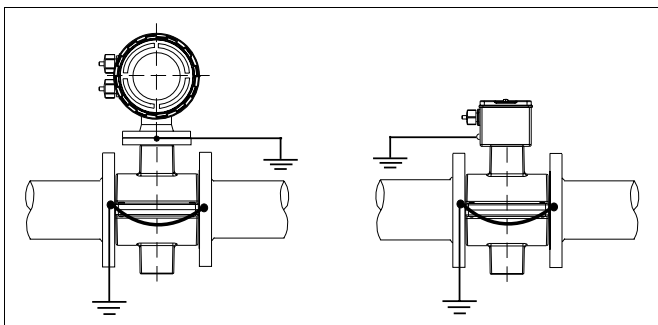


Fig. 23 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Wafer Design

b) Metal pipe with loose flanges

- 1) In order to assure a trouble free ground connection to the fluid and to the flowmeter primary in a pipeline with loose flanges, 6 mm threaded studs should be welded onto the pipeline.
- 2) Attach the ground strap to the threaded stud using a nut, spring washer and flat washer and connect to the ground connection on the flowmeter primary.
- 3) Connect a 2.5 mm² CU wire between the ground connection on the flowmeter primary and a good ground.

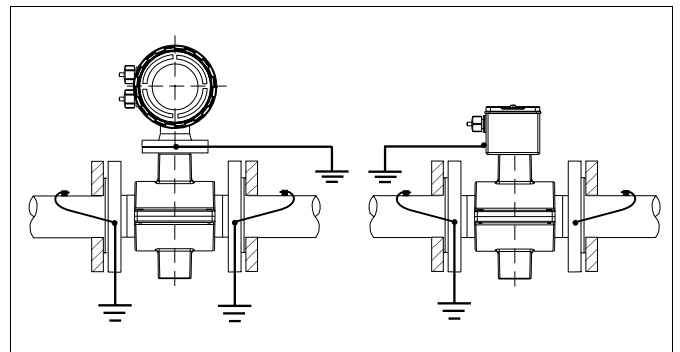


Fig. 24 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Flanged

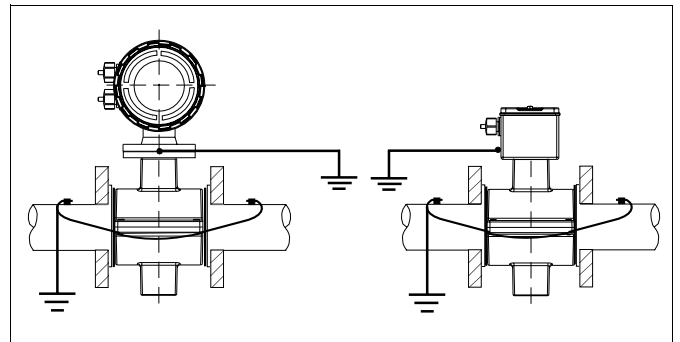


Fig. 25 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Wafer Design

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c) Plastic, Concrete or Pipelines with Insulating Liners.

- 1) Install EMF in pipeline with a grounding plate.
- 2) Connect the connection tab on the grounding plate to the ground connection on the flowmeter primary with a ground strap.
- 3) Connect a 2.5 mm² CU wire between the ground connection on the flowmeter primary and a good ground.

For plastic pipelines or pipelines with insulating liners the fluid is grounded by the grounding plate as shown in Figs. 26 & 27 or by grounding electrodes, which are installed in the flowmeter primary (option). If grounding electrodes are installed the grounding plates shown in Figs. 26 & 27 are not required.

When there are stray currents in the pipeline it is recommended that a grounding plate be installed at both ends of the flowmeter primary.

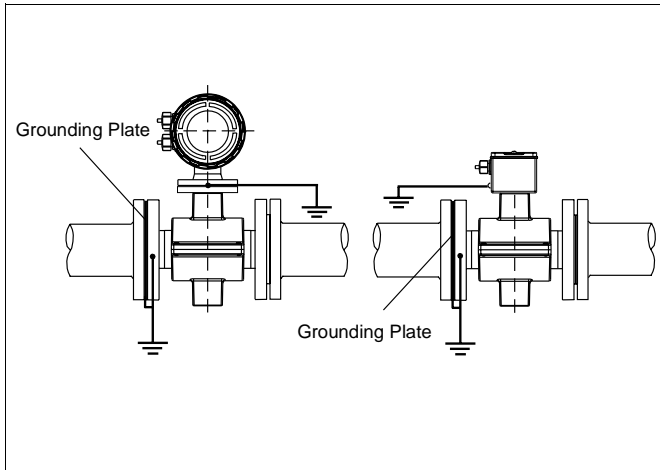


Fig. 26 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Flanged

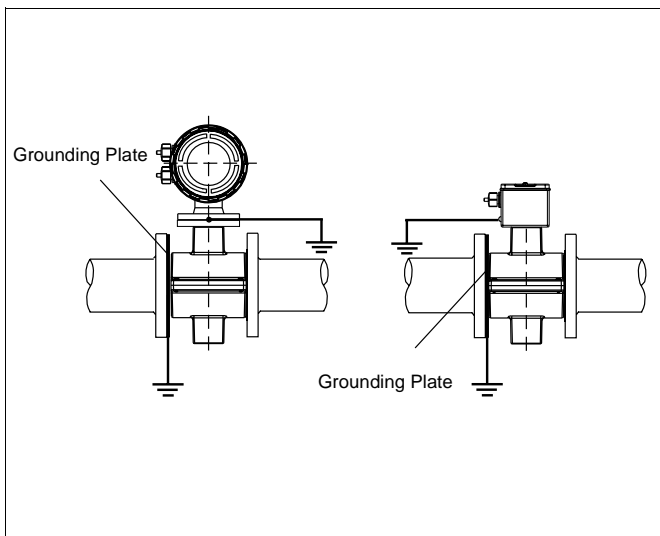


Fig. 27 Flowmeter Primary 1/8"- 4" [DN3 - DN100] Wafer Design

9.1.1 Grounding Models DE21_ and DE23_

The ground connections are made as shown in Fig. 28. The fluid is grounded by its contact with the adapter so that an additional ground connection is not required.

Exception:

Flowmeter primaries with plastic solvent weld process connections must have a grounding electrode installed in the flowmeter primary.

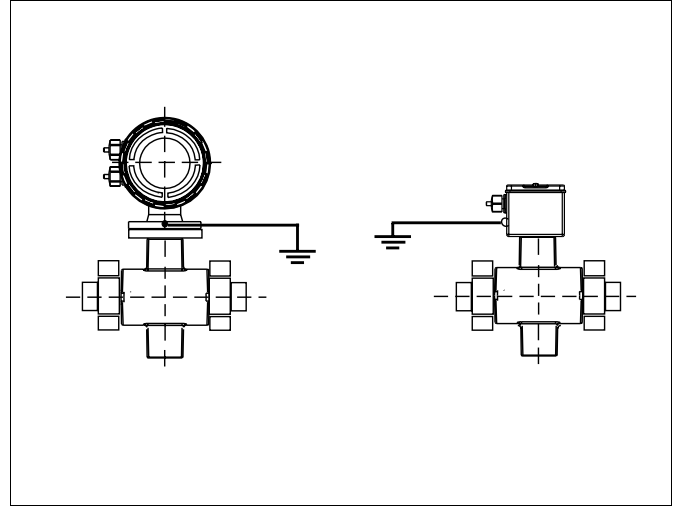


Fig. 28 Flowmeter Primary 1/8"- 4" [DN3 - DN100]

9.1.2 Grounding for Flowmeters with Hard or Soft Rubber Liners

In these flowmeters, sizes 5" [DN 125] and above a conductive section is integrated in the liner. This section grounds the fluid.

9.2 Signal and Excitation Cable Connections for Model MAG-XE

The Electromagnetic Flowmeter primary is connected to its converter by a cable. The magnet coil supply voltage of ≤ 12 V DC is provided from terminals M1/M2. The signal/excitation cable is connected to the flowmeter primary at terminals 1, 2, M1, M2, 3, SE. A description of the connections is shown in Fig. 29. The shield 3 is connected to common at the flowmeter which is connected to ground internally. The ground connection on the outside of the flowmeter primary is also to be connected to ground.

