Operating & Instruction manual

Electromagnetic Flowmeter

Model : EMFF/EMFS Series

(Integral Type / Remote Type)

Valid for Software Versions B. 12

Valid for HART-Software Versions X. 30

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1.1. Abstract

The electromagnetic flowmeters(EMF) from ientek. Products are the ideal flowmeters for metering the flow of all liquids, slurries and sludges that have a specific minimum electrical conductivity.
These flowmeters measure accurately, create no additional pressure drop, contain no moving or protruding parts, are wear free and corrosion resistant.
Installations are possible in any existing piping system.
The ientek. Products EMF has proven itself over many decades and is the preferred flowmeter in the Chemical, Pharmaceutical and Cosmetic industries, Municipal Water and Waste Water treatment facilities and in the Food and Paper industries.

1.2. Measurement Principle

Faraday's Laws of Induction form the basis for the electromagnetic flowmeter which states that a voltage is generated in a conductor as it moves through a magnetic field.
This principle is applied to a conductive fluid which flows through the meter tube perpendicular to the direction of the magnetic field (see Schematic).

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

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. From the equation for calculating the volume flowrate*) $U_E \sim qv$, it follows that the signal voltage is linear and proportional to the volumetric flowrate.

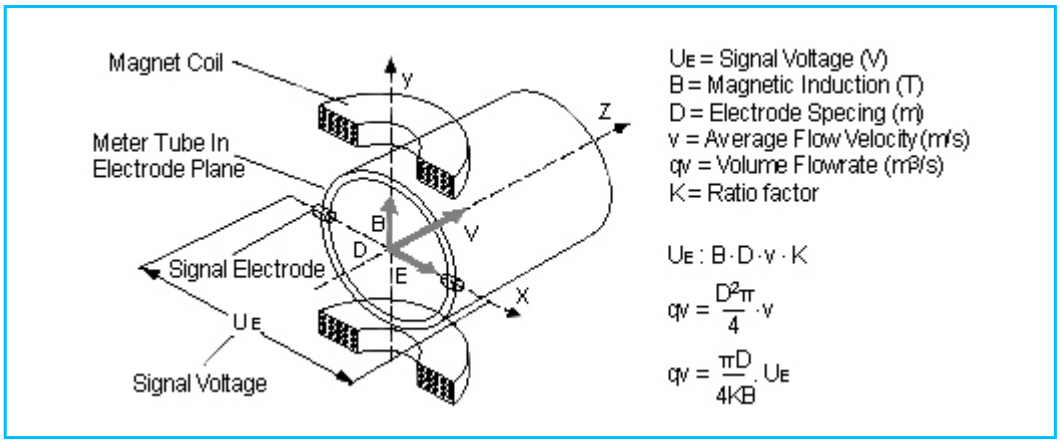


Fig. 1 : Schematic of an Electromagnetic Flowmeter

1.3. Design

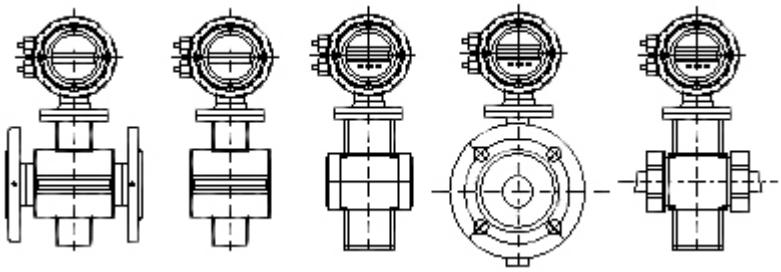
An electromagnetic flow metering system consists of a flowmeter primary and a converter.
The flowmeter primary is installed in the specified pipeline while the converter can be mounted locally (Remote type) or at a central location. In the Compact Design (Integral type) the flowmeter primary and converter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

1.4. Flowmeter Primary and Converter Coordination

Compact Design Integral Type

The μP-converter and the flowmeter primary con-Statute a single mechanical entity.
Flowmeter primary with Aluminum housing: Models EMF-EMFF and EMF-EMFS
Flowmeter primary with a stainless steel housing: Model EMF-EMFF_

Integral Type

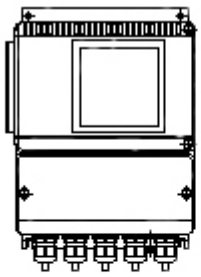


-EMFF Flanged | -EMFS Wafer Design | -EMFS -EMFF -EMFF Multiple Process Connections Stainless Steel

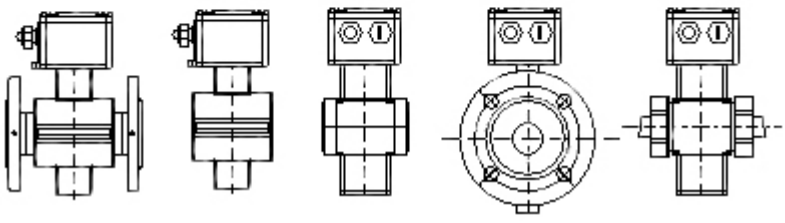
Remote Design Remote Type

The μP-converter is mounted remote from the Flowmeter primary.
Cable lengths up to 50m are Permitted for conductivities above 5 μS/cm.
The electrical interconnection between the converter and flowmeter primary are made in connection boxes using a single signal cable.
Flowmeter primary with Aluminum housing: Models EMF-EMFF and EMF-EMFS
Flowmeter primary with a stainless steel housing: Model EMF-EMFS

Remote Type



Field Mount Housing



-EMFF Flanged | -EMFS Wafer Design | -EMFS -EMFF -EMFF Multiple Process Connections Stainless Steel

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. Transport General

Note when transporting the instrument to the meter installation site:

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

Warning!

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

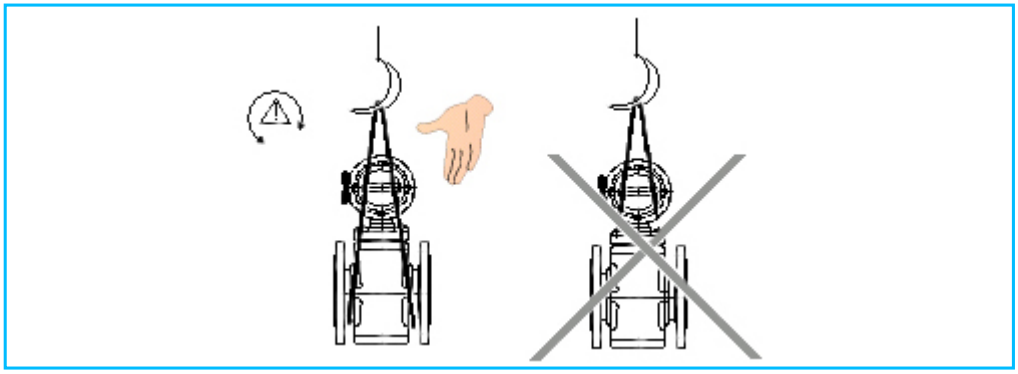


Fig. 2 : Transport of Flanged Instruments ≤ DN 300 [12"]

2.2.1. Transport of Flanged Instruments ≥ DN 350 [14"]

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

Attention!

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

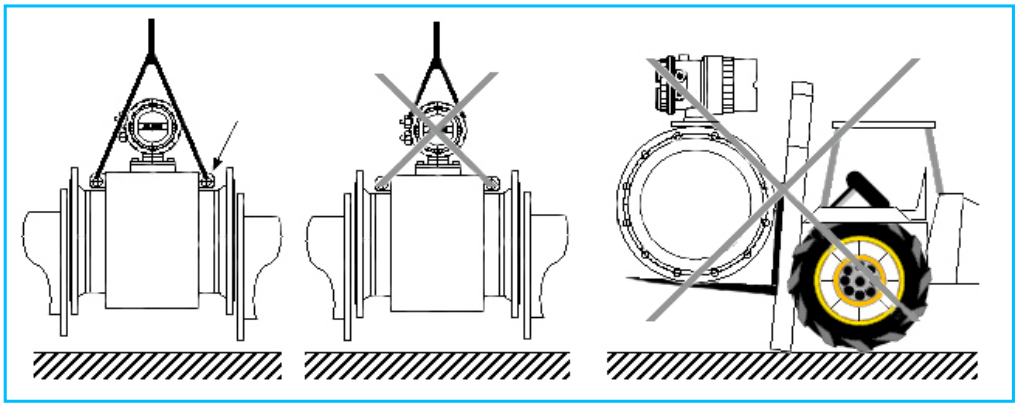


Fig. 3 : Transport of Flanged Instruments ≥ DN 350[14"]

2.2.2. Foundation and Supports DN 350 [14"]

These instruments must be set on appropriate foundations on supports.

Attention!

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

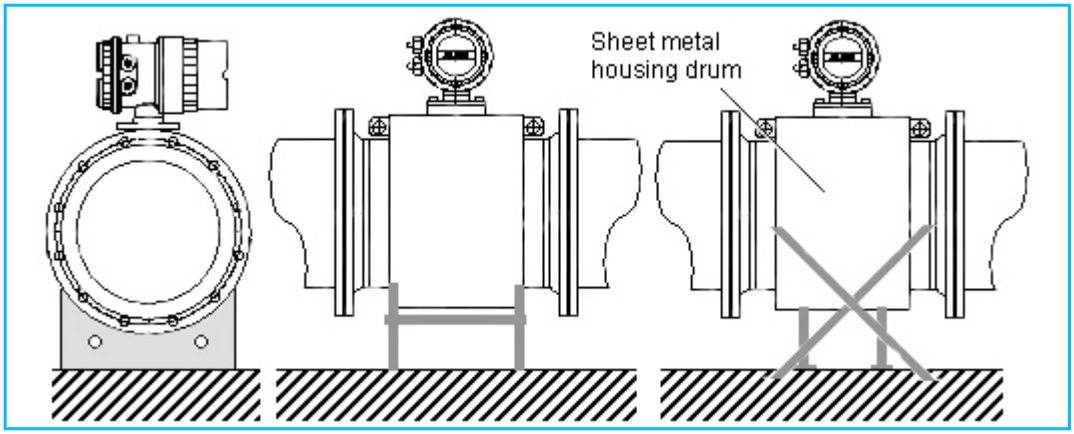


Fig. 4 : Supports for Flowmeter Sizes ≥ DN 350 [14"]

2.3. Installation Requirements

During installation assure that:

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

2.3.1. Recommended Installation Conditions

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

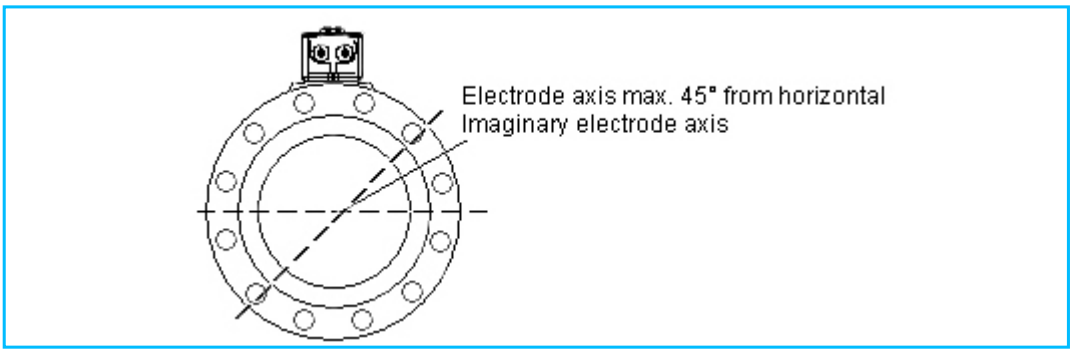


Fig. 5 : Electrode axis max.

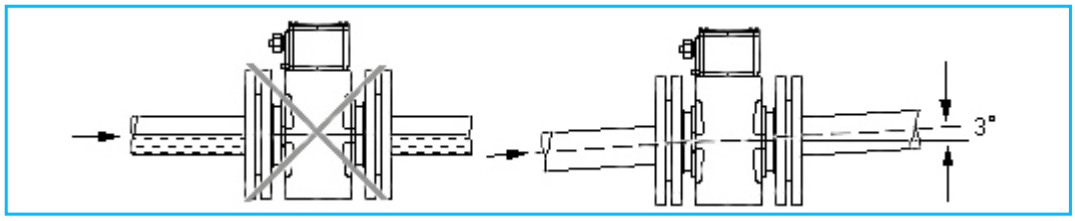


Fig. 6 : Installation in Horizontal Pipeline

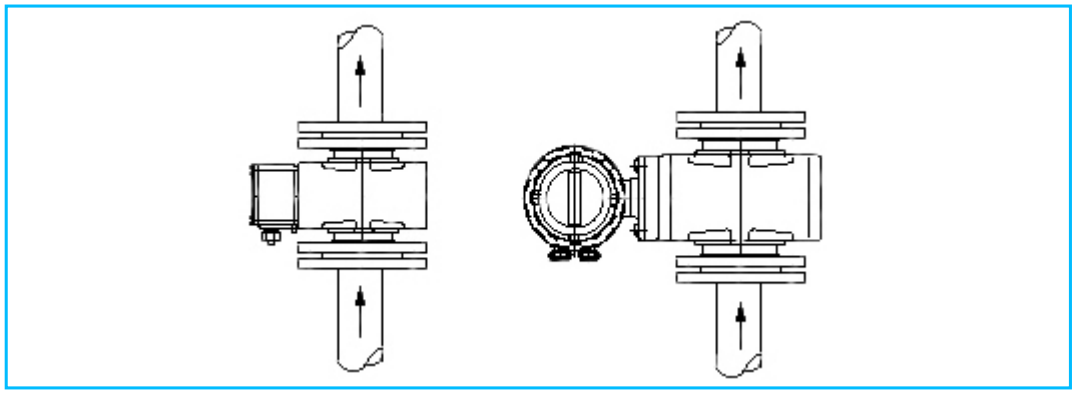


Fig. 7 : Installation in Vertical Pipeline

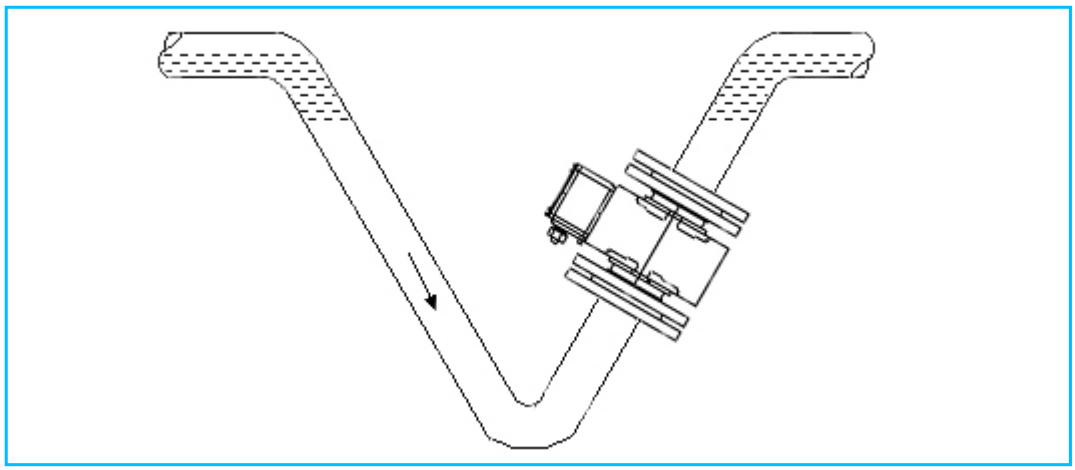


Fig. 8 :

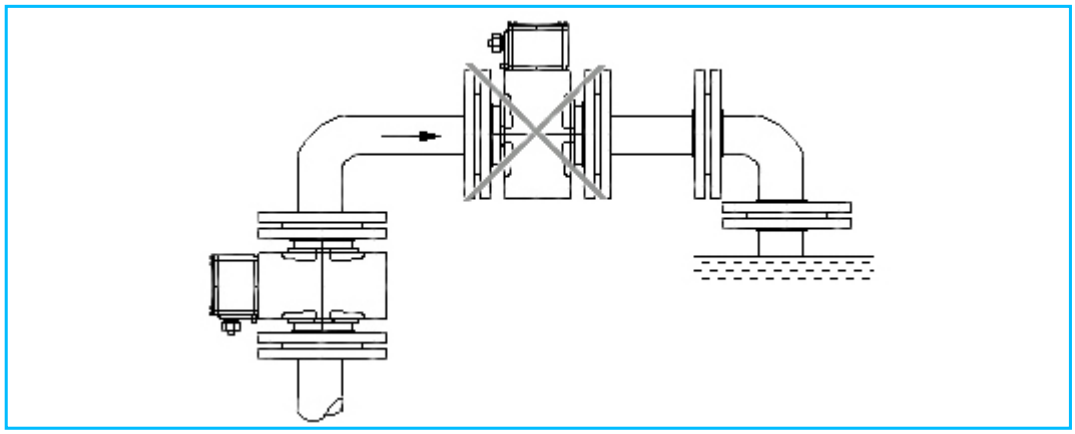


Fig. 9 :

2.3.2. In- and Outlet Straight Sections

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

Instruments for certified custody transfer applications special requirements apply.