9.2.1 Signal and Excitation Cable Construction

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

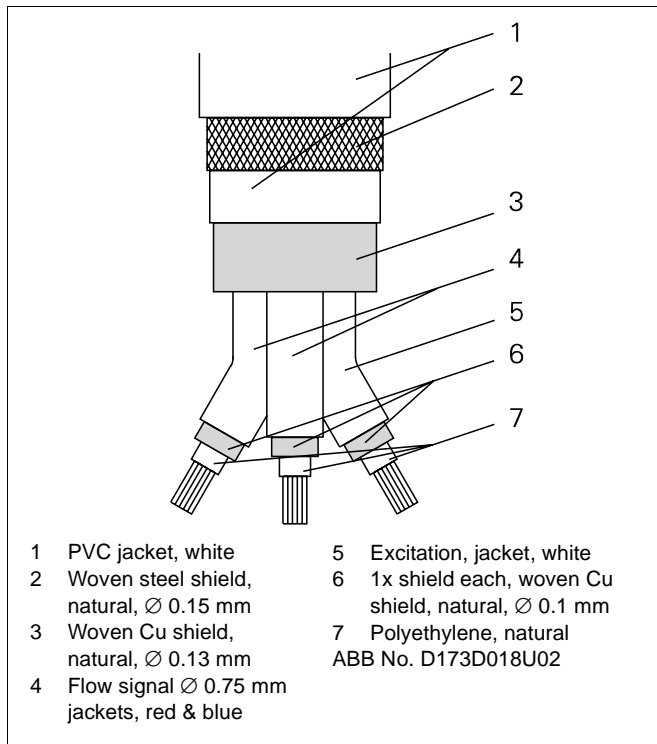


Fig. 29 Signal Cable Construction

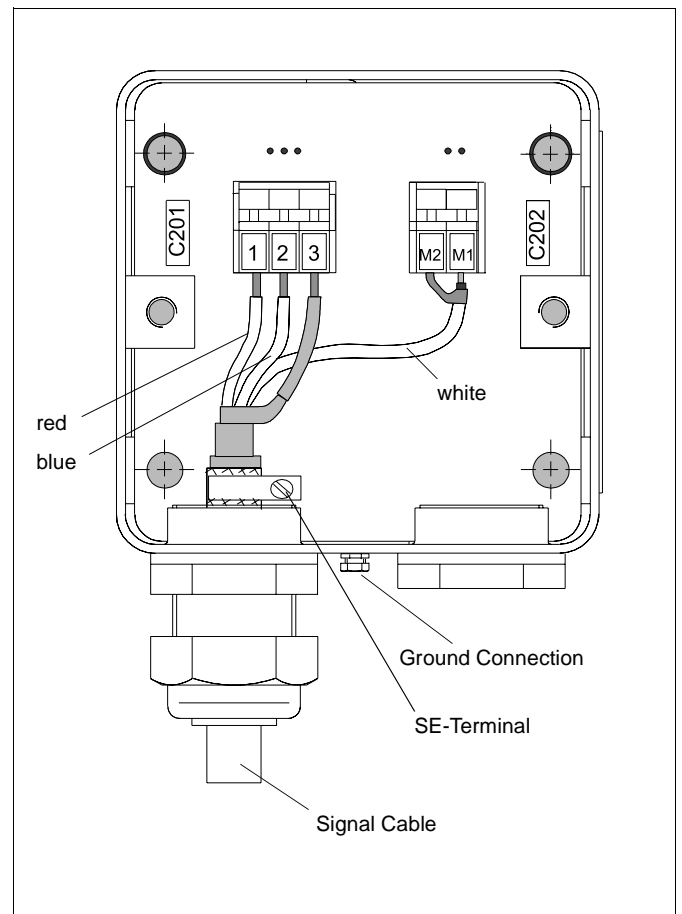
The cables should not be routed in the vicinity of large electrical machinery and switch gear equipment which could induce stray fields, pulses and voltages. All leads are to be shielded and their shields connected to ground B. The signal cable should not be fed through branch fittings or terminals strips.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

! Note:

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

9.2.2 Flowmeter Primary Connection Area

The leads of the signal/excitation cable should be routed in the shortest manner to the connection terminals. Cable loops are to be avoided (see Fig. 29).



Terminal Designations	Connections
1 + 2	Flow signal leads (red & blue)
3	Inner cable shield (Copper)
M1 + M2	Signal potential
SE	Magnetic field excitation connections
	Outer cable shield (steel)

Fig. 30 Flowmeter Primary Connection Area

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9.2.3 Electrical Connection Area

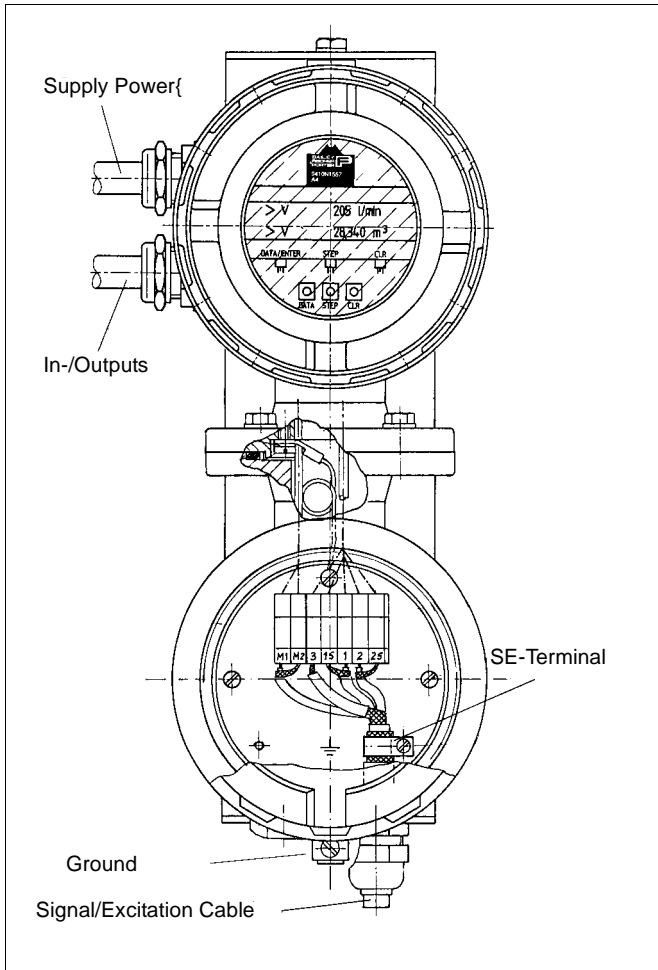


Fig. 31 Converter, Field Mount Housing View into Connection Box

9.2.4 Installations for Protection Class IP 68

The max. submergence depth for flowmeter primaries designed for Protection Class IP 68 is 5 m. A hose enclosed connector is used in place of the standard PG connector. The signal/excitation cable must be enclosed in the 1/2" hose from the connection box to above the maximum submergence level (Fig. 33). Above this level the cable is installed using the cable connector included with the shipment in a water tight manner. The hose is then attached to the hose connector using the threaded clamp ring. Finally the connection box should be carefully secured.

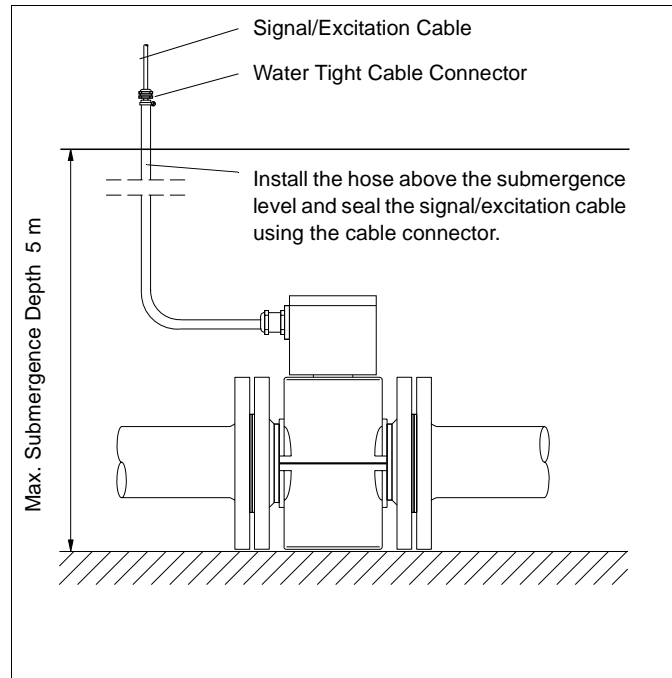


Fig. 33 Installation IP 68 (Hose Connector)

Note:

When installing the signal/excitation cable at the flowmeter primary a water trap should be provided (Fig. 32).

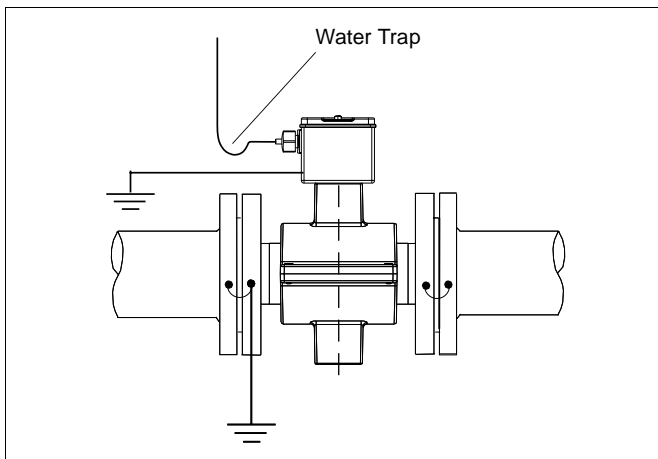


Fig. 32 Cable Installation with a Water Trap

9.3 Interconnection Diagrams

9.3.1 Interconnection Diagram COPA-XE

Connection Variations for Analog Communication (incl. HART)

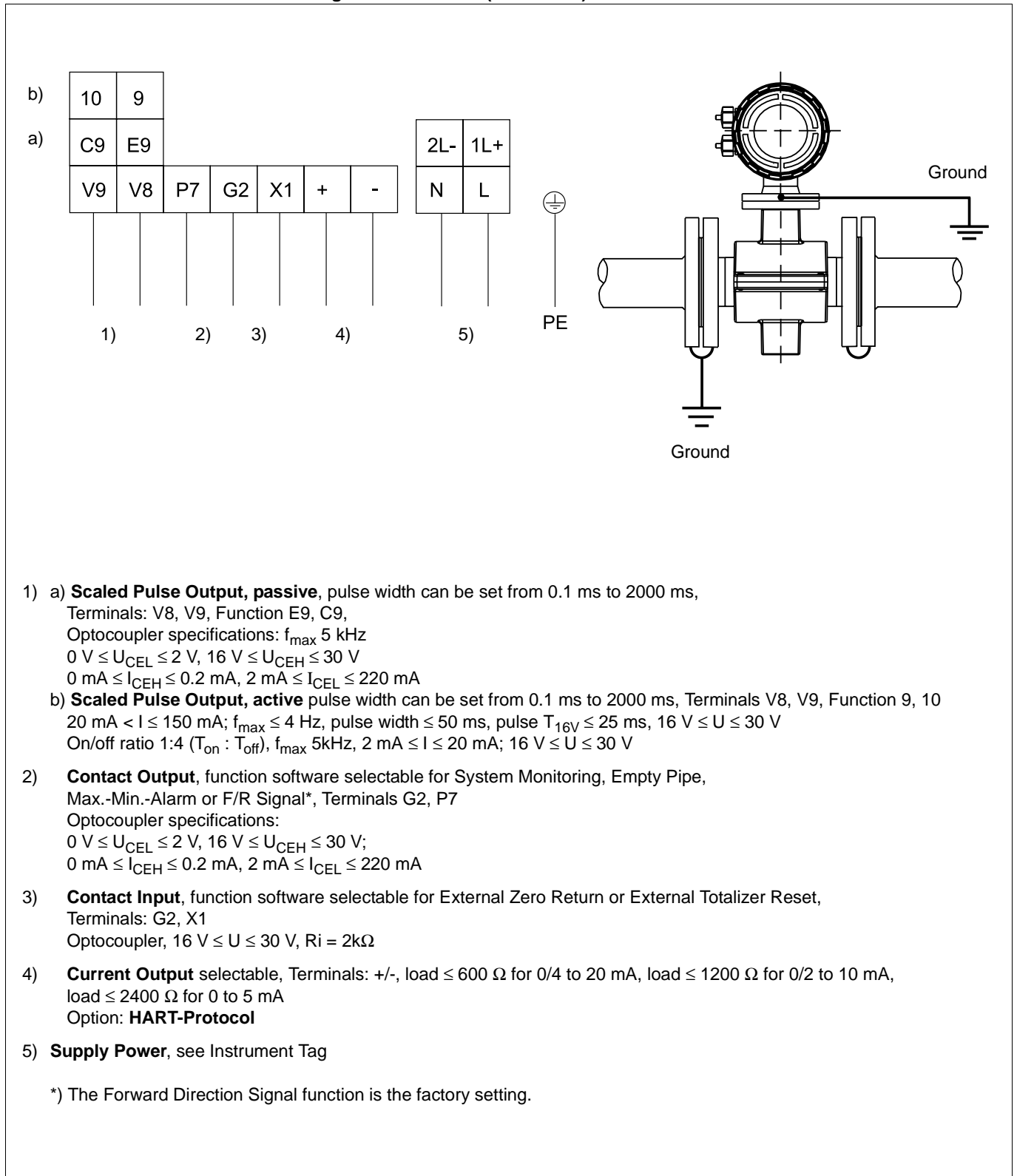


Fig. 34 Interconnection Diagram COPA-XE for Analog Communication

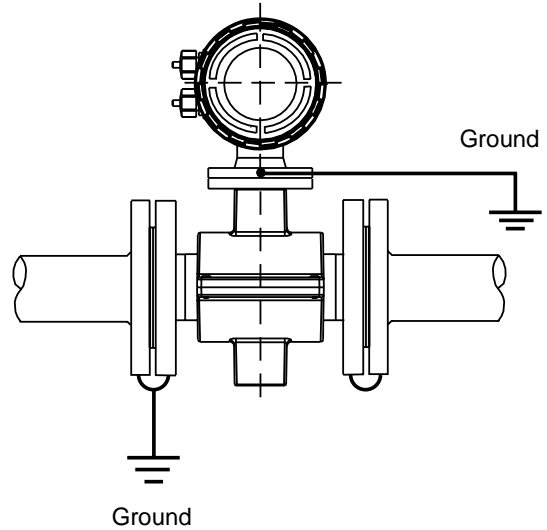
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9.3.2 Interconnection Diagram COPA-XE Connection Variations for Digital Communication

- c) Profibus DP
- b) RS485 (ASCII Protocol)
- a) Profibus PA

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



Design a)

Terminals Ux, V8

Scaled Pulse Output, passive (Optocoupler), pulse width can be set from 0.1 ms to 2000 ms, Optocoupler specifications:

f_{max} 5 kHz

$0 V \leq U_{CEL} \leq 2 V$, $16 V \leq U_{CEH} \leq 30 V$;

$0 mA \leq I_{CEH} \leq 0.2 mA$, $2 mA \leq I_{CEL} \leq 220 mA$

Terminals Ux, P7

Contact Output, function software selectable for System Monitoring, Empty Pipe, Max.-Min.-Alarm or F/R Signal

Optocoupler specifications:

$0 V \leq U_{CEL} \leq 2 V$, $16 V \leq U_{CEH} \leq 30 V$;

$0 mA \leq I_{CEH} \leq 0.2 mA$, $2 mA \leq I_{CEL} \leq 220 mA$

Terminals PA+, PA-

Connection for Profibus PA per IEC1158-2 (see also Page 50)

Terminals +, -

Current Output, Terminals: +/-, load $\leq 600 \Omega$ (4 to 20 mA only)

Design b)

Same as Design a), except

Terminals A, B

Serial Data Link RS485 for Communication using ASCII-Protocol

Design c)