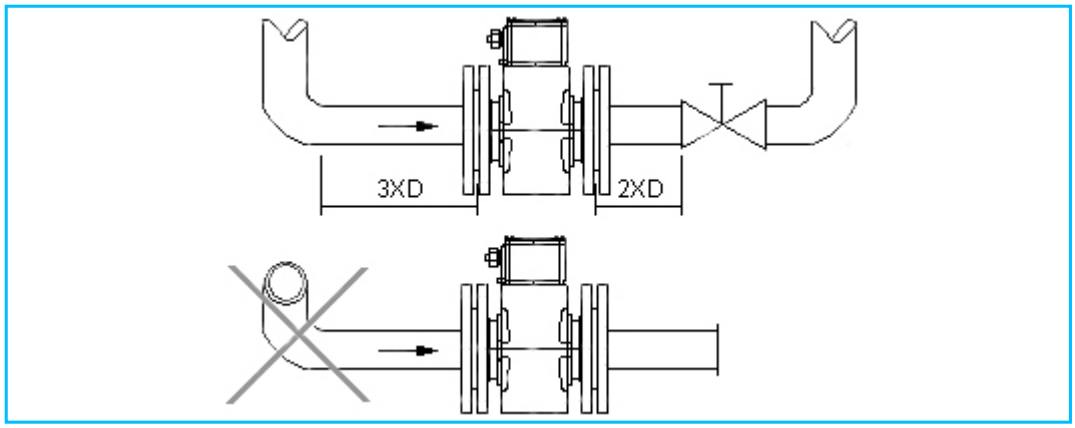


Fig. 10 :

Wafer valves are to be installed in such a manner that the wafer, when open, does not extend into the flowmeter. Valves or other shut off devices should be installed downstream. For highly contaminated fluids a bypass line Fig. 11, is recommended so that the during mechanical cleaning system operation need not be interrupted.

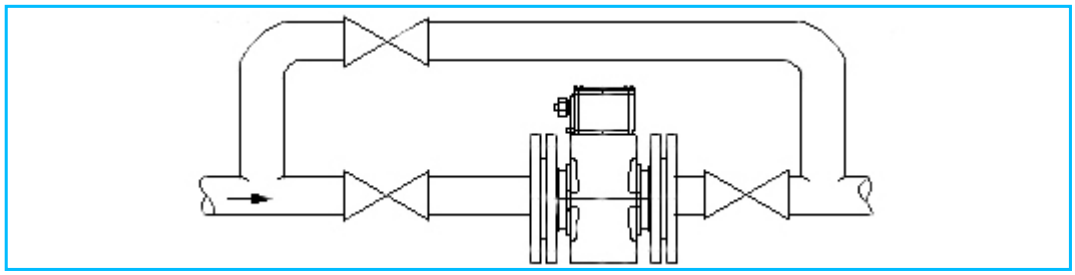


Fig. 11 :

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

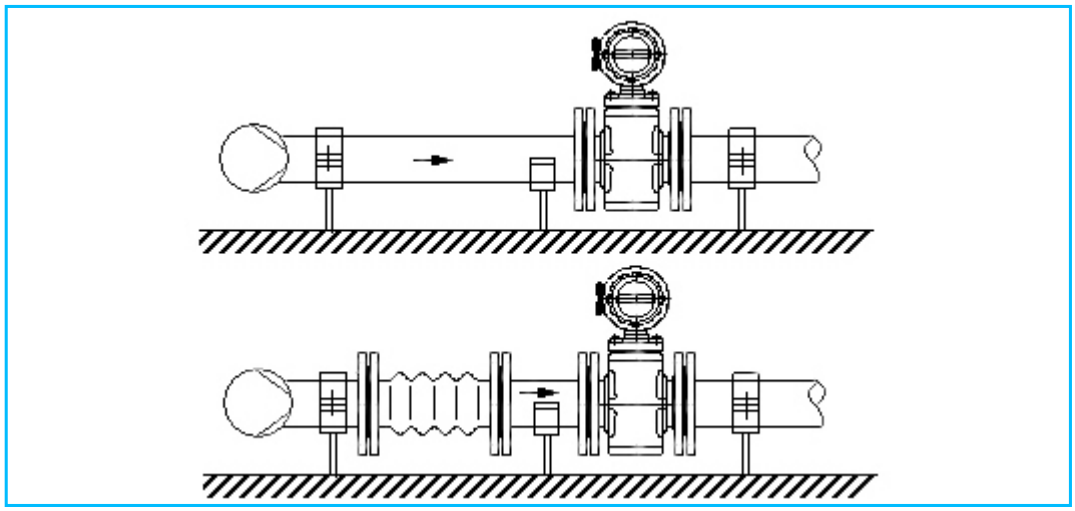


Fig. 12 :

2.3.3. Installation of the Flowmeter Primary

The electromagnetic flowmeter can be installed at any arbitrary location in the pipeline as long as the installation requirements are satisfied (see 2.3).
When selecting the installation site consideration should be given to assure that moisture cannot enter into the electrical connection or converter areas.
Make certain to carefully seat the gaskets and secure the covers after installation and start-up have been completed. Tighten the cable connectors.
The protective plugs in the cable connectors should only be removed when the cables are ready for installation.
The flowmeter primaries sizes DN 3 to DN 8 [1/10" to 5/16"] in the flanged design have a DN 10 [3/8"] connection flange. The diameter reduction to DN 3, 4, 6 or 8 [1/10" , 5/32" , 1/4" or 5/16"] is incorporated in the instrument.
As an option, flowmeter primaries sizes DN 3 to DN 8 [1/10" to 5/16"] are also available with a DN 15 [1/2"] connection flange.

Information!

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

Gasket Surface on the Mating Flanges

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

Protection Plates

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

Flange Bolt Tightening Torque

The mounting bolts are to be tightened equally in the usual manner without excessive one-sided tightening.
We recommend that the bolts be greased prior to tightening and that they be tightened in a crisscross pattern as shown in Fig. 13. Tighten the bolts during the first pass to approx. 50 %, during the second pass to approx. 80 % and only during the third pass to100 % of the max. torque value. The max. torque values should not be exceeded, see the table below.

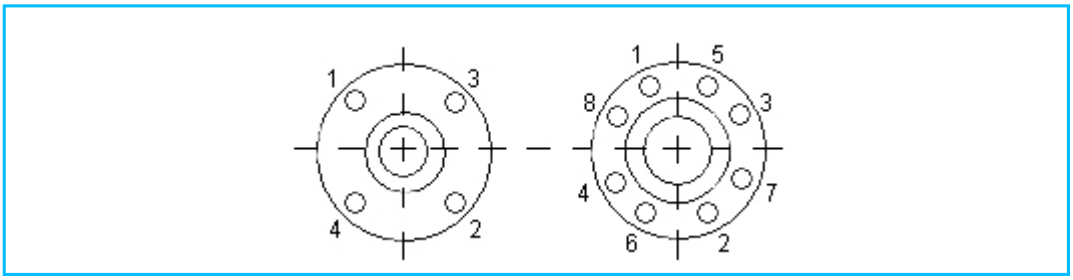


Fig. 13 :

2.3.4. Torque Values

2.3.4.1. Torque Specifications for Flanged Instruments

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

Table. 1

2.3.4.2. Torque Specifications for Wafer Design Instruments and Variable Process Connections

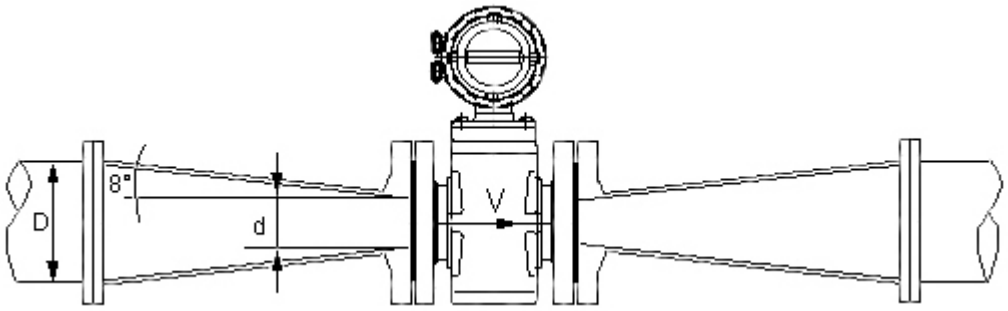
Liner	Meter Size DN	Meter Size Inch	Bolts	Torque max. Nm	Press. Rating bar
PFA	3 - 8	1/10-5/16	4 x M12	2.3	40
PFA	10	3/8	4 x M12	7.0	40
	15	1/2	4 x M12	7.0	40
	20	3/4	4 x M12	11.0	40
	25	1	4 x M12	15.0	40
	32	1-1/4	4 x M16	26.0	40
	40	1-1/2	4 x M16	33.0	40
	50	1	4 x M16	46.0	40
	65	2-1/2	8 x M16	30.0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

Table. 2

2.3.5. Installations in Larger Size Pipelines

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

1. Calculate the diameter ratio d/D.
2. Calculate the flow velocity as a function of the meter size and the flowrate.
   The flow velocity can also be determined from the Flow Rate Nomograph (Fig. 15).
3. The pressure drop can be read on the -Y- axis at the intersection of the flow velocity curve and the "Diameter Ratio d/D " value on -X- axis in Fig. 14.



d = Inside diameter of the EMF
D = Inside diameter of the pipeline
v = Flow velocity in (m/s)
Δp= Pressure drop in mbar

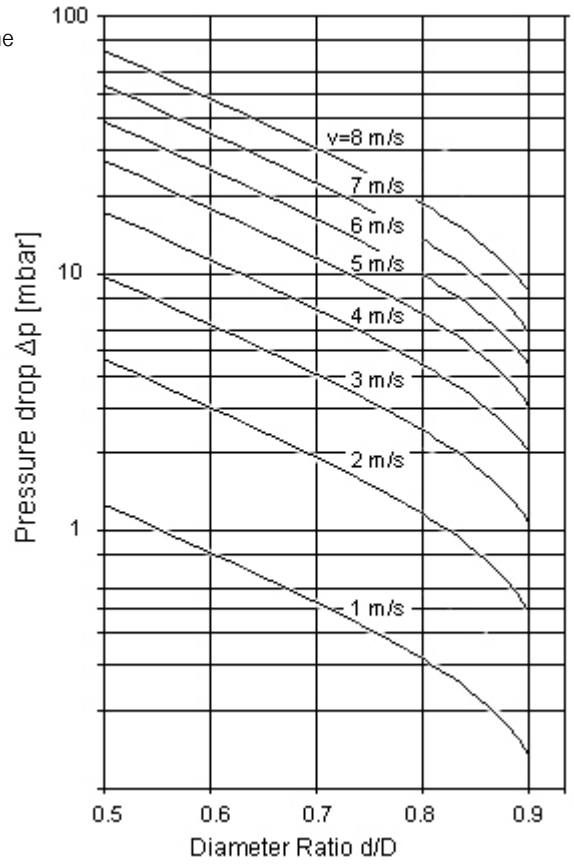


Fig. 14 : Nomograph for Pressure Drop Determination for EMF with Flanged Reducers, a/2 = 8°

2.3.6. Meter Sizes, Pressure Ratings and Flow Ranges

Meter Size DN	Inch	Std. Press. Rating PN	Min. Flow Range 0 to 0.5 m/s Flow Velocity				Max. Flow Range 0 to 10 m/s Flow Velocity			
3	1/10	40	0	to	0.2	l/min	0	to	4	l/min
4	5/32	40	0	to	0.4	l/min	0	to	8	l/min
6	1/4	40	0	to	1	l/min	0	to	20	l/min
8	5/16	40	0	to	1.5	l/min	0	to	30	l/min
10	3/8	40	0	to	2.25	l/min	0	to	45	l/min
15	1/2	40	0	to	5.0	l/min	0	to	100	l/min
20	3/4	40	0	to	7.5	l/min	0	to	150	l/min
25	1	40	0	to	10	l/min	0	to	200	l/min
32	1-1/4	40	0	to	20	l/min	0	to	400	l/min
40	1-1/2	40	0	to	30	l/min	0	to	600	l/min
50	2	40	0	to	3	m3/h	0	to	60	m3/h
65	2-1/2	40	0	to	6	m3/h	0	to	120	m3/h
80	3	40	0	to	9	m3/h	0	to	180	m3/h
100	4	16	0	to	12	m3/h	0	to	240	m3/h
125	5	16	0	to	21	m3/h	0	to	420	m3/h
150	6	16	0	to	30	m3/h	0	to	600	m3/h
200	8	10/16	0	to	54	m3/h	0	to	1080	m3/h
250	10	10/16	0	to	90	m3/h	0	to	1800	m3/h
300	12	10/16	0	to	120	m3/h	0	to	2400	m3/h
350	14	10/16	0	to	165	m3/h	0	to	3300	m3/h
400	16	10/16	0	to	225	m3/h	0	to	4500	m3/h
450	18	10/16	0	to	300	m3/h	0	to	6000	m3/h
500	20	10	0	to	330	m3/h	0	to	6600	m3/h
600	24	10	0	to	480	m3/h	0	to	9600	m3/h
700	28	10	0	to	660	m3/h	0	to	13200	m3/h
800	32	10	0	to	900	m3/h	0	to	18000	m3/h
900	36	10	0	to	1200	m3/h	0	to	24000	m3/h
1000	40	10	0	to	1350	m3/h	0	to	27000	m3/h

Table. 3

Flowrate Nomograph

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

Example:

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

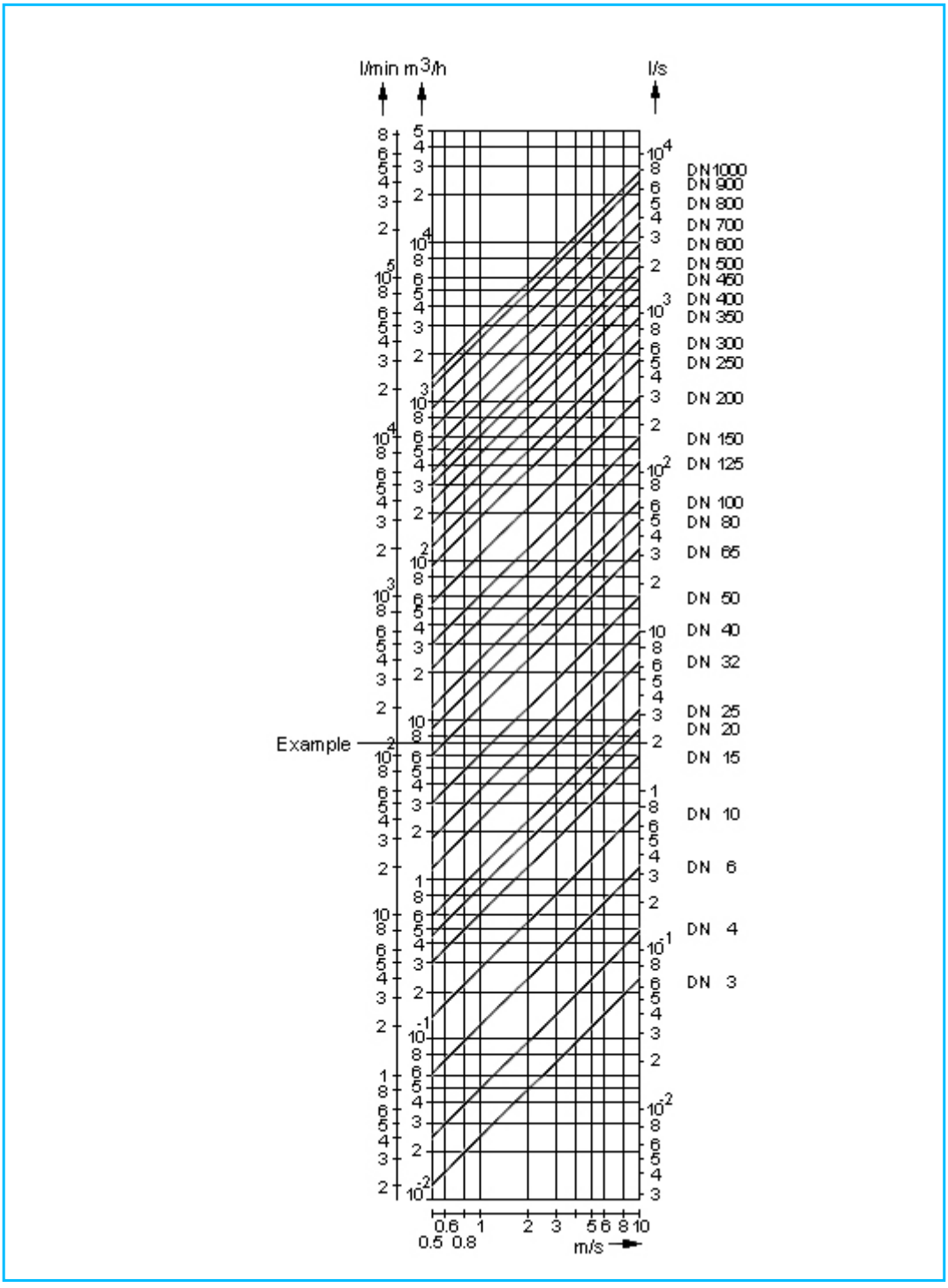


Fig. 15 : Flowrate Nomograph DN 3 to DN 1000 [1/10" to 40"]

3. Electrical Connections, Grounding

3.1. Grounding the Flowmeter

The grounding procedure described in this manual must be observed. Corresponding to VDE 0100, Part 540 the grounding screws on the flowmeter primary (on the flange and on the converter housing) are to be connected to earth with a copper wire whose cross section is at least 2.5 mm2. In order to comply with the EMC-Resistance/Low Voltage Regulations both the meter pipe of the flowmeter primary and the connection box or COPA-housing must be connected to earth. Please use the green/yellow cables included with the shipment for these connections. For measurement reasons the earth potential should be identical to the potential of the pipeline. An additional earth connection at the terminals in the connection box is not required.

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

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

a) Metal pipeline with fixed flanges

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

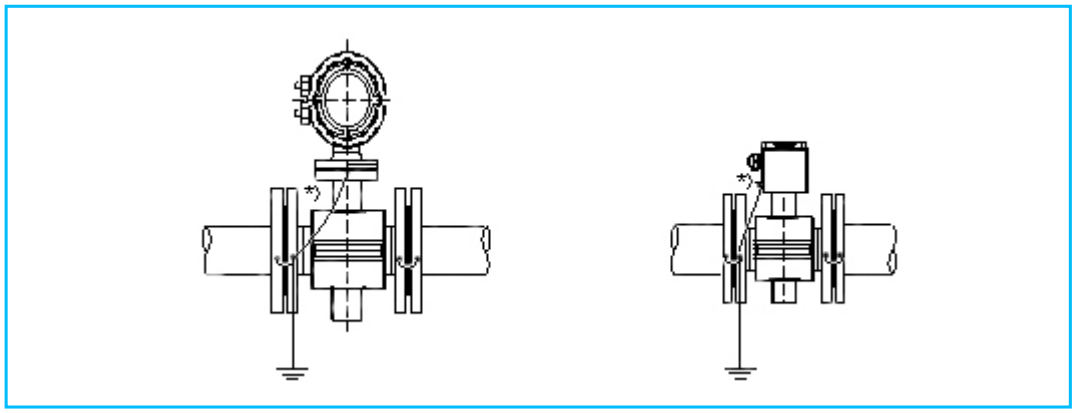


Fig. 16 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

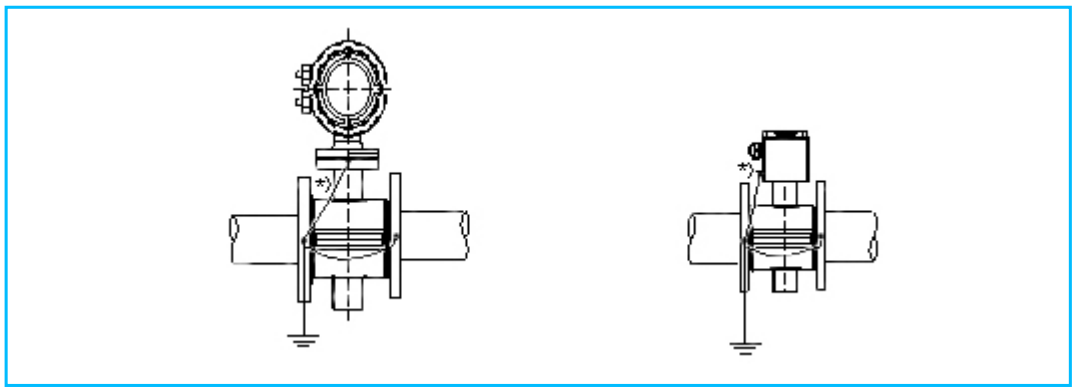


Fig. 17 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

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

b) Metal Pipeline with Loose Flanges

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

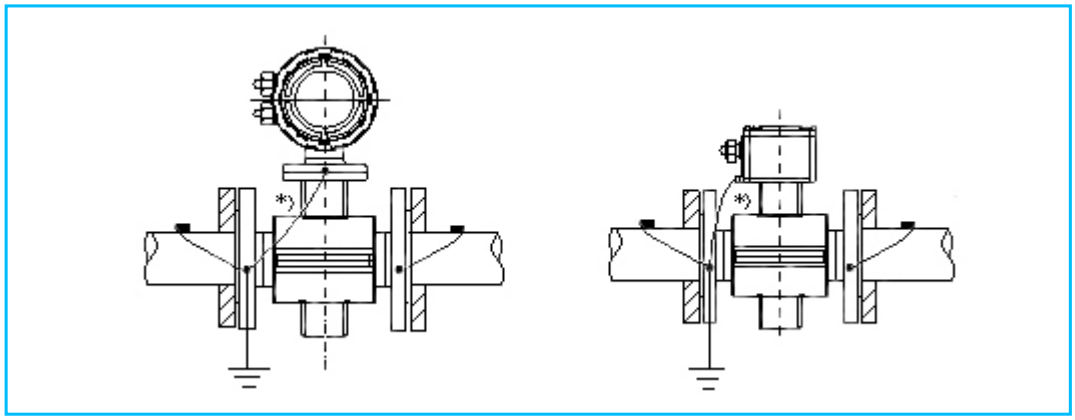


Fig. 18 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

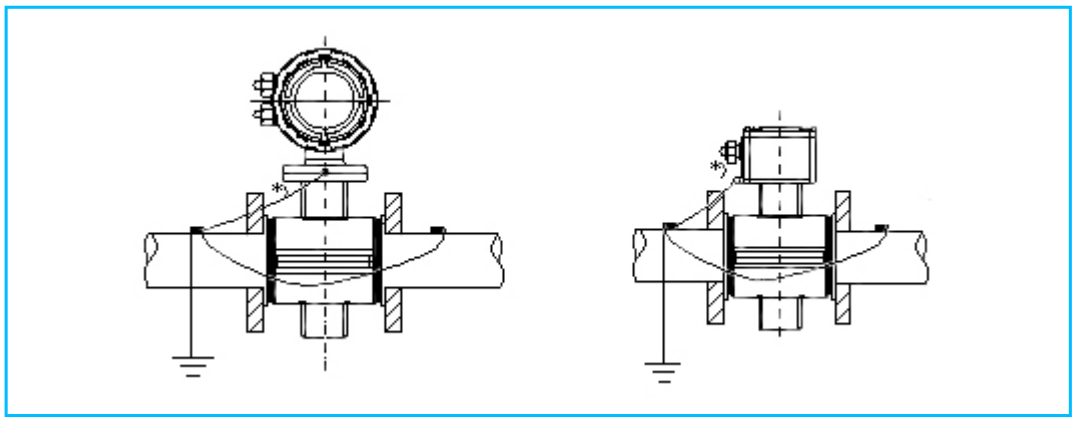


Fig. 19 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

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

c) Plastic, Concrete or Pipelines with Insulating Liners.

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

For plastic pipelines or pipelines with insulating liners the fluid is grounded using the grounding plate as shown in Fig. 20 or using grounding electrodes, when installed in the flowmeter primary (option). If grounding electrodes are installed the grounding plates shown Fig. 21 are not required. When there are stray currents in the pipeline it is recommended that, if grounding plates are to be used, to install one at both ends of the flowmeter primary.

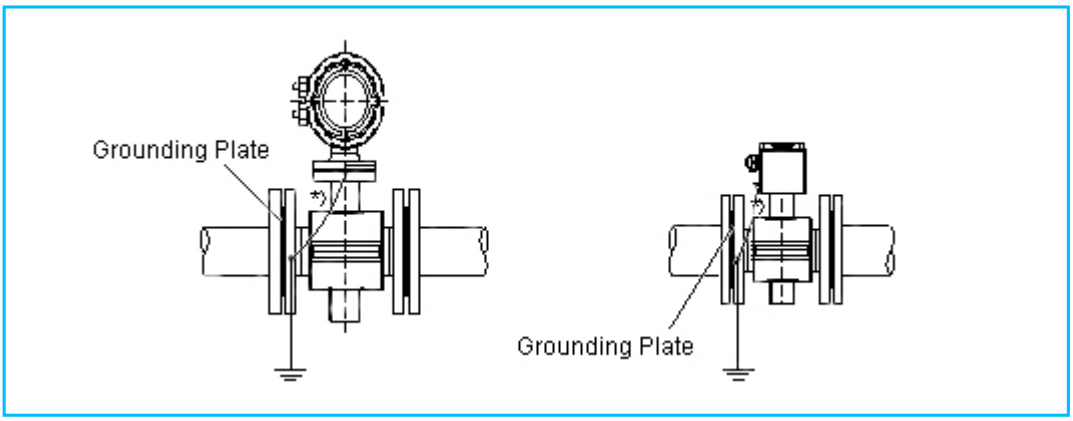


Fig. 20 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Flanged

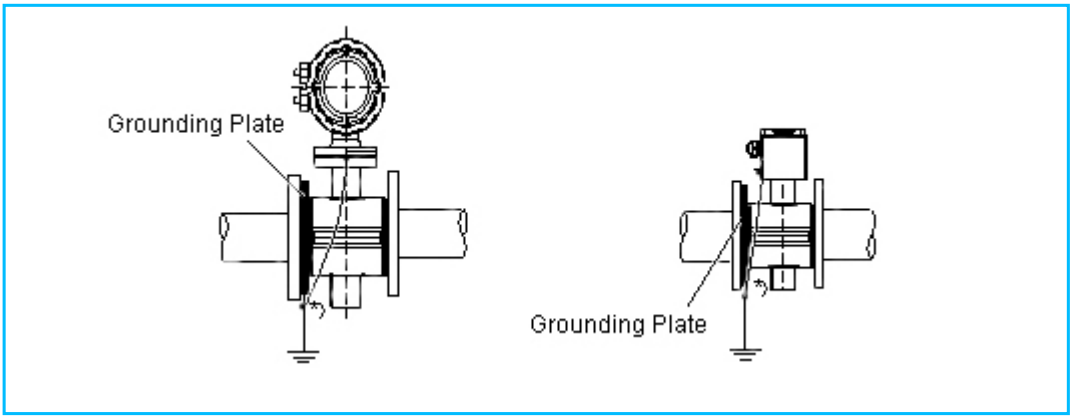


Fig. 21 : Flowmeter Primary DN 3 - DN 100 [1/10" - 4"] Wafer Design

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

3.1.1. Grounding Models EMF-EMFS_ and EMF-EMFS_

The ground connections are made as shown in Fig.22. The fluid is ground by the metal adapter pieces, so that an additional ground is not required.

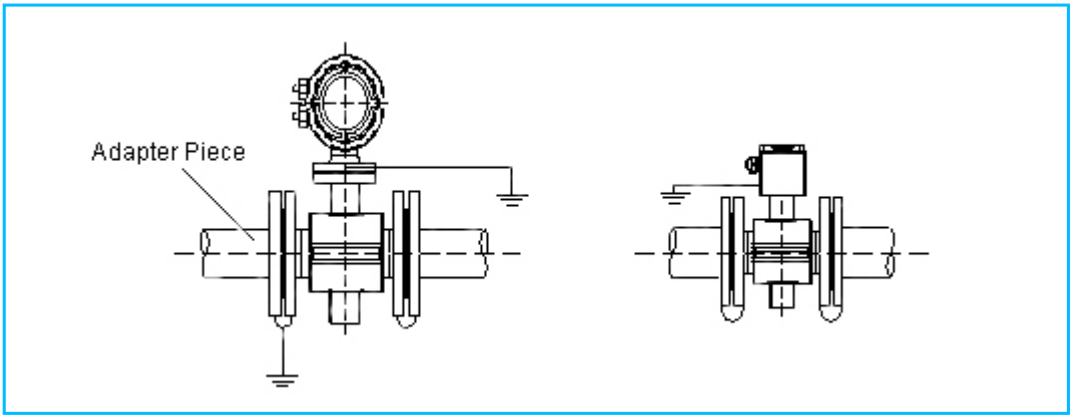


Fig. 22 : Flowmeter Primary DN3-DN100 [1/10" -4"]

3.1.2. Grounding Instruments with Hard or Soft Rubber Liners

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

3.1.3. Grounding for Instruments with Protection Plates

Fig. 23 : Protection Plates

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

3.2. Signal and Excitation Cable Connections for Model EMFS(Remote Type), Special Requirements for Protection Class IP67

The electromagnetic flowmeter primary is connected to the converter by a signal/excitation cable. The magnet coils in the flowmeter primary are supplied from terminals M1/M2 in the converter with an excitation voltage.

The signal/excitation cable is connected at the flowmeter primary to terminals 1, 2, M1, M2, 3, SE. The terminal assignments are described in Fig. 25. The shield 3 is at the common potential of the flowmeter primary and connected to earth. The ground connection on the exterior of the connection box of the flowmeter primary should also be connected to earth.