Same as Design a), except

Terminals +VD, A, B, GND

Connections for Profibus DP per EN50170 (see also Page 49)

Supply Power

See Instrument Tag

Fig. 35 Interconnection Diagram COPA-XE for Digital Communication

9.3.3 Interconnection Diagram MAG-XE Connection Variations for Analog Communication (incl. HART)

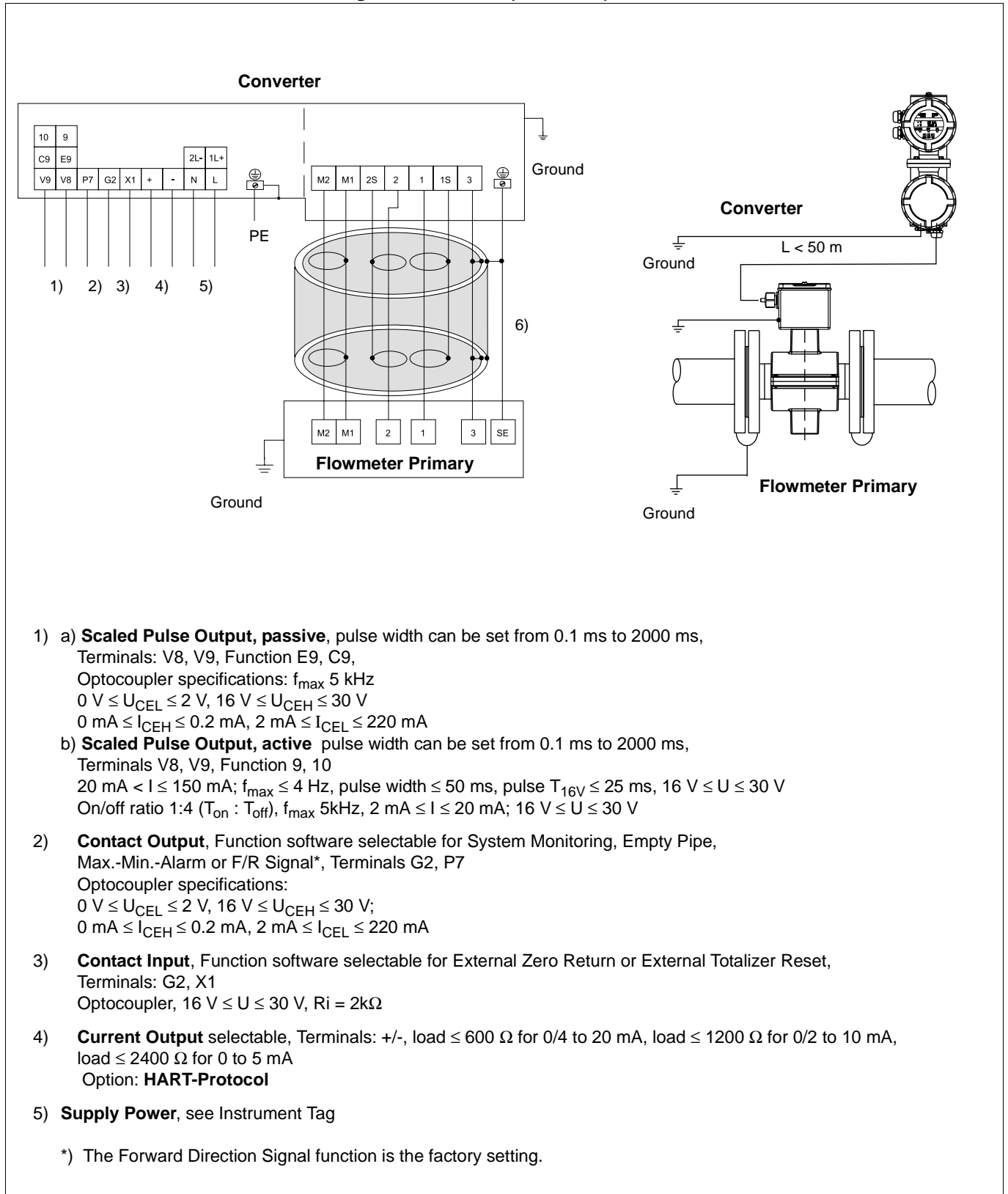


Fig. 36 Interconnection Diagram MAG-XE for Analog Communication (incl. HART)