3.2.1. Signal and Excitation Cable Construction

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

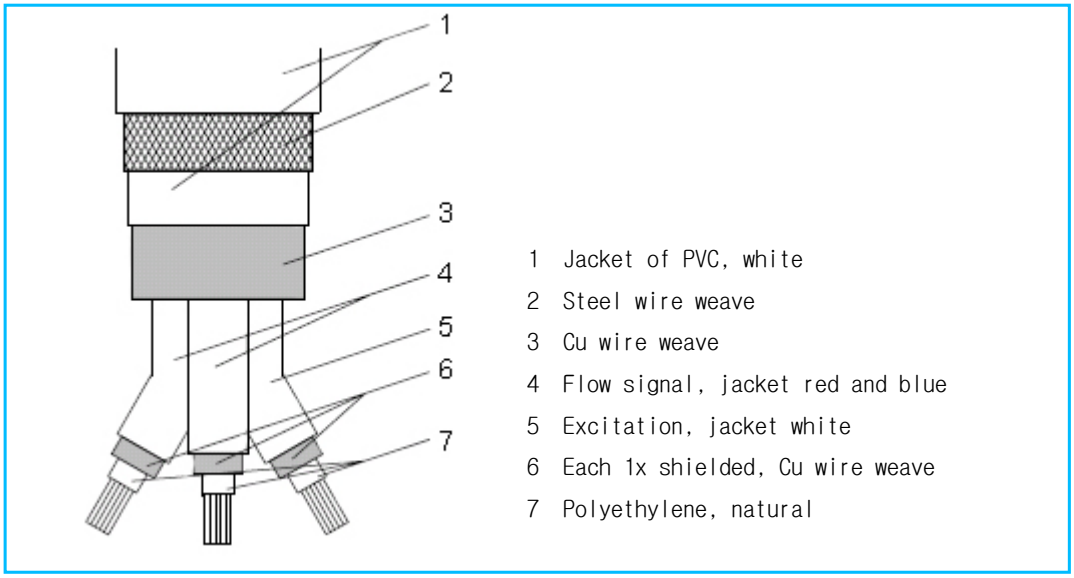


Fig. 24 : Signal Cable Construction

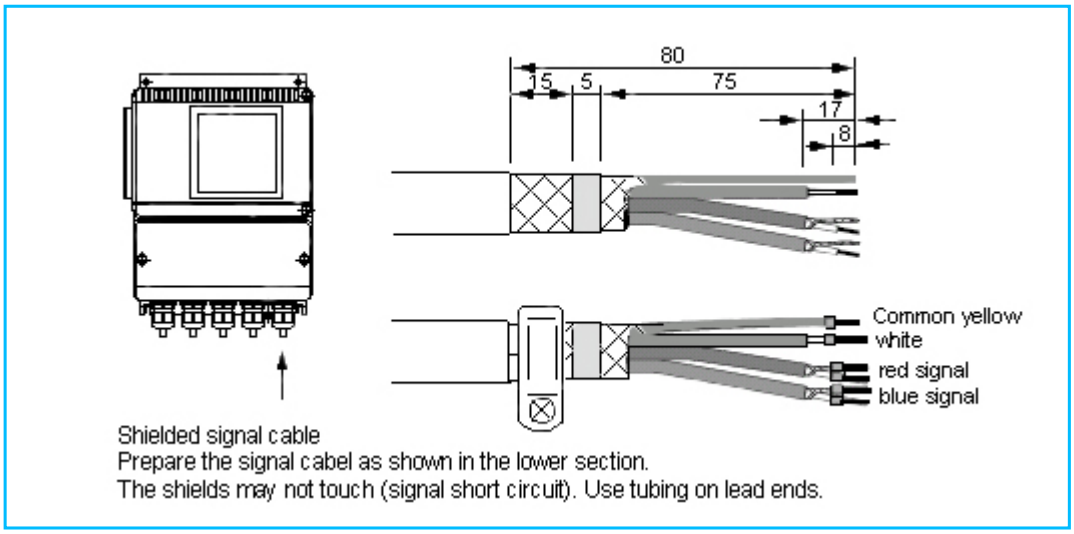


Fig. 25 :

The cables should not be routed in the vicinity of large electrical machinery or switch gear equipment which could induce stray fields, pulses and voltages. All leads are to be surrounded by shields connected to earth.

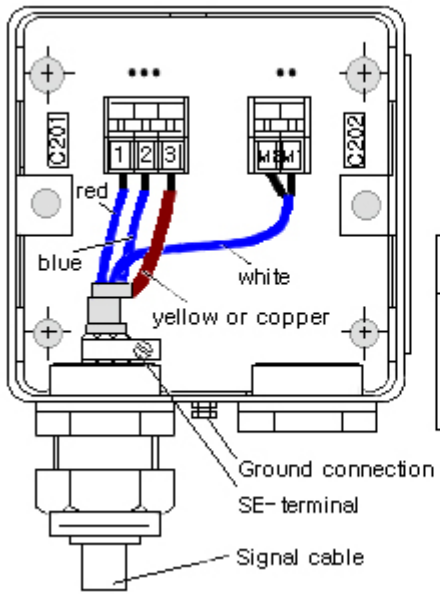
The signal cable should not be fed through branch fittings or terminals strips. A shielded excitation cable(white) is located parallel to the signal leads (red and blue) in the cable assembly so that only one cable is required between the flowmeter primary and the converter.

Attention!

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

3.2.2. Connection Area Flowmeter Primary

The leads of the signal/excitation cable are to be routed in the shortest way to the connection terminals. Loops are to be avoided (see Fig. 26)



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

Fig. 26 : Flowmeter Primary Connection Area

3.2.2.1. Using the Spring Loaded Connection Terminals

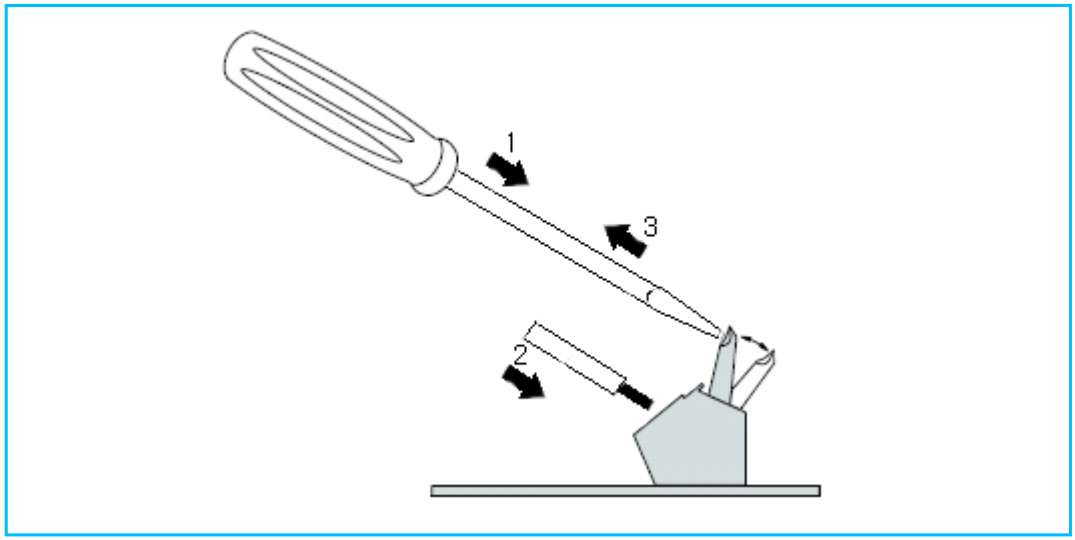


Fig. 27 :

Information!

When installing the signal/excitation cable assure that a water trap is provided, (Fig. 28).
For vertical installations the cable connectors should point downward.
When reinstalling and tightening the housing cover care should be exercised.
Check to make sure that the gaskets are seated properly. Only then will the Protection Class be effective.

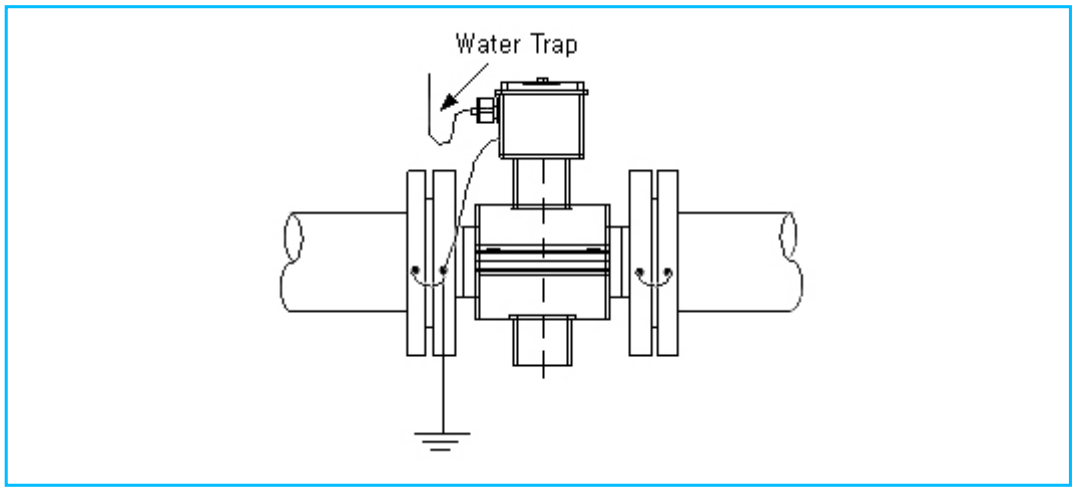


Fig. 28 : Cable Routing

3.2.3. Assembly and Installation for Protection Class IP67

There are 2 different designs available.

3.2.3.1. Design with Hose Connection

For flowmeter primaries for use in Protection Class IP67 areas the max. submergence depth is 5m. In place of the cable connectors a connector surrounded by a hose is used. The signal/excitation cable must be Routed through the 1/2" hose from the connection box to a point above the maximum submergence level(Fig.29).

Above the submergence level the water tight connector included with the shipment is installed on the cable. Then the hose is sealed to the hose connector with a threaded clamp.

Finally, the connection box must be carefully closed.

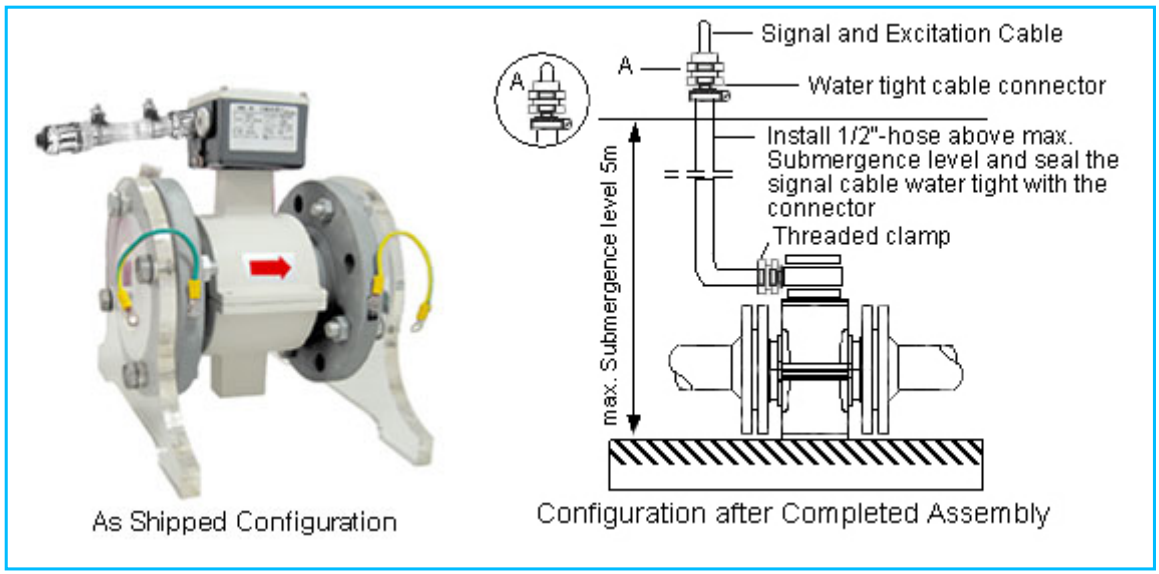


Fig. 29 : Installation IP67(Hose Connection)

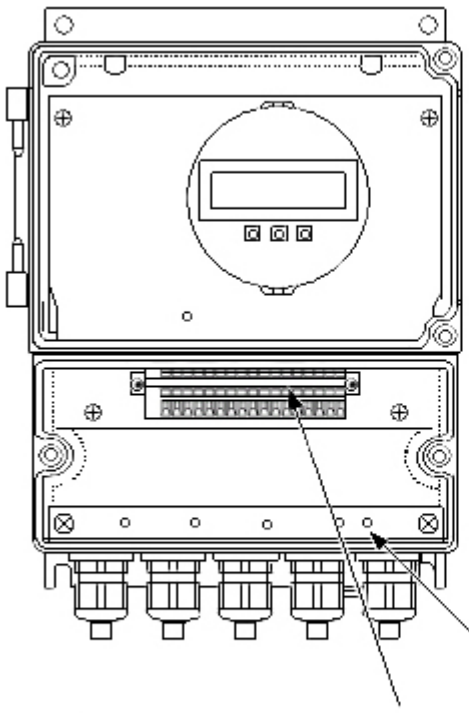
3.2.3.2. Design without Hose Connection

Two signal cables are to be used to connect flowmeter primary and the converter(see Fig 38, 39). After the connections have been made, the cable connectors are to be tightened and the connection box carefully dosed. The jacket of the signal cable may not be damaged.

Only then will Protection Class IP67 for the flowmeter primary be assured.

3.2.4. Electrical Connection Area in the Converter

3.2.4.1. Remote Type



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

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

Connection for the cable shield (steel)

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

Fig. 30 : Connection Box Field Mount Housing

Attention!

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

Using the Spring Loaded Connection Terminals Remote Type Converter

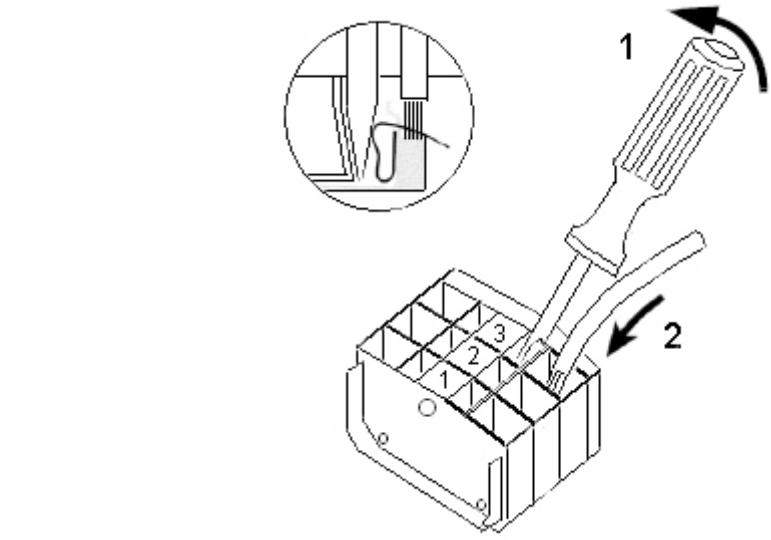
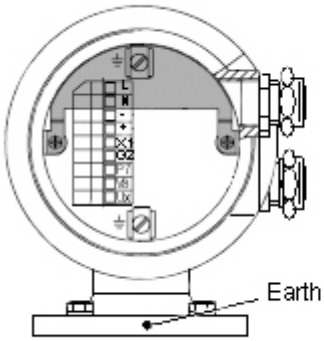


Fig. 31 :

3.2.4.2. Integral Type



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

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

Fig. 32 : Connection Box

Using the Spring Loaded Connection Terminals Integral Type

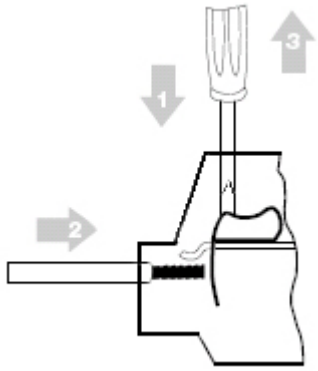
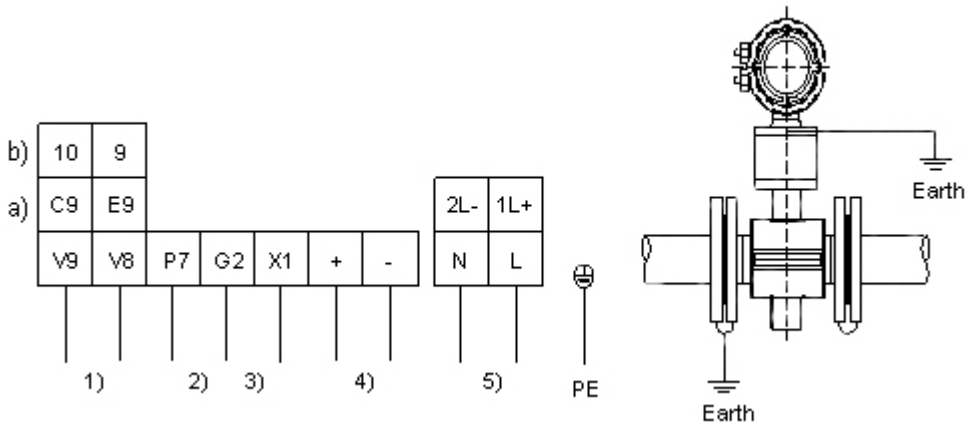


Fig. 33 :

3.3. Interconnection Diagrams

3.3.1. Interconnection Diagram Integral Type, Connection Options for Analog Communication (incl. HART)



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

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

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

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

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

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

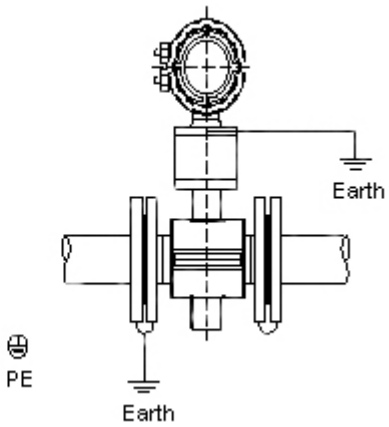
*) When shipped the function forward direction signal was selected.

Fig. 34 : Interconnection Diagram integral Type, Connection Options for Analog Communication (incl. HART)

3.3.2. Interconnection Diagram Integral Type, Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

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

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



Design a)

Terminals PA+, PA-

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

Design b)

Terminals Ux, V8

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

Terminals Ux, P7

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

Terminals A, B

Serial data link RS485 for communication using ASCII-Protocol

Terminals +, -

Current output, terminals: +/-, load $\le 600\ \Omega$ for 0/4 to 20 mA

Design c)

Same as design b), except

Terminals +VD, A, B, GND

Connection for PROFIBUS DP per EN 50170

Design d)

Terminals FF+, FF-

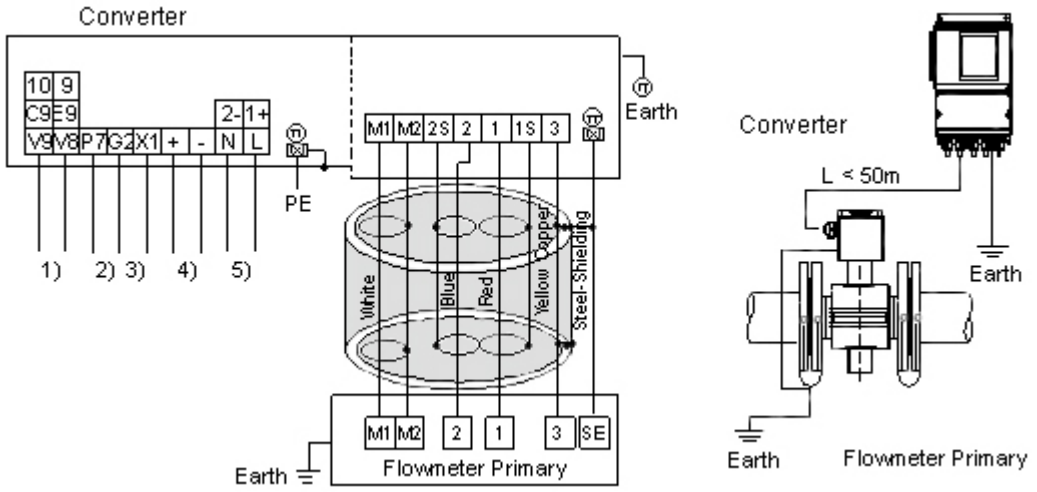
Connection for FOUNDATION Fieldbus (H1) per IEC 61158-2,
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Supply power

see Type Tag

Fig. 35 : Interconnection Diagram integral Type, Connection Options for Digital Communication

3.3.3. Interconnection Diagram Remote Type, Connection Options for Analog Communication (incl. HART)



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

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

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

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

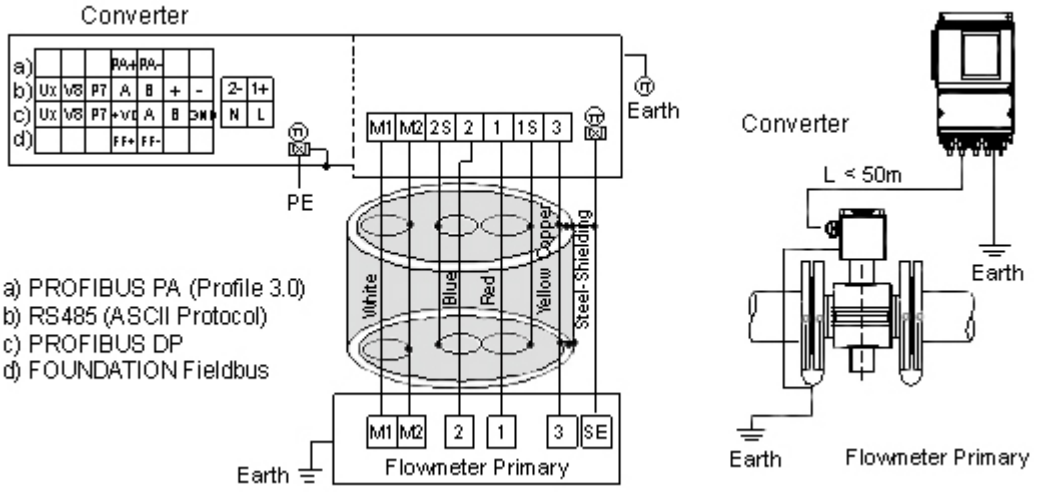
4) **Current output** selectable, terminals: +/-, load $\leq$ 600 Ω for 0/4 to 20 mA,
Load $\leq$ 1200 Ω for 0/2 to mA, load $\leq$ 2400 Ω for 0 to 5 mA
Option: **HART-Protocol**

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

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

Fig. 36 : Interconnection Diagram Remote Type, Connection Options for Analog Communication (incl. HART)

3.3.4. Interconnection Diagram Remote Type, Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)



Design a)

Terminals PA+, PA-

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

Design b)

Terminals Ux, V8

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

Terminals Ux, P7

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

Terminals A, B

Serial data link RS485 for communication using ASCII-Protocol

Terminals +, -

Current output, terminals: +/-, load $\le 600\ \Omega$ for 0/4 to 20 mA

Design c)

Same as design b), except

Terminals +VD, A, B, GND

Connection for PROFIBUS DP per EN 50170

Design d)

Terminals FF+, FF-

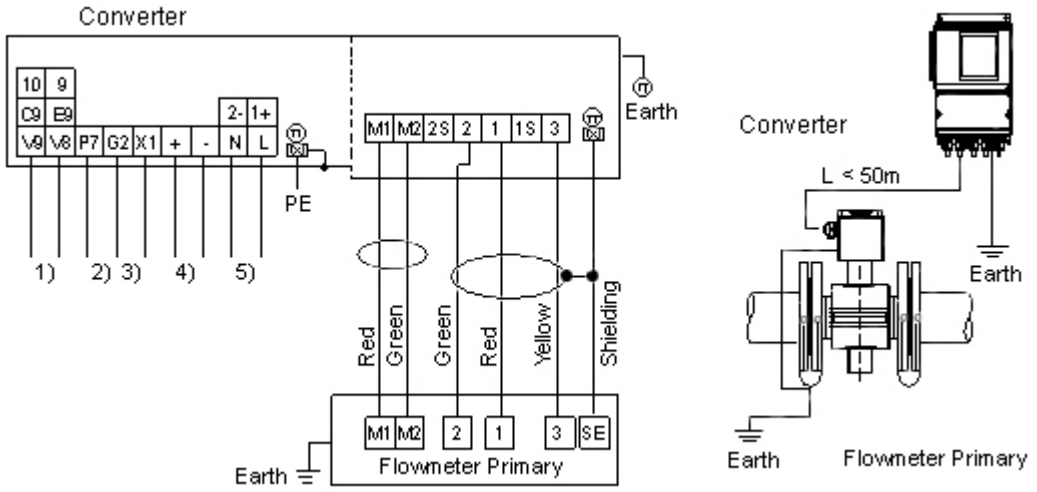
Connection for FOUNDATION Fieldbus (H1) per IEC 61158-2,
U = 9-32 V, I = 13 mA (normal operation); 17 mA (during fault condition / FDE)

Supply power

see Type Tag

Fig. 37 : Interconnection Diagram Remote Type, Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

3.3.5. Interconnection Diagram Remote Type(two cables), Connection Options for Analog Communication(incl. HART)



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

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

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

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

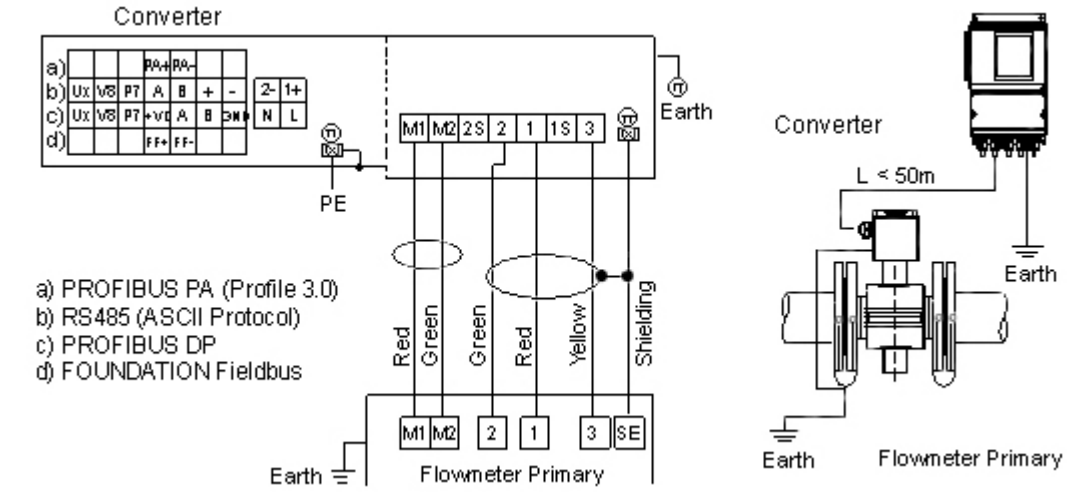
4) **Current output** selectable, terminals: +/-, load ≤ 600 Ω for 0/4 to 20 mA,
Load ≤ 1200 Ω for 0/2 to mA, load ≤ 2400 Ω for 0 to 5 mA
Option: **HART-Protocol**

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

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

Fig. 38 : Interconnection Diagram Remote Type(two cables), Connection Options for Analog Communication (incl. HART)

3.3.6. Interconnection Diagram Remote Type(two cables), Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)



Design a)

Terminals PA+, PA-

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

Design b)

Terminals Ux, V8

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

Terminals Ux, P7

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

Terminals A, B

Serial data link RS485 for communication using ASCII-Protocol

Terminals +, -

Current output, terminals: +/-, load $\le 600\ \Omega$ for 0/4 to 20 mA

Design c)

Same as design b), except

Terminals +VD, A, B, GND

Connection for PROFIBUS DP per EN 50170

Design d)

Terminals FF+, FF-

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

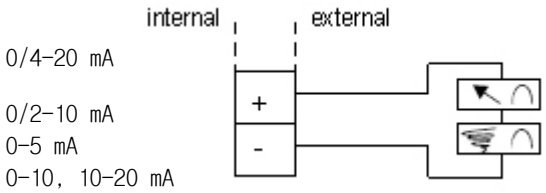
Supply power

see Type Tag

Fig. 39 : Interconnection Diagram Remote Type(two cables), Connection Options for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII)

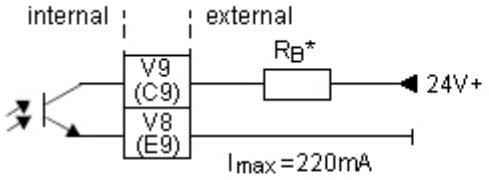
3.3.7. Connection Examples for Peripherals for Analog Communication (incl. HART)

Current Output



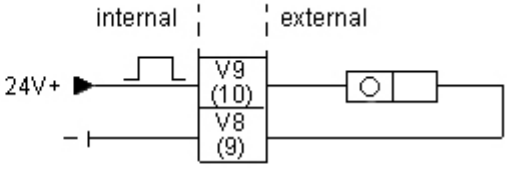
0/4-20 mA load: max. 600 Ohm
0/2-10 mA load: max. 1200 Ohm
0 - 5 mA load: max. 2400 Ohm

Pulse Output (optocoupler)



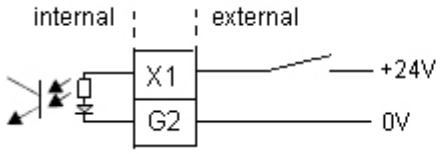
$*R_B \geq \frac{U_{CE}}{I_{CE}}$

Pulse Output (active)



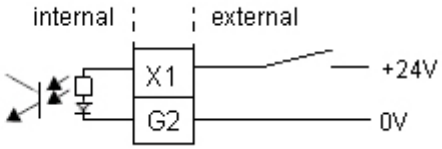
Contact Input for External Zero Return or External Totalizer Reset

Function selectable in software



Ri = 2kΩ

Contact settings:
Output is turned off when contact is closed.

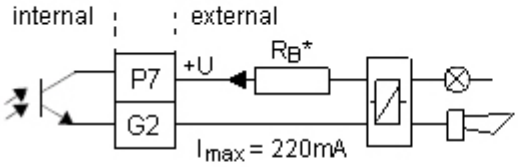


Ri = 2kΩ

Contact settings:
internal totalizer is reset, when contact is closed.