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COPA-XE / MAG-XE

9.3.4 Interconnection Diagram MAG-XE Connection Variations for Digital Communication

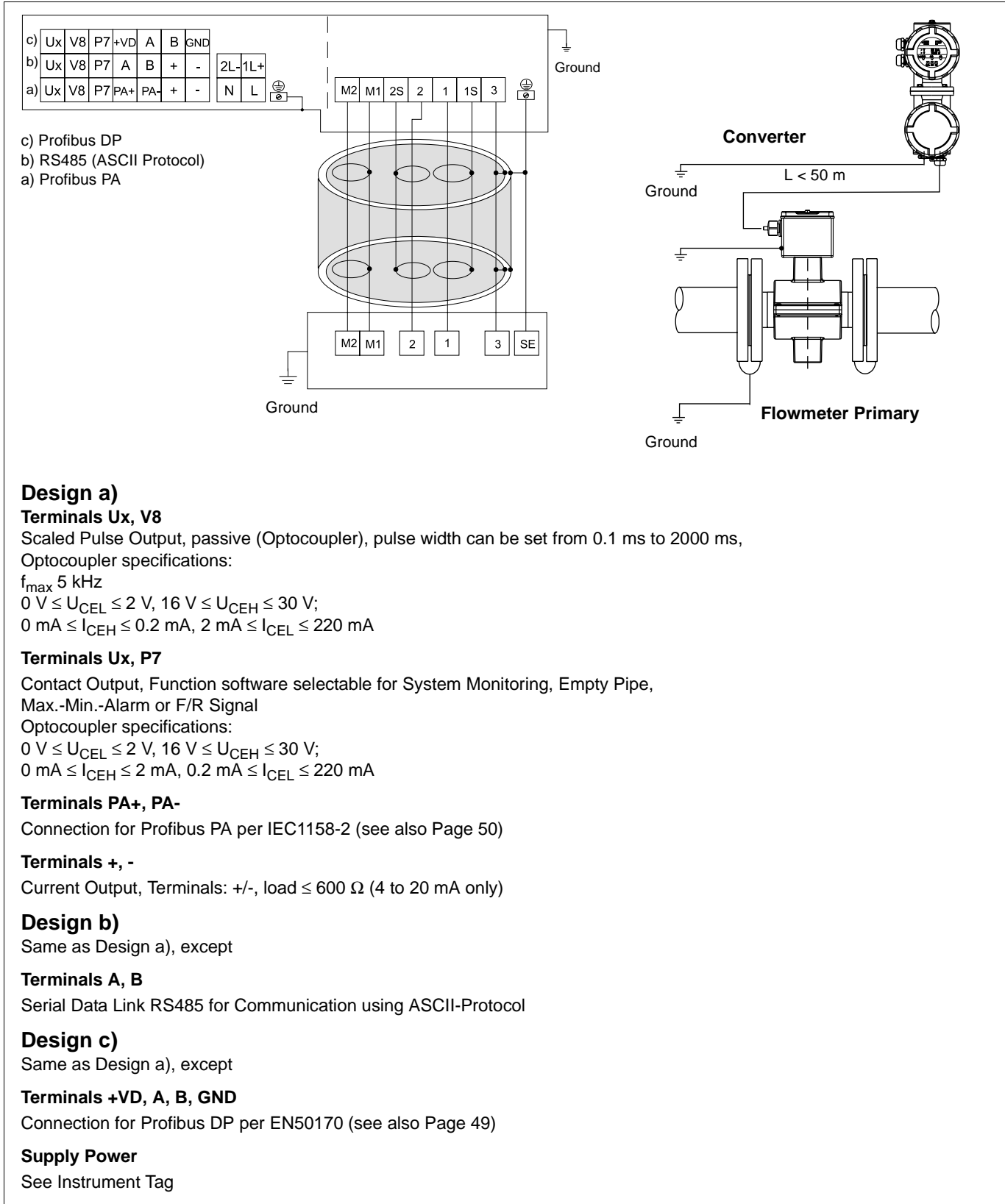


Fig. 37 Interconnection Diagram MAG-XE for Digital Communication

9.3.5 Interconnection Examples for Peripherals For Analog Communication (incl. HART)

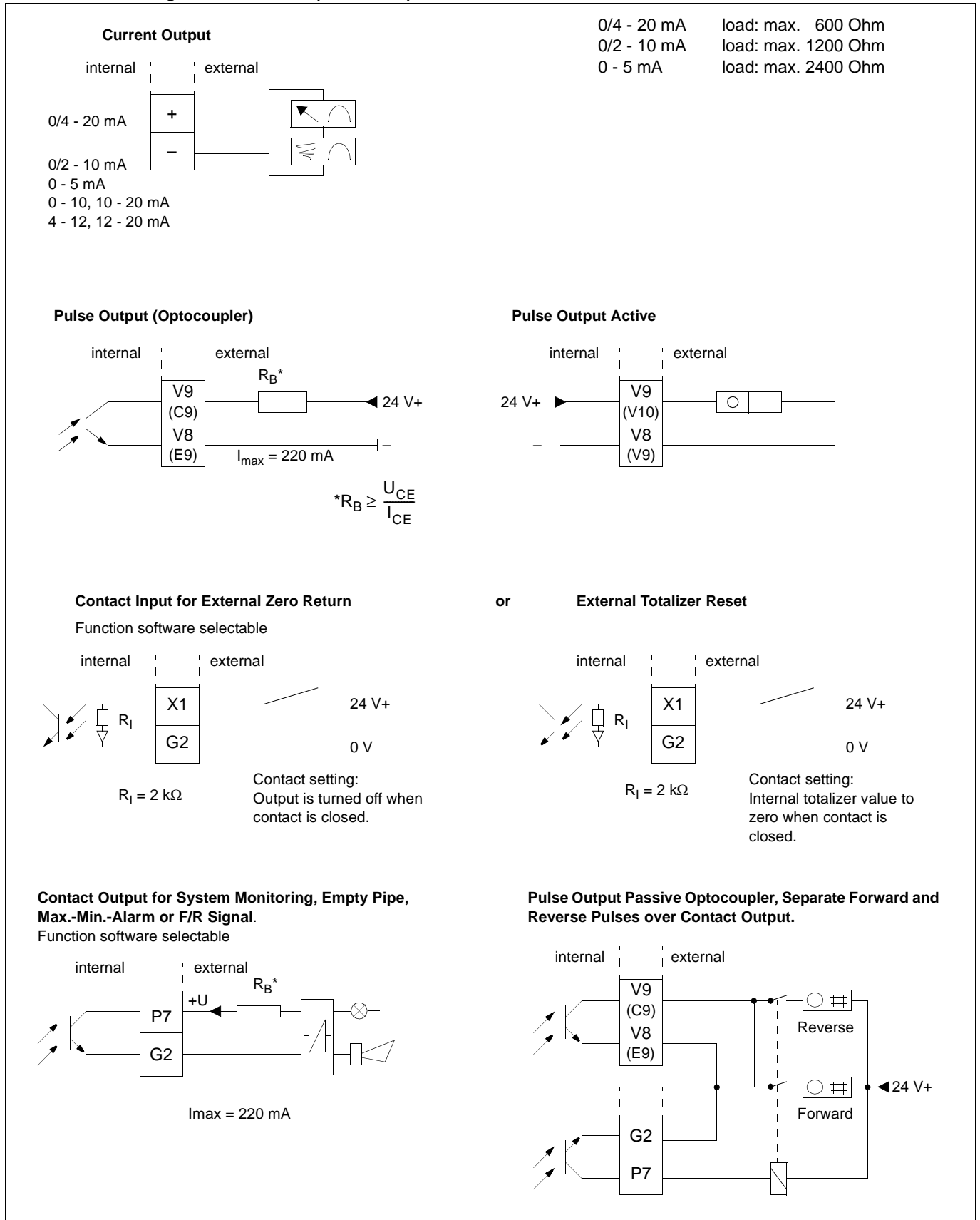


Fig. 38 Interconnection Examples for Peripherals for Analog Communication Including HART

Electromagnetic Flowmeter

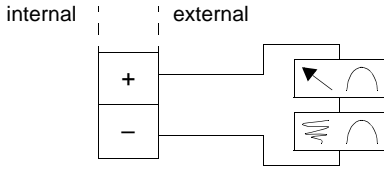
COPA-XE / MAG-XE

9.3.6 Interconnection Examples for Peripherals For Digital Communication

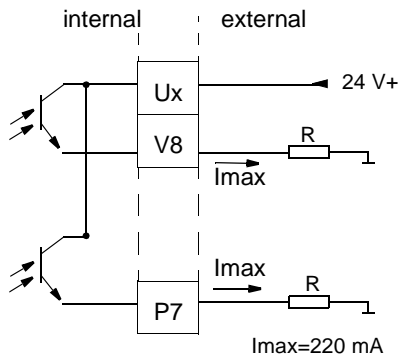
Current Output (not available with Profibus DP)
(for Profibus PA only 4-20 mA)

4 - 20 mA

load: max. 600 Ohm

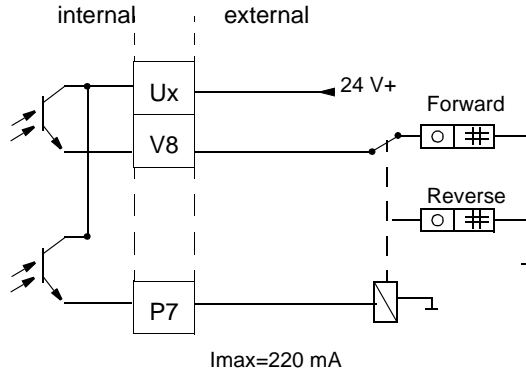


Pulse Output and Contact Output



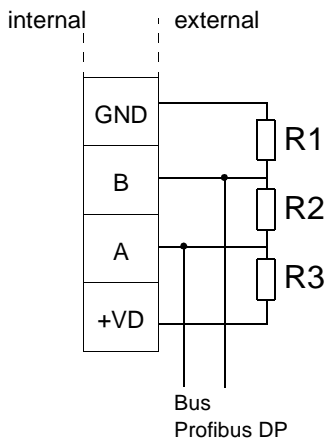
Contact Output Ux / P7 for System Monitoring, Empty Pipe, Max.-Min.-Alarm or F/R Signal
Function software selectable
Pulse Output Optocoupler Ux/V8

Connection Example for Separate Forward and Reverse Pulses over Contact Output



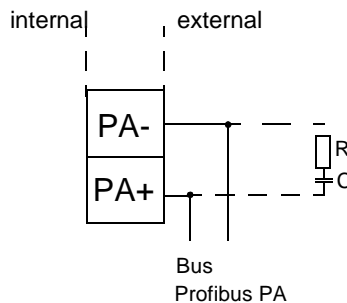
Profibus DP

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



Profibus PA

The resistor R and the capacitor C form the bus termination. They are to be installed when the instrument is connected at the end of the bus.
R = 100 Ω; C = 1 μF



Data Link RS485

Two wire data link, halfduplex, max. cable length: 1200 m, max. 32 instruments on bus, twisted pair cable.

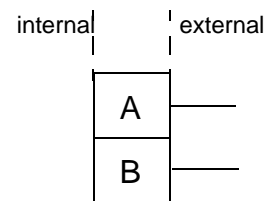


Fig. 39 Interconnection Examples for Digital Peripherals

9.3.7 Supplementary Information for Connecting Profibus DP

A Profibus DP Protocol is available among others in the converter for digital communication. The digital communication utilizes the RS 485 Data Link.