Contact Output e.g. for System Monitor, Max.-Min.-Alarm, Empty Pipe or Forward/Reverse Signal

Function selectable in software



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

Pulse Output (passive optocoupler), Separate Forward and Reverse Pulses over Contact Output

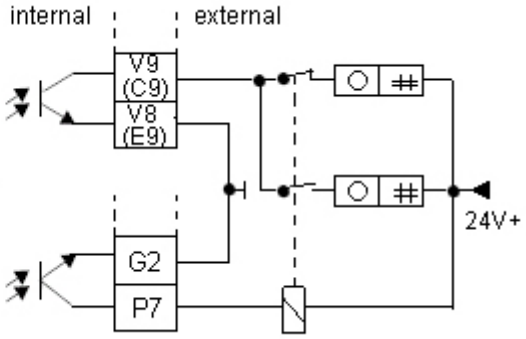
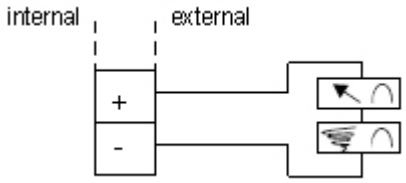


Fig. 40 : Connection Examples for Peripherals for Analog Communication (incl. HART)

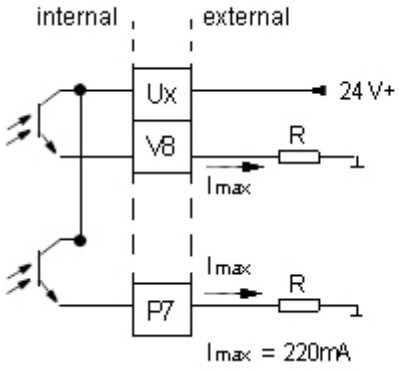
3.3.8. Interconnection Examples for Peripherals for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII-Protocol)

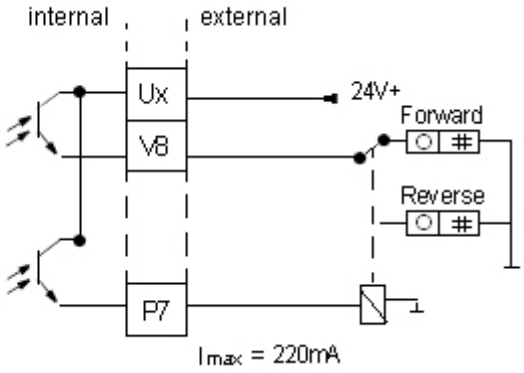
Current Output (only available for ASCII-Communication) 0/4-20 mA load: max. 600 Ohm



Pulse Output and Contact Output
(only available for PROFIBUS DP or ASCII Protocol)

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





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

Pulse output optocoupler Ux/V8

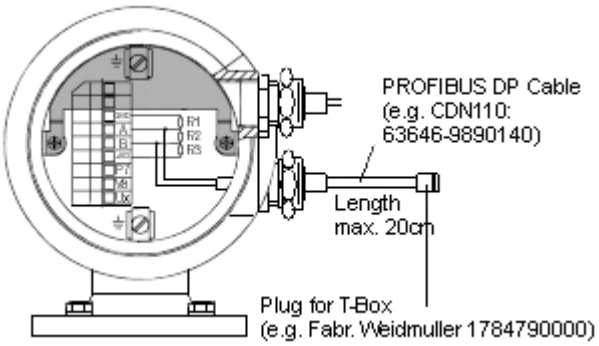
Fig. 41 : Connection Examples for Peripherals for Digital Communication (PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII-Protocol)

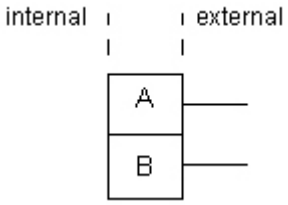
PROFIBUS DP

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

Data link RS485 (ASCII Protocol)

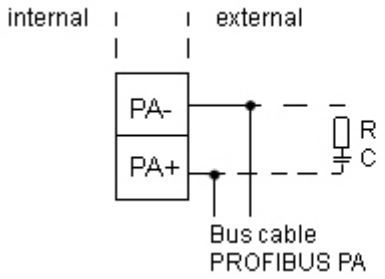
2-wire data link, half-duplex, max. cable length: 1200 m, max. 32 instruments in parallel on bus twisted pair cable.

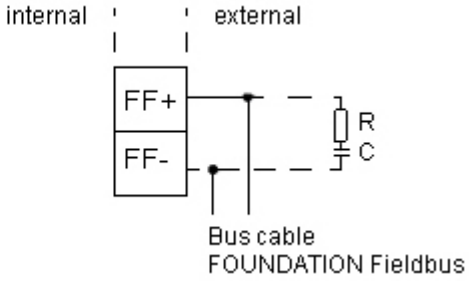




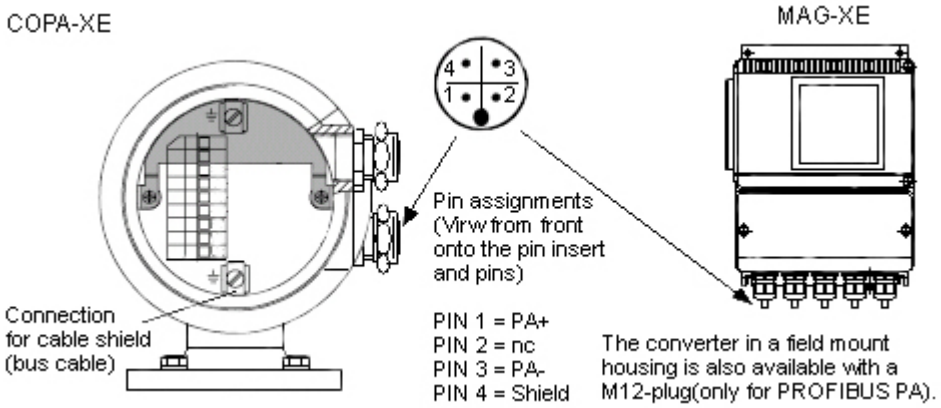
PROFIBUS PA / FOUNDATION Fieldbus

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





Connection Example for PROFIBUS PA using M12 plug



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

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

4. Start-Up

4.1. Preliminary Checks/Starting Up the Flowmeter System

4.1.1. Flowmeter Integral Type

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

The supply power is turned off.

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

Turn on supply power!

- After the supply power is turned on, the flowmeter primary data stored in the external EEPROM are compared to the values stored internally. If the data are not identical, an automatic exchange of the data in the converter is initiated (upload). The converter displays the message "Primary data are loaded". The system is now operational.
- The display indicates the instantaneous flowrate value.
- In order to set up the system only a few entries or selections of parameters must be made. The flow range is automatically set to 10 m/s. Enter the desired flow range in the submenu "Range". Hydraulically ideal range end values are equivalent to ca. 2-3 m/s. In the submenu "current output" the required current range can be selected. For the pulse output the pulse factor (pulses per unit) and the pulse width should be entered in the submenu "Totalizer". (see Section 5)
- The system zero value should be checked (see Section 4.2).
- To finish the start-up procedure, the menu "Store data in external EEPROM" should be called in order to store all the settings which were made during the start-up. If the converter was exchanged, then the EEPROM is to be removed from the old converter and plugged into the new one (see Section 4.4).

4.1.2. Flowmeter Remote Type

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

The supply power is turned off.

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

Turn on supply power.

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

output" the required current range can be selected. For the pulse output the pulse factor (pulses per unit) and the pulse width should be entered in the submenu "Totalizer". (see Section 5)

- The system zero value should be checked (see Section 4.2).
- To finish the start-up procedure, the menu "Store data in external EEPROM" should be called, in order to store all the settings which were made during the start-up. If the converter was exchanged, then the EEPROM is to be removed from the old converter and plugged into the new one (see Section 4.4).

4.2. System Zero Adjustment

The System-Zero for the system is set in the converter. To check or adjust the zero the flow in the pipeline must be at absolute zero and the pipeline must be completely filled.
Using the parameter "System Zero Adj." the adjustment can be made manually or automatically:
Select parameter using ENTER, use the arrow keys to select "manual" or "automatic".
For an automatic "adjustment", initiate the procedure using ENTER. After the counter displayed in the 2nd line counts down from 255 to 0 the adjustment procedure is finished. The adjustment takes approx. 20 seconds, see also Section 6.6.

Start-up of PROFIBUS PA/DP Instruments

A detailed description of the data link communication may be found in the separate Operation Manuals.
For PROFIBUS PA: Part No. D184B093U11
For PROFIBUS DP: Part No. D184B093U09
These data link descriptions are included with the shipment of the PROFIBUS instrument including the GSD File.

4.3. Detector "Empty Pipe"

At start-up the detector empty pipe must be adjusted for the existing operating conditions.
For adjustment procedure see Section 5.

Attention!

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

4.4. Converter Exchange

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

4.5. Socket Location for the Memory Module (external EEPROM)

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

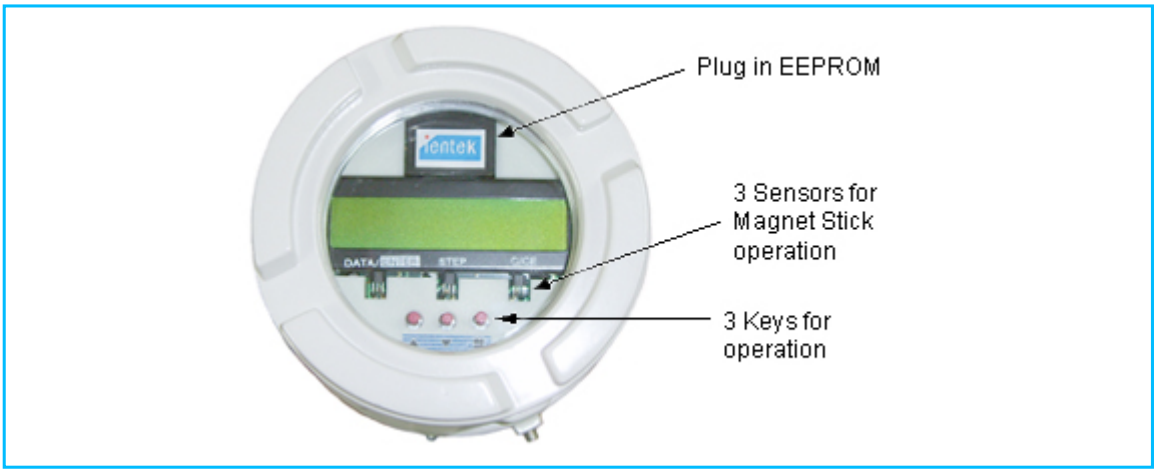


Fig. 43 : Display Board

Attention!

Information for Opening the Housing

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

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

4.6. Rotate Display/Rotate Housing

Warning!

Turn off the supply power!

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

After the screws are removed the display can be pulled off and rotated 90° to the left or 90° to the right, Carefully plug in the display again and reinstall the screws. Carefully reinstall the cover. Check that the gaskets are properly seated. Only then will Protection Class IP67 be maintained.

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

Fig. 44 :

5. Setup the Converter

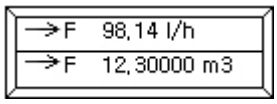
5.1. Initial value setup

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

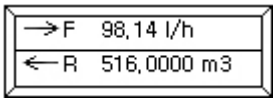
In the first line the present flow direction (→ F for forward or ← R for reverse) and the instantaneous flowrate value in percent or direct reading engineering units is displayed. The totalizer value (7 digits) for the present flow direction is displayed with its units.

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

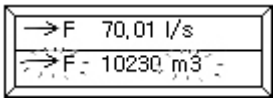
The totalizer value for the other flow direction can be displayed by pressing the STEP or DATA key.



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



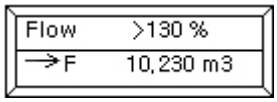
1st line Instantaneous forward flowrate value
2nd line Reverse totalizer value (multiplex operation)



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

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

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



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

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

Error Code Table Listed by Priority

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

5.2. Data Entry

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

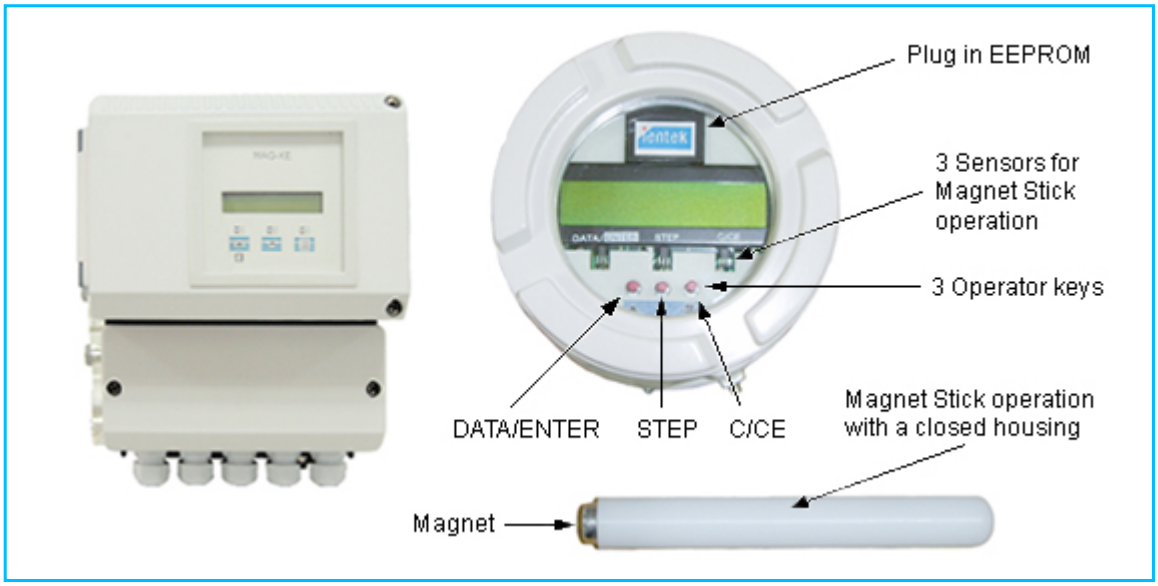


Fig. 45 : Converter keypad and Display

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

C/CE — The C/CE key is used to toggle back and forth between the operating mode and the menus.

STEP — The STEP-key is one of two arrow keys. STEP is used to scroll forward through the the menus. All desired parameters can be accessed.

DATA — The DATA-key is one of two arrow keys. DATA is used to scroll backward through the menus. All desired parameters can be accessed.

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

ENTER — ENTER is used to turn the program protection on and off. Additionally, ENTER is used to access the values in the parameter to be changed and to accept the new values or selections.

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

ENTER Function for Magnet Stick Operation

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

Data entry is divided into two entry types;

- Direct numeric entries
- Selections from a predefined table.

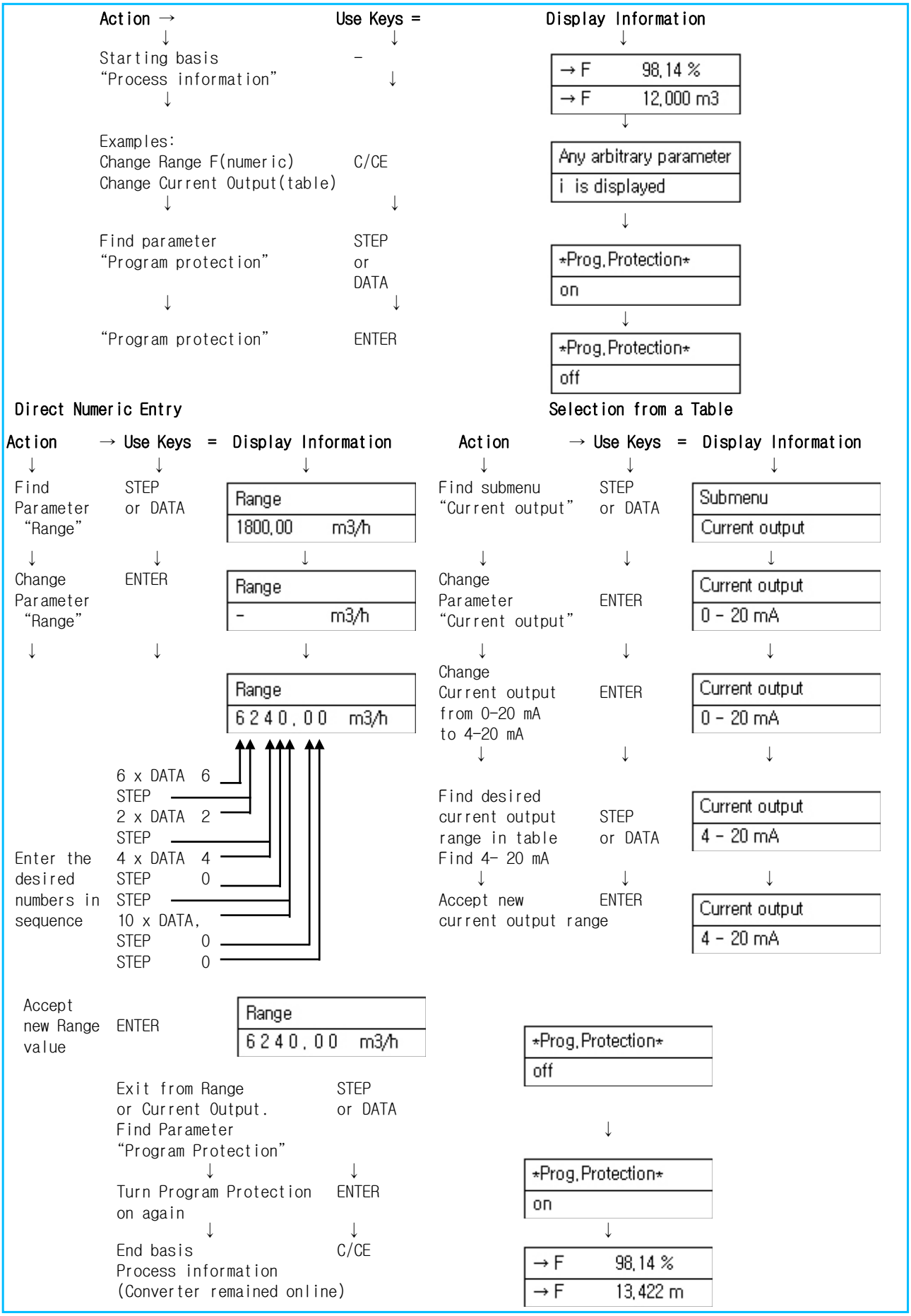
Information!