Transmission format	RS 485 Data Link
Transmission speed	9.6 to 1500 KBit/s
Protocol	per EN 50170
Ident-No.	6666 HEX

Cyclical (output variables, see separate Data Link Description for COPA/MAG-XE, Part No. D184B093U09)

Terminal	Function	Reference
+VD	VP	Supply voltage +5V
A	RxD/TxD-N	Receive/send-data-N
B	RxD/TxD-P	Receive/send-data-P
GND	C DGND	Data reference potential M5V

Cable

A shielded and twisted data cable is recommended.
 Max. cable length 1200 m (Cable Type A)
 Characteristic impedance 135-165Ω
 Max. 32 instruments on a single bus
 Baudrate: 9.6-1500 kbit/s
 Distributed capacitance <30 pF/m, loop resistance 110 Ω/km
 Tap length max. 1 m.
 Incoming and outgoing cables on the same terminals.

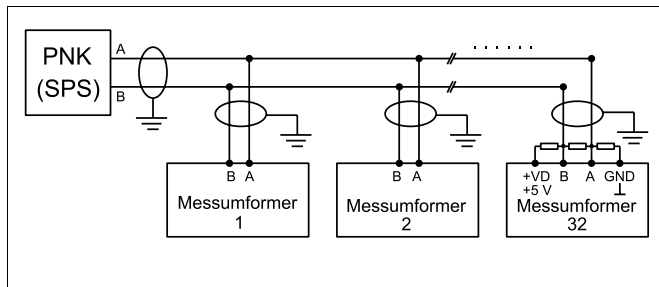


Fig. 40 Communication Profibus DP

Bus Terminations for Profibus DP

Both ends of the bus must have bus terminations installed, see Fig. 41. In addition to the bus termination resistor R2 per the EIA-RS-485 Standard a resistor R1 (Pull-down) to the data reference potential GND and a resistor R3 (Pull-up) to the plus supply voltage +VD are to be installed. These two resistors assure that a defined idle potential exists on the bus when no participant is transmitting (idle time between telegrams, the so-called idle status).

For values see DIN 19245, Part 1 and Part 3.

For Cable Type A: R1 = 390 Ω, R2 = 220 Ω, R3 = 390 Ω

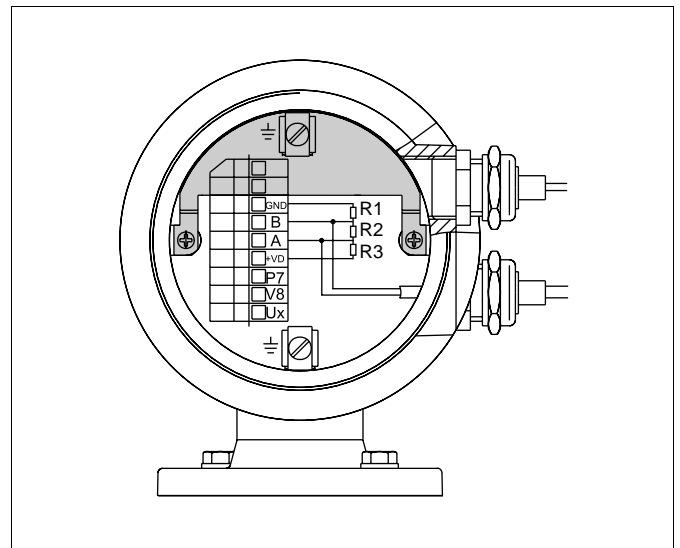


Fig. 41 Bus Terminations for Profibus DP, when the Instrument is Connected at the End of the Bus

Electromagnetic Flowmeter

COPA-XE / MAG-XE

9.3.8 Supplementary Information for Connecting Profibus PA

Profibus PA Protocol

Transmission format	per IEC 1158-2
Transmission speed	31.25 KByte/s
Protocol	per EN 50170
Ident-No.	6668 HEX

Cyclical (output variables "out" and "Out_Total")

The variable "OUT" contains the present measurement value in engineering units (% , l/s, m3/h...) and the corresponding status.

The variable "Out_Total" contains the present totalizer value in engineering units (m3, l...) and the corresponding status.

Acyclical

- Flowmeter primary size ("NOMINAL_SIZE")
- Instantaneous flowrate units ("FLOWRATE_UNITS")
- Self test on/off ("SELF_CHECKING")
- Flow direction normal/inverse ("FLOW_DIRECTION")
- Excitation frequency ("SAMPLE_RATE")
- Low flow cutoff value in % ("LOW_FLOW_CUTOFF")
- and additional data, see separate Data Link Description for COPA/MAG-XE)

The stored data are maintained during power interruptions.

Cable

A 2-conductor twisted shielded Cu cable per EN 50170 Type A is recommended

Conductor area (nominal):	0.8 mm ² (AWG 18)
Loop resistance (DC)	44 Ω/km
Characteristic impedance at 31.25 kHz	100 Ω +/-20 %
Wave attenuation at 39 kHz	3 dB/km
Capacitive unsymmetry	2 nF/km

Max. cable length 1900 m for use with standard Power Supply Type IV (Segment Coupler) in non-Intrinsically Safe Design (U = 24 V, I_{max} = 500 mA, P_{max} = 12 W)

Tap lead: Max. 30 - 60 m from tee or from subdistributor.

No. of participants: Max. 32 instruments on a single segment, maximum 126 in total

Bus topology: Tree and/or linear structure

Bus termination: Passive at both ends of the main bus (RC-Element R = 100 Ω, C = 1 μF)

Isolation in-/outputs: There is no galvanic isolation between the current output (terminals +/-) and the Profibus PA (terminals PA+/PA-)!)

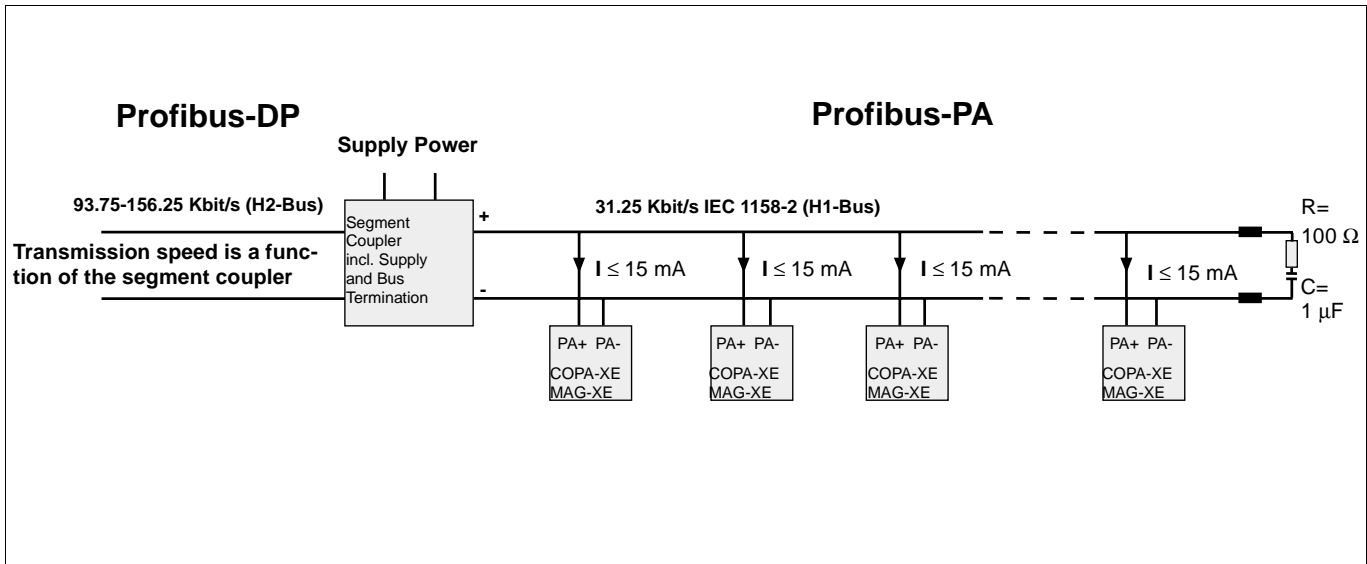


Fig. 42 Profibus

Bus Termination:

A bus terminator must be installed at each end of the bus, see Fig. 43.