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

Warning!

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

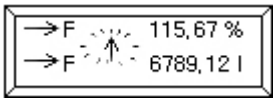
5.3. Data Entry in “Condensed Form”



5.4. Parameter and Data Entry in “Condensed Form”

Submenu/Parameter	Entry Type	Comments
Prog. Protection on	from table/numeric	Data can be entered only after the Program Protection has been turned off.
ENTER → *Prog. Protection* off		on/off
PP-Code? 0		If a number other than “0” (factory default setting) has been programmed for the Prog. Prot. Code, the Program Protection can only be turned off after the correct PP-Code (1-255) has been entered.
Prog. Protection off		After the Prog. Protection has been turned off, parameters can be changed.
Prog. port. code	numeric	After the Prog. Protection has been turned off it is possible to change the PP-Code.
ENTER → Old PP-Code? 0		Enter the old PP-Code 0 = factory default setting
New PP-Code? 0		Enter new PP-Code(0-255) and press ENTER to activate. The new PP-Code is now active.
Language English	from table	German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish. For HART-Protocol, PROFIBUS PA, FOUNDATION Fieldbus only German, English
Submenu Primary		In this submenu parameters other than the meter size for the flowmeter primary are located. These cannot be changed. Their values are listed on the factory tag of the flowmeter primary. They must be identical!
ENTER → Meter size DN 250 10 In		Actual meter size, see factory tag on flowmeter primary
Span Cs 6,25 Hz 56,123 %		Flowmeter primary span value Cs for the selected excitation frequency, see factory tag on flowmeter primary
Zero Cz 6,25 Hz 0,1203 %		Flowmeter primary zero value Cz for the selected excitation frequency, see factory tag on flowmeter primary
Short model no. DE4,...		Short Model Number of the flowmeter primary
Order no. 000195368/X001		Order number of the flowmeter primary. This number must be identical to the value on the factory tag and on the sticker located on the external EEPROM plugged in above the display.

Submenu/Parameter	Entry Type	Comments
Cal-fact 10 m/s 1800,00 m3/h	numeric	Cal-factor is the flowrate value at 10 m/s flow velocity. The Cal-factor is automatically selected when the flowmeter size is selected.
Range 400,000 m3/h		Flow range for the forward and reverse flow directions. Min. flow range setting is 0 - 0.5 m/s (0-0.05 Cal-fact) Max. flow range setting is 0 - 10 m/s (0-1 Cal-fact) The flow range end value can be entered anywhere between 0.5 and 10 m/s. The units are selected in the submenu Unit. (See also Section 6.7)
Pulse 1,0000 /m3		For int. and ext. flow totalization, range 0.001-1000 pulse per selected unit, max. count frequency 5 kHz. The units are selected in the submenu Unit. (See also Section 6.2 and 6.8)
Pulse width 30,000	numeric	For external pulse output, pulse width can be set between 0.1 and 2000 ms. For PROFIBUS PA and FOUNDATION Fieldbus this menu is not displayed. (See also Section 6.3)
Low flow cut-off 1,000 %	numeric	Range 0-10 % of the flow range set in “Range” . Applies to the values in the display and all outputs. When the flowrate is below the low flow cut-off value the flow is no longer measured. The current output is set to its zero value. The switching hysteresis for the flow cut-off is 1 %.
Damping 10,0000 s	numeric	The damping can be set between 0.5 and 99.9999 s. The value is the time for the indication to reach 99% of its final value for a flowrate step change. It applies to the instantaneous values in the display and the current output.
Filter on	numeric	On/off. (factory default setting = OFF). When the output signal is noisy, turn the filter on and enter a damping time > 2.4 s . (See also Section 6.4)
Density 2,54300 g/cm3	numeric	If the totalizer values and flowrate display are to use mass units (g/kg/t/pound or uton), then a fixed density value must be entered for the calculations. Density values in the range between 0.01 and 5.0 g/cm^3 can be entered.
System zero adj. 3,5 Hz		Zero value adjustment (See also Section 6.6)
ENTER → Adjust manual		Manual entry
Adjust automatic		Valve must be closed. Pipeline must be completely full. Flowrate must be at zero. The auto. adjustment is initiated using ENTER.
Submenu Unit	from table/numeric	C/CE Exit the submenu (See also Section 6.7)
ENTER → Range unit l/s		lbs/s, lbs/min, lbs/h, uton/min, uton/h, uton/day, l/s, l/min, l/h, hl/s, hl/min, hl/h, m3/s, m3/min, m3/h, igps, igpm, igph, mgd, gpm, gph, bbl/s, bbl/min, bbl/h, bbl/day, bbl/min, bbl/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, kgal/s, kgal/min, kgal/h

Submenu/Parameter	Entry Type	Comments
	Totalizer unit m3	ml, l, hl, m3, igal, gal, mgal, bbl, bls, kg, t, g, Ml, lb, uton, kgal
	Unit factor 3785,41 Liter	If a desired unit is not included in the table, it is possible to program a user defined flow unit, based on Liters. The value of 3785.41 shown here is for the kgal unit kgal (factory default setting).
	Unit name kgal /s /min /h	Four character name for the user programmed unit.
	Prog.unit without Density	Programmed unit for mass (with density) or volume flowrate (without density)
Submenu Alarm	from table/numeric	C/CE Exit the submenu
ENTER	Error log 0 ... 3 ...	All detected errors (Error 0-9, A, B, C) are stored. Use ENTER to clear the Error Log. To display the clear text for all Error Codes press ENTER and then STEP.
	Max alarm 130 %	The value of the desired MAX-Alarm limit can be set in 1%-steps from 0 to 130 % of the flow range entered in “Range” . This value applies to the forward and reverse flow directions. Selecting the MAX-Alarm function causes the contact across the terminals to be actuated when the flowrate exceeds the limit value entered. In addition, whenever the MAX-alarm is active an upward blinking arrow is displayed. 
	Min alarm 10 %	Alarm, range 0-130 % of the flow range entered in “Range” . Set in 1% steps, switching hysteresis 1 % (see MAX-Alarm)
Submenu Prog.in/output	from table	This menu is not displayed for PROFIBUS PA and FOUNDATION Fieldbus. (See also Section 6.8)
ENTER	Terminal P7/G2 General alarm	Contact output terminals P7/G2 selections: General alarm1), empty pipe1), F/R-Signal, no function, MAX-Alarm1), MIN-Alarm1), MAX/MINAlarm1) 1) Contact can be configured as normally open or closed.
	Terminal X1/G2 Ext. zero return	Contact input terminals X1/G2 selections: External zero return, totalizer reset, external totalizer stop, no function. For HART-Protocol the external totalizer stop is not available. For PROFIBUS the contact input is not available. (See also Section 6.8)

Submenu/Parameter	Entry Type	Comments
Submenu: Current output	from table	This menu is not displayed for PROFIBUS PA and FOUNDATION Fieldbus. For instruments without HART-Protocol the menu structure in the "Current output" menu is as follows:
ENTER → Current output: 0 - 20 mA		Selections: 0-20 mA/4-20 mA, 0-10 mA/2-10 mA, 0-5 mA/9-10 mA, 10-20 mA/4-12 mA, 12-20 mA
Iout at Alarm: 130 %		Current output: 4 - 20 mA During an error condition the contact output can be activated by the converter, an error message displayed and the current output set to a fixed value. The selections are: 3.8 mA or 0 or 130 % of the selected current output range. For Error 3 Flow > 130 % the current output is set to 130 % of the selected current output maximum value. If "HART Communication" was selected in the submenu Data Link (only available when this option was ordered), then the menu structure in the "Current output" menu is as follows: Attention: For HART Protocol the current output is fixed at 4-20 mA. The value to which the current is set during an alarm condition can be set as described in the following menus (for instruments with HART Protocol).
		Iout at Alarm: Low Current output during an error condition selections: "Low" or "High" . The "Low" or "High" value is set in the following menus.
		Low Alarm: 4,000 mA User selectable value for the "Low" status between 3.000 and 4.000 mA
		High Alarm: 24,8 mA User selectable value for the "High" status between 20.000 and 26.000 mA
		C/CE Exit the submenu
Submenu: Data link	from table/numeric	The submenu Data Link is only displayed when this option was ordered and a data link is recognized by the converter. Details for ASCII, HART, PROFIBUS PA or FOUNDATION Fieldbus communication may be found in the appropriate supplementary Operation Manuals.
ENTER → Communication: ASCII		1. Communication ASCII For this option the menu structure in the submenu Data Link is shown to the left: Selections: ASCII or ASCII2w. ASCII2w indicates ASCII-Communication on a 2-wire line. The communication is then half-duplex. Default setting: ASCII
Instr. address: 0		If multiple instruments are connected to a single bus (RS485 with ASCII Protocol), each instrument must have a unique address. In the submenu "Instrument Address" an address between 0 and 99 can be entered. Default value: 0
Baudrate: 4800 Baud		In this submenu the transmission speed for the ASCII communication can be set between 110 and 28800 Baud.

Submenu/Parameter	Entry Type	Comments
	Communication HART	**2. Communication HART** (Only available when this option was ordered). For this option the menu structure in the submenu Data Link is shown to the left: Read only display, no changes possible.
	Instr. address 000	For **HART-Protocol** the instrument address can also be set. HART-Protocol allows a bus with up to 15 instruments (1-15). Attention: If for HART-Protocol an address greater than 0 is entered, then the instrument operates in the Multidrop-Mode, i.e. the current output is fixed at 4 mA and only digital information it transmitted on the leads.
	Communication Fieldbus PA	**3. Communication PROFIBUS PA 3.0** (Only available when this option was ordered). For this option the menu structure in the submenu Data Link is shown to the left: Only for display of the Communication Protocol: no changes can be made.
	Slave Address 126 -BUS-	Only for Communication PROFIBUS PA(no function for FF) Display of the Slave Address. Factory default setting: 126 Information for the DIP-Switch settings : DIP-Switches 1 to 7 define the PROFIBUS Address DIP-Switch 8 defines the Address mode: **DIP-Switch 8 = Off** = Address over the bus or using the converter keypad and menus. The display indicates "-BUS-" **DIP-Switch 8 = On** = Address using DIP-Switches 1-7. The display indicates "-switch-" Factory default setting for DIP-Switch 8: Off
	IdentNo. Selector 0x9700	Only for Communication PROFIBUS PA(no function for FF) Setting the Ident-Number-Selectors. selections: 0x9700; 0x9740: 0x0691, 6668 Factory default setting: 0x0691. Changes cannot be made during cyclical operation, only when the status is STOP. The Ident-Number 0x6668 assures backward compatibility with Profile 2.0
	Gateway 11/2002 D200S022U01 A.13	Display of the Gateway software version Read only display, no changes possible. If the instrument is not connected to the bus, the display indicates "No Gateway"
	Communication PROFIBUS DP	**4. Communication PROFIBUS DP** (Only available when this option was ordered). For this option the menu structure in the submenu Data Link is shown to the left: PROFIBUS DP can be selected
	Slave Addr. 008	The instrument address for PROFIBUS DP can be entered in this menu or over the bus. The instrument address is to be entered as a 3 digit number. Entry range 0-125; default value: 126
	Function Param.-PROFIB.DP	Read only display, no changes possible A detailed description may be found in the separate document Data Link Description for PROFIBUS DP Instruments.

Submenu/Parameter	Entry Type	Comments
Submenu Function test	from table/numeric	
ENTER → Function test Iout		This menu is not displayed for PROFIBUS DP/PA, FOUNDATION Fieldbus Function test current output, enter value in mA. For additional information see Section 6.9
Function test RAM (ASIC)		Function test int. modules. Auto. Test: RAM (ASIC), NVRAM, EPROM (Program), EEPROM, ext. EEPROM. Additional test functions: terminals P7/G2, switch S201, display, terminals X1/G2, HART-Command, Simulation and Test Mode. For additional information see Section 6.9
Submenu Detector e.pipe	from table/numeric	A full pipeline is essential for accurate measurements. If this condition cannot be maintained continually, the function “Detector empty pipe” can be utilized to automatically turn off all output signals when the pipeline empties.
ENTER → Detector e.pipe on		Use ENTER and then STEP, to turn the detector on and off. off = Detector not active on = When the pipeline is empty, message in the display. The following menus are only displayed when the detector empty pipe is turned “On” .
Iout at e.pipe 130 %		Current output status when pipeline is empty: When the pipe is empty and the detector and the alarms are turned on, the following selections for the current output value are available: For 0-20 mA 0 % = 0 mA or 130 % = 26 mA For 4-20 mA 0 % = 3.6 mA or 130 % = 26 mA For Error 3 (Flow >130 %) the output is always set to 130 % = 26 mA. For HART-Protocol the display for Iout at empty pipe is “Low” or “High” . The “Low” or “High” state is defined in the menu “Current output” . The alarm output is activated and the message Empty pipe “and Error 0” are displayed. This menu is not available for PROFIBUS PA or FOUNDATION Fieldbus.
Alarm e.pipe on		On = when the pipeline is empty, signal over contact P7, G2 or Ux, P7 Off = when the pipeline is empty, no signal over the contact This menu is not available for PROFIBUS PA or FOUNDATION Fieldbus.
Threshold 2300 Hz		Threshold 2300Hz for activating the empty pipe alarm
Adjust Detector e.pipe		The pipeline must be full. After ENTER the following message is displayed (as an example) Adjust 18750 196 Use STEP or DATA keys to adjust the 18750 value to 2000 ±25 Hz. Use ENTER to accept this value. Then empty the pipeline. The adjustment value in the display must increase above the value set in the menu “Threshold” . The detector empty pipe is adjusted.