The termination utilizes a RC-element with the following values:

$R = 100 \text{ Ohm}$; $C = 1 \mu\text{F}$

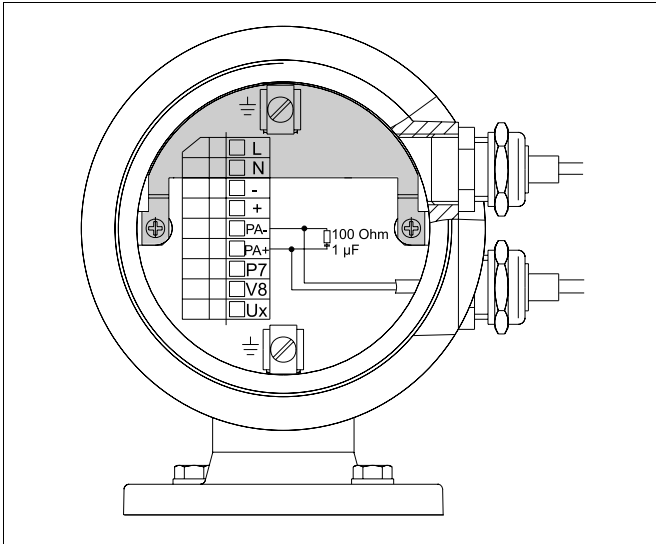



Fig. 43 Bus Termination for Profibus PA, when the Instrument is Connected at the End of the Bus

9.3.9 Safety Information

Note

There are circuits in the flowmeter primary and converter which are dangerous to personnel contact. Therefore the supply power should be turned off before the covers are removed. Service on opened instruments should only be performed by qualified personnel.

- Converter and flowmeter primary are to be grounded in accordance with the valid international standards.
- The connection leads must be sized for the current draw of the flowmeter. The cables must correspond to IEC227 or IEC245.
- For installations inside buildings the supply power cables to the flowmeter are to be installed with a switch or line switch which should be located in the vicinity of the flowmeter and identified accordingly.
- The electrical connections between the flowmeter primary and the converter can only be made with the signal cable supplied by ABB Automation Products. The connections are to be made in accordance with the appropriate Interconnection Diagram.
- For safe operation of the instrument the instructions contained in the Instruction Bulletin are to be followed.

The Notes  are to be observed!

Notes for Connection of Peripheral Instruments

With the exception of the supply power circuit the circuits contain voltages which are not dangerous to personnel contact. To these circuits, only instruments with circuit voltages which are not dangerous to personnel contact may be connected.

Electromagnetic Flowmeter

COPA-XE / MAG-XE

10. Start-Up

10.1 Initial Checks of the Flowmeter System

10.1.1 Checking the Flowmeter COPA-XE

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

The supply power is turned off.

- Check the grounds.
- Check the connections per the Interconnection Diagram.
- Check that the supply power values agree with the specifications on the Instrument Tag.

Turn on the supply power!

- After the supply power is turned on the flowmeter primary data stored in the external EEPROM are compared to the values stored internally. If the data sets are not identical, an automatic exchange of the data (upload) into the converter is initiated. The message "Primary data are loaded" is displayed on the converter. The flowmeter is now ready for operation.
- The converter must display one of the process indication formats, (Section 3.1).
- In order for the instrument to be operational it is necessary to select or enter a few parameters. The flow range is automatically set to 10 m/s. Enter the desired flow value for Qmax with the appropriate engineering units. Hydraulically ideal are flow range end values of approx. 2-3 m/s. In the "Submenu Current Output" select the desired current output range. For the pulse output the pulses/unit, the pulse width are to be entered and the selections in the Submenu Totalizer are to be made.
- The system zero should be checked (see Section 10.2).
- To complete the start-up call the submenu "Store data in external EEPROM", to save the settings which were changed during start-up. For a converter exchange the EEPROM is to be unplugged from the old converter and plugged into the new converter (see Section 10.4).

10.1.2 Checking the Flowmeter MAG-XE

The start-up procedure described here is to be followed after the assembly and installation of the flowmeter primary and the converter have been completed.

The supply power is turned off.

- Check that the installation requirements have been followed.
- Check the grounds.
- Check the connections per the Interconnection Diagram.
- Check that the supply power values agree with the specifications on the Tag.
- Check that the converter is mounted in an essentially vibration free location.
- Check that the ambient temperature limits for the converter (-20 °C and +60 °C) will not be exceeded.

- Check for correct coordination between the flowmeter primary and the converter. The instruments which belong together which are identified by the same end digits on the Instrument Tag e.g. A1 goes with B1 or A2 goes with B2.
- Check that the EEPROM is plugged into the socket on the display board of the converter (see Section 10.5). A tag on this EEPROM contains the Order No. with its end digits. These end digits should be the same as those contained on the Instrument Tag of the flowmeter primary to be used. Both must be identical!

Turn on the supply power!

- The converter must display one of the process indication formats, see Section 3.1. In order for the instrument to be operational it is necessary to select or enter a few parameters. Enter the desired flow value for Qmax with the appropriate engineering units. Hydraulically ideal are flow range end values of approx. 2-3 m/s. In the "Submenu Current Output" select the desired current output range. For the passive pulse output the pulses/unit, the pulse width are to be entered and the selections in the Submenu Totalizer are to be made.
- Check the flow direction. If the flow direction indicators in the display do not agree with the actual flow direction change the parameter "Flow Direction" from "Normal" to "Inverse".
- To complete the start-up call the submenu "Store data in external EEPROM", to save the settings which were changed during start-up. For a converter exchange the EEPROM is to be unplugged from the old converter and plugged into the new converter, see Section 10.4.
- Check the system zero.

10.2 System Zero Check

The system zero of the flowmeter system is set at the converter. The flow in the flowmeter primary is to be brought to an absolute standstill. The meter tube in the flowmeter primary must be guaranteed full. Then the parameter "System Zero" can be utilized for a manual or to initiate an automatic zero adjustment: Select parameter with ENTER, use the ARROW keys to select the method, e.g. "Automatic" and initiate by pressing ENTER. During the adjustment procedure the converter displays in the 2nd line a count down from 255 to the actual zero value after which the zero adjustment procedure is completed. The procedure takes approx. 20 seconds, see also Section 4.11.

Start-up of meters with Profibus PA/DP communication

A detailed description is available as a separate manual.

For Profibus PA: Part No. of manual is D184B093U10

For Profibus DP: Part No. of manual is D184B093U12

10.3 "Empty Pipe" Detector (Option)

At start-up the Empty Pipe Detector module is to be adjusted for the operating conditions. For adjustment instruction see Section 4.18.

10.4 Converter Exchange

All parameter settings are stored in an EEPROM located on the display board. When a converter module has to be exchanged, it is possible, after the new converter module is installed to plug the old EEPROM into the new converter and upload all the parameter settings into the new converter. Converter specific data are automatically updated.

! Note:

- After the configuration process has been completed, all parameter settings should be saved in the external EEPROM.

10.5 Socket Location for the Memory Module (external EEPROM)

The socket for the ext. EEPROM is located on the front of the display board or for versions without a display, on the EEPROM connection board.

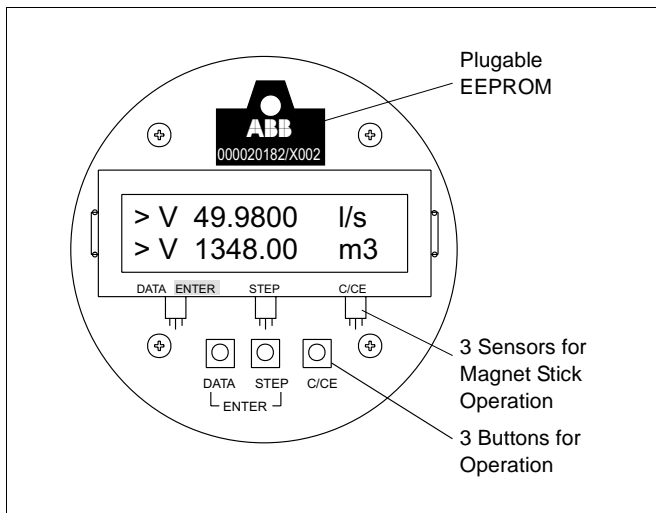


Fig. 44 Display Board

10.6 Maintenance / Repair

The flowmeter primary is essentially maintenance free. An annual check should be conducted of the ambient conditions (air circulation, humidity), seal integrity of the process connection gaskets, cable connectors and cover screws, functional reliability of the supply voltage, the lightning protection and the grounds.

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

Please observe the Note (Hazardous Material Information) when returning the flowmeter primary to the ABB Automation Products factory for repair!

! Notes for Opening the Housing

The following notes must be observed when opening the housing of the converter:

- All connection leads must be voltage free.
- When the housing is open, the EMC-Protection is limited.

10.7 Display Rotation

Remove the housing cover screws. The display board is mounted by 4 Phillips head screws (Fig. 45, 1 to 4).

After removing these screws the display can be removed. Carefully plug in the rotated display and reinstall the 4 screws. Then carefully reinstall the cover and secure with the cover screws. Check that the gaskets are properly seated. Only then can Protection Class IP 67 be maintained.

! General Note

- If the forward and reverse flow indicators in the display do not agree with the actual flow direction change the parameter "Flow Direction" from "Normal" to "Inverse".

10.8 Replaceable Parts List, Flowmeter Primary

If the liner, electrodes or magnet coils require repair the flowmeter primary must be returned to the ABB Automation Products factory in Göttingen, Germany. Please observe the Note "Hazardous Information".

Electromagnetic Flowmeter

COPA-XE / MAG-XE

11. Specifications Converter for COPA-XE and MAG-XE

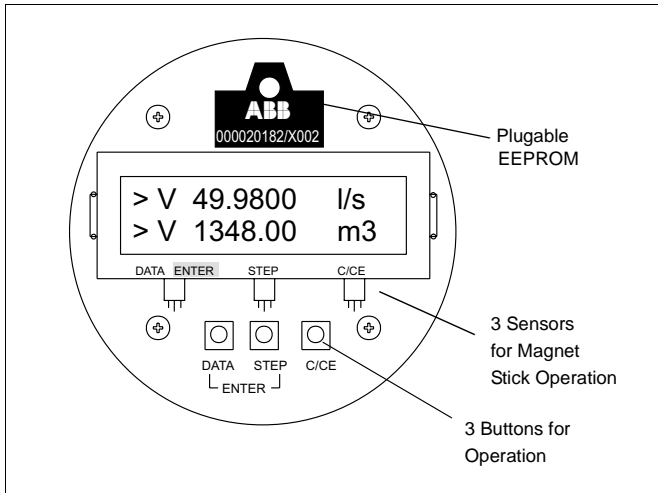


Fig. 45 Converter Keypad and Display

Flow Range

Continuous between 0.5 and 10 m/s

Accuracy

≤ 0.5 % of rate

Reproducibility

≤ 0.15 % of rate

Minimum Conductivity

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

Response Time

For a 0-99 % step function (corresponds to 5 τ) ≥ 1 s

Supply Power

High voltage AC 85-253 V
Low voltage AC 16.8-26.4 V
Low voltage DC 16.8-31.2 V
Harmonic content: 5%

Magnetic Field Supply

6¼ Hz, 7½ Hz, 12½ Hz, 15 Hz, 25 Hz, 30 Hz
(50/60 Hz Supply Power)

Power

Flowmeter primary incl. converter
≤ 14 VA for AC supply power
≤ 6 W for DC supply power

Ambient Temperature

-20 to +60 °C

Electrical Connections

Screwless spring terminals

Protection Class per EN 60529

IP 67, IP 68 (only MAG-XE)

Forward/Reverse Metering

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

Display

With Lighted Display, data entry using the 3 buttons directly from the converter or with a Magnet Stick when the housing is closed.

2x16-character LCD-Dot Matrix display. The flow is totalized internally separately for each flow direction in one of 16 different units. The flowrate can be displayed in percent or one of 45 different units. The converter housing can be rotated by 90°. The display can be plugged into 3 different positions so that optimal readability is assured. In multiplex operation the flowrate in %, engineering units or bargraph, the totalizer value forward or reverse, the TAG No. or the current output value can additionally be selected for the 1st or 2nd lines of the display.

Converter Housing Designs

For Model COPA XE

Compact Design with converter housing made of a light metal casting, painted, 60 μm thick coat, center section dark grey RAL 7012, front and rear sections (cover) light gray RAL 9002.

Option:

Stainless steel converter housing

For Model MAG-XE

- Field mount housing made of light metal casting, painted, 60 μm thick coat, center section dark grey RAL 7012, front and rear sections (cover) light gray RAL 9002
- 19" Insert
- Panel mount housing
- Rail mount housing

Weight:

COPA-XE: see Dimensions in spec-sheet
MAG-XE: Field mount housing: 4.5
19" Insert: 1.5 kg
Rail mount housing: 1.2 kg
Panel mount housing: 1.2 kg

Signal Cable (only MAG-XE)

The maximum cable length between the flowmeter primary and the converter is 50 m. Each flowmeter system is shipped with a 10 m long signal cable. If more than 10 m are required, additional cable can be ordered using Part No. D173D018U02.

Note:

- The instrument conforms to the NAMUR-Recommendation NE21. Electromagnetic Compatibility of Industrial Equipment in Processes and Laboratories 5/93 and EMC Guideline 89/336/EWG (EN 50081-1, EN 50082-2). Warning: The EMC-Protection is limited when the housing is opened.

Data Security

All data are stored when the supply power is turned off or interrupted in an EEPROM in the Converter. When a converter module and its external EEPROM are exchanged, all parameter settings are automatically uploaded when the power is turned on.

12. Overview, Parameter Settings and Designs

Meter location:	TAG-No.:
Flowmeter primary type:	Converter type:
Order No.: Instr. No.:	Order No.: Instr. No.:
Fluid Temp.:	Supply voltage:
Liner: Electrodes:	Excitation frequency:
C _{zero} : C _{Span} :	System zero

Parameter	Setting Range
Program Protection Code	0-255 (0=Factory setting)
Language	German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish
Meter Size	1/8" - 24" [DN 3 - 600]
Q _{max} :	0.5 Range _{max} -1 Range _{max}
Pulse Factor:	0.001 - 1000 pulses./unit
Pulse Width:	0.100 - 2000 ms
Low Flow Cutoff:	0 - 10 % of flow range end value
Damping:	0.125 - 99.99 seconds
Filter:	ON/OFF
Density:	0.01 g/cm ³ - 5.0 g/cm ³
Units Q _{max} :	l/s, l/min, l/h, hl/s, hl/min, hl/h, m ³ /s, m ³ /min, m ³ /h, igps, igpm, igph, mdg, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, ml/s, ml/min, ml/h, Ml/min, Ml/h, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, kgal/s, kgal/min, kgal/h, l, hl, m ³ , igal, gal, mgal, bbl, bls, g, kg, t, ml, uton, lb, kgal
Units Totalizer:	%
Max. Alarm:	%
Min. Alarm:	%
Terminals P7/G2:	Max. Alarm, Min. Alarm, Max./Min. Alarm, general alarm, empty pipe, F/R-signal, no function
Terminals X1/G2:	External zero return, totalizer reset, no function
Current Output:	0/4-20 mA, 0/2-10 mA, 0-5 mA, 0-10-20 mA, 4-12-20 mA
Iout at Alarm:	0 %, 130 %, 3.8 mA
Empty Pipe Detector:	ON/OFF
Alarm Empty Pipe	ON/OFF
Iout at Empty Pipe:	0 %, 130 %, 3.8 mA
Threshold:	2300 Hz
Adjust Empty Pipe:	Software potentiometer
Totalizer Function:	Standard, difference totalizer
1st Display Line:	Q (%), Q (units), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
2nd Display Line:	Q (%), Q (units), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
1st Line Multiplex:	ON/OFF
2nd Line Multiplex:	ON/OFF
Operating Mode:	Standard/fast
Flow Direction:	Forward/reverse, forward
Direction Indication:	Normal, inverse
Store Data in ext. EEPROM:	Yes/No
Pulse Output:	<input type="checkbox"/> Optocoupler <input type="checkbox"/> active 24 V
Contact In-/Output:	<input type="checkbox"/> Yes Optocoupler <input type="checkbox"/> No
Empty Pipe Detector:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Communication:	<input type="checkbox"/> HART-Protocol <input type="checkbox"/>
Display Design	<input type="checkbox"/> None <input type="checkbox"/> Lighted with Magnet Stick operation



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