Submenu/Parameter	Entry Type	Comments
Submenu Totalizer	from table/numeric	C/CE Exit the submenu
ENTER Totalizer →F reset		The totalizer values and overflow messages can be reset independently for the forward and reverse flow directions with ENTER. First the overflow counter value (if any) is reset and using ENTER again the totalizer value. When an overflow has occurred, the forward or reverse direction indicators and the units blink in the process display. The software can record up to 250 totalizer overflows. When an overflow occurs (totalizer value >9/999/999 units) the totalizer is reset and the overflow counter incremented by 1. If more that 250 overflows occur, the message "Overflows >250" is displayed. The forward totalizer is reset using ENTER. If overflow >0, then only the overflow counter value is displayed. This function is not available for certified instruments.
Totalizer →F 4697,00 m3		The totalizer value for the "Forward" and "Reverse" flow directions can be manually preset to any value. This feature could be used to transfer the totalizer value from an old converter to a new converter after an exchange. Use STEP or DATA to access the parameter, the present totalizer value is displayed in the 2nd line; after using ENTER a new value can be entered and accepted using ENTER again. Preset totalizer (totalizer value settable) 2nd display line = present value
Overflow →F 250		This function is not available for certified instruments. Overflow counter max. 250, 1 Overflow = totalizer value 10,000,000 units (display indication reset and overflow counter increment by 1.
Totalizer ←R reset		See Forward Totalizer
Totalizer ←R 625,000 m3		See Forward Totalizer
Overflow ←R 004		See Forward Overflow
Totalizer funct. Standard		Selections: "Standard" or "Difference" The selection is made using STEP and DATA and closed using ENTER. In the "Totalizer function Standard" the count pulses for the forward and reverse flow direction totalizers and integrated on two separate totalizers. If in menu "Operating mode" the flow direction is selected as "Forward" only, then only the forward totalizer counts. For the "Difference" selection the flows in both directions are integrated in a single totalizer. In the forward direction the pulses are added while in the reverse direction they are subtracted from the totalizer value. The pulse output is not affected by these selections.
Mains interrupt reset		If a blinking asterisk is displayed in the first line, a power outage has occurred, it can be reset using ENTER. This function is only available for instruments with HART-Protocol.

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

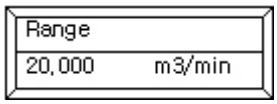
Submenu/Parameter	Entry Type	Comments
Submenu Operating mode	from table	Example for display of "A1, Value and Unit" in 1st line 1st line A1 Value Unit This is how the values are displayed A1 149,501 l 1353 m3 First the block is shown from which the values and units originate A1 corresponds to the AI-Block A2 corresponds to the totalizer Block Tot 1 A3 corresponds to the totalizer Block Tot 2 Then its value is displayed (149.501) with units ("l" = Liter) The display shows in sequence the 3 Blocks (A1, A2, A3) with their value and units. **Information:** If when turning the power to the instrument on, the bus is not connected then the message "No Gateway" is displayed
C/CE		Exit the submenu
ENTER → Operating mode Standard		Standard/Fast Standard: continuous flow metering Fast: accelerated measurement signal processing (short time batches > 3 s or pulsating flow) The converter must be equipped with a higher excitation frequency. In this operating mode a better reproducibility for short measurement times or piston pump operation is achieved through use of accelerated signal measurements.
Flow direction Forward/reverse		Defining the flow direction for metering Forward/ Reverse “or only Forward” . For “Forward” the instrument only meters in the forward flow direction. No measurement or totalization is made in the reverse flow direction.
Flow indication Standard		“Standard” or “Opposite” Here the flow direction indicators in the display can be reversed. I.e. the forward flow direction can be defined as the reverse flow direction. Select “Flow indication opposite”
Load data from external EEPROM	from table	When a converter is replaced the data stored in the external EEPROM are automatically uploaded when the supply power is turned on. It is also possible to upload the data from the external EEPROM on comand.
Store data in external EEPROM	from table	**Information!** After the start-up has been completed the actual settings must be stored in the external EEPROM. The same applies after any settings are changed.
Model number 05/02 Part No. B.12		Identifies the installed software version. 05/02 = Date of the release B.12 = Revision level

5.4. Parameter and Data Entry in “Condensed Form”

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

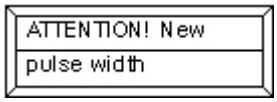
6. Parameter Entries

6.1. Range / Numeric Entry

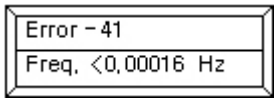


The flow range end value Range applies to both flow directions.
The flow range can be set between 0.05 Cal-fact and 1.0 Cal-fact.

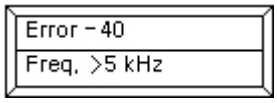
The selection can be made using the STEP and DATA keys.
The units are selected in the Submenu “Unit” .



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

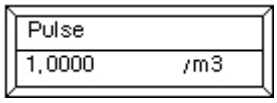


If the output frequency is too low an error message is displayed:



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

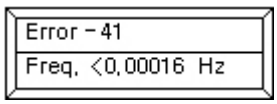
6.2. Pulse Factor Forward and Reverse Flow Directions / numeric entry



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

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

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



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

6.3. Pulse Width / numeric entry

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

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

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

When flow range is exceeded by 30 %
f = 1.666Hz . 1.3 = 2.166Hz (l/s) on/off ratio 1:1 (pulse width = pause width)

$$t_p = \frac{1}{2{,}166} \cdot 0.5 = 230\text{ms}$$

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

Pulse width
230 ms

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

Error 46
Entry too large

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

Additional information for active pulse output

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

Example for an active pulse output:

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

The ratio of pulse/pause may not be less than 1:4. The the value of the 24 V pulse drops exponentially as the load increases (see Fig. 46).

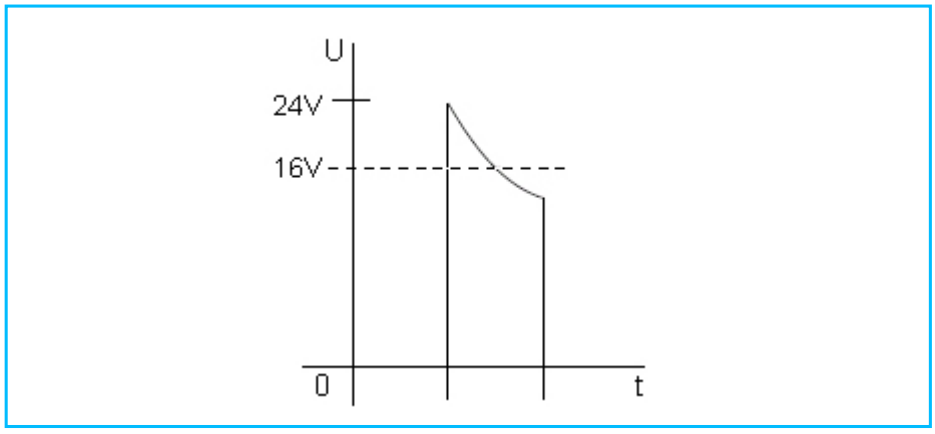


Fig. 46 :

Example for a passive pulse output:

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

Optocoupler specifications:

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

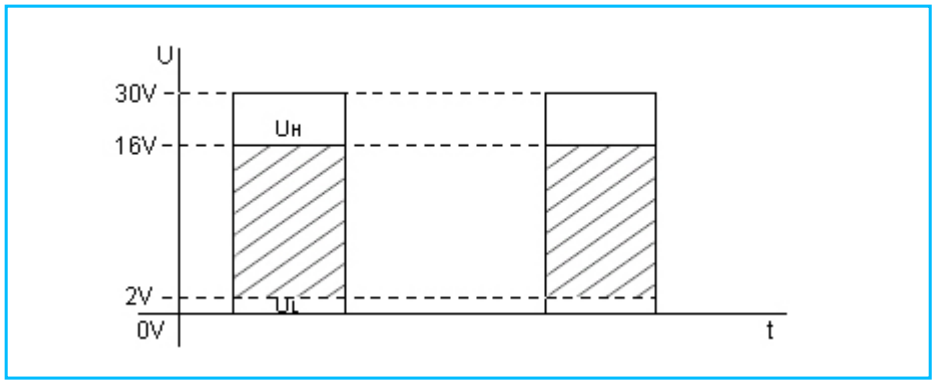


Fig. 47 :

6.4. Filter (Noise Reduction) / entry from table

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

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

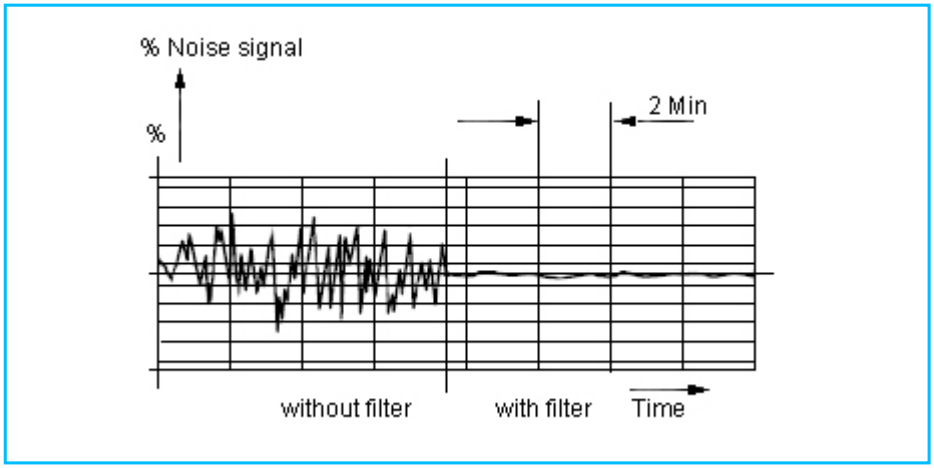
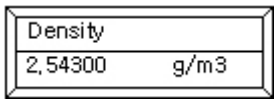


Fig. 48 :

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

6.5. Density / numeric entry



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

6.6. System Zero Adj. / numeric entry

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

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

For security, a confirmation message is displayed:

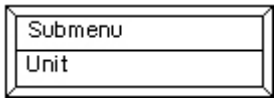
The choice between “manual” and “automatic” can be made with the STEP or DATA keys.
Select Automatic” .

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

6.7. Submenu Unit

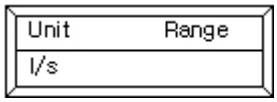
The following functions and parameters are included in the submenu:

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



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

6.7.1. Range Unit / entry from table

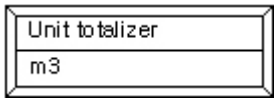


The units listed in the following table can be selected using the STEP and DATA keys and accepted using ENTER.

Units	Standard	HART/PROFIBUS/FOUNDATION Fieldbus
Liter	l/s, l/min, l/h	l/s, l/min, l/h
Hectoliter	hl/s, hl/min, hl/h	
Cubic meter	m3/s, m3/min, m3/h	m3/s, m3/min, m3/h
Imperial-gallon per	ipgs, igpm, igph	ipgs, igpm, igph
U.S-mill-gallon per day	mgd	mgd
U.S.gallon per	gpm, gph	gpm, gph
Barrel-Beer	bbl/s, bbl/min bbl/h	bbl/s, bbl/min, bbl/h
Barrel-Petrochemical	bls/day, bls/min bls/h	
Kilogram	kg/s, kg/min, kg/h	kg/s, kg/min, kg/h
Ton	t/s, t/min, t/h	 t/min, t/h
Gram	g/s, g/min, g/h	g/s, g/min, g/h
Milliliter	ml/s, ml/min, ml/h	
Megaliter	Ml/min, Ml/h Ml/day	
Pound (454 g)	lb/s, lb/min, lb/h	lb/s, lb/min, lb/h
US-Ton	uton/min, uton/h Uton/day, kgal/s kgal/min, kgal/h	 kgal/s, kgal/min kgal/h

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

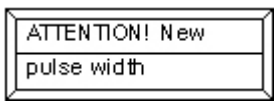
6.7.2. Units Totalizer / entry from table

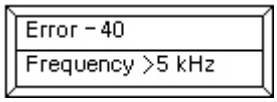


The units listed below apply to the totalizer values in the 2nd display line can be selected using the DATA and STEP keys. They may be different than the flowrate units. The engineering units selection is accepted by pressing ENTER.

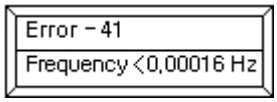
Unit: ml, Ml, lb, uton, kgal, l, hl, m3, igal, gal, mgal, bbl, lbs, kg, t, g.

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





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



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

6.7.3. User Programmable Units

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

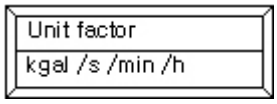
a) Unit factor
b) Unit name
c) Prog. Unit with/without density

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

6.7.3.1. Unit Factor / numeric entry

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

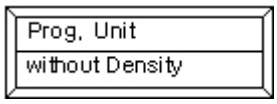
6.7.3.2. Unit Name / entry from table



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

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

6.7.3.3. Programmable Unit / entry from table



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

6.8. Submenu "Programmable In/Output" / entry from table

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

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

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

6.8.1. Function Terminals P7, G2 (Ux, P7 for PROFIBUS DP)

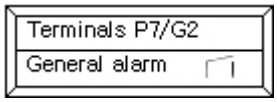
One of the following functions can be assigned to the contact output P7, G2.

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

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

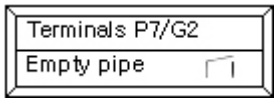
Normally closed configuration, i.e. the contact opens when the signal is applied.
Normally open configuration, i.e. the contact closes when the signal is applied.

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



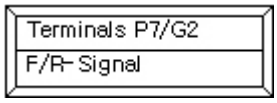
All detected errors (Error 0 to 9, A, B) are signalled over the terminals. During an error condition, the contact at terminals P7, G2 is opened in the example shown.

6.8.1.2. Empty pipe / entry from table



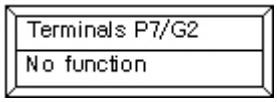
If the function "Detector empty pipe" is turned on, the current output is set to its programmed value and the pulse totalization is interrupted. The alarm empty pipe is activated. In this example the contact opens, and the message "Empty pipe" and "Error 0" are displayed

6.8.1.3. F/R-Signal / entry from table



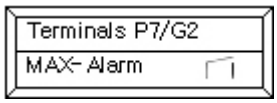
The present flow direction is indicated in the display by the direction arrows and signalled over the contact output P7, G2.

6.8.1.4. No Function



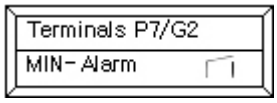
No signal is transmitted over terminal P7, G2 when “No Function” is selected.

6.8.1.5. MAX-Alarm / entry from table



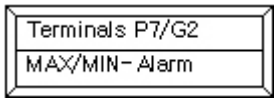
When the MAX-Alarm function is selected an alarm is signalled when the flowrate exceeds the limit value set, in this example the contact opens.

6.8.1.6. MIN-Alarm / entry from table

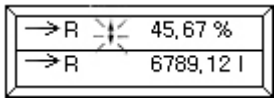


When the MIN-alarm function is selected an alarm is signalled when the flowrate is below the limit value set, in this example the contact opens.

6.8.1.7. MAX/MIN-Alarm / entry from table



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



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

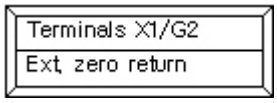
Example:
MAX-Alarm = 20 %
MIN-Alarm = 80 %
Blinking double arrow indicates that the flowrate is between 20 and 80 %.

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

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

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

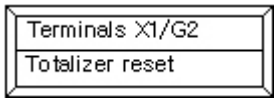
6.8.2.1. External Zero Return / entry from table



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

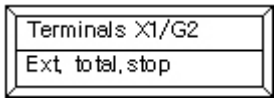
When the external zero return is activated the actual flowrate will continue to be displayed.

6.8.2.2. External Totalizer Reset / entry from table



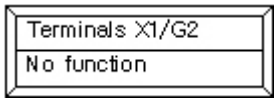
The contact input can be utilized to reset the internal totalizers for the forward and reverse flow directions and the overflow counters.

6.8.2.3. External Totalizer Stop



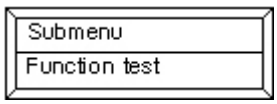
If the contact input is activated, the flow integration will be stopped and the message “Totalizer stop” displayed in place of the totalizer value. This function is not available with HART-Protocol.

6.8.2.4. No Function / entry from table



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

6.9. Submenu Function Test / numeric entry only for Iout



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

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

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

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

Information!

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

Select **Pulse Output**, press ENTER. A scaled pulse output with a frequency of1 Hz and a pulse width of 500 ms is transmitted.

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

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

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

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

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

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

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

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

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

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

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

Only for HART-Protocol:

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

Information!

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

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

7. Error Messages

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

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

8. Maintenance and Repair

8.1. General Information

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

8.1.1. Flowmeter Primary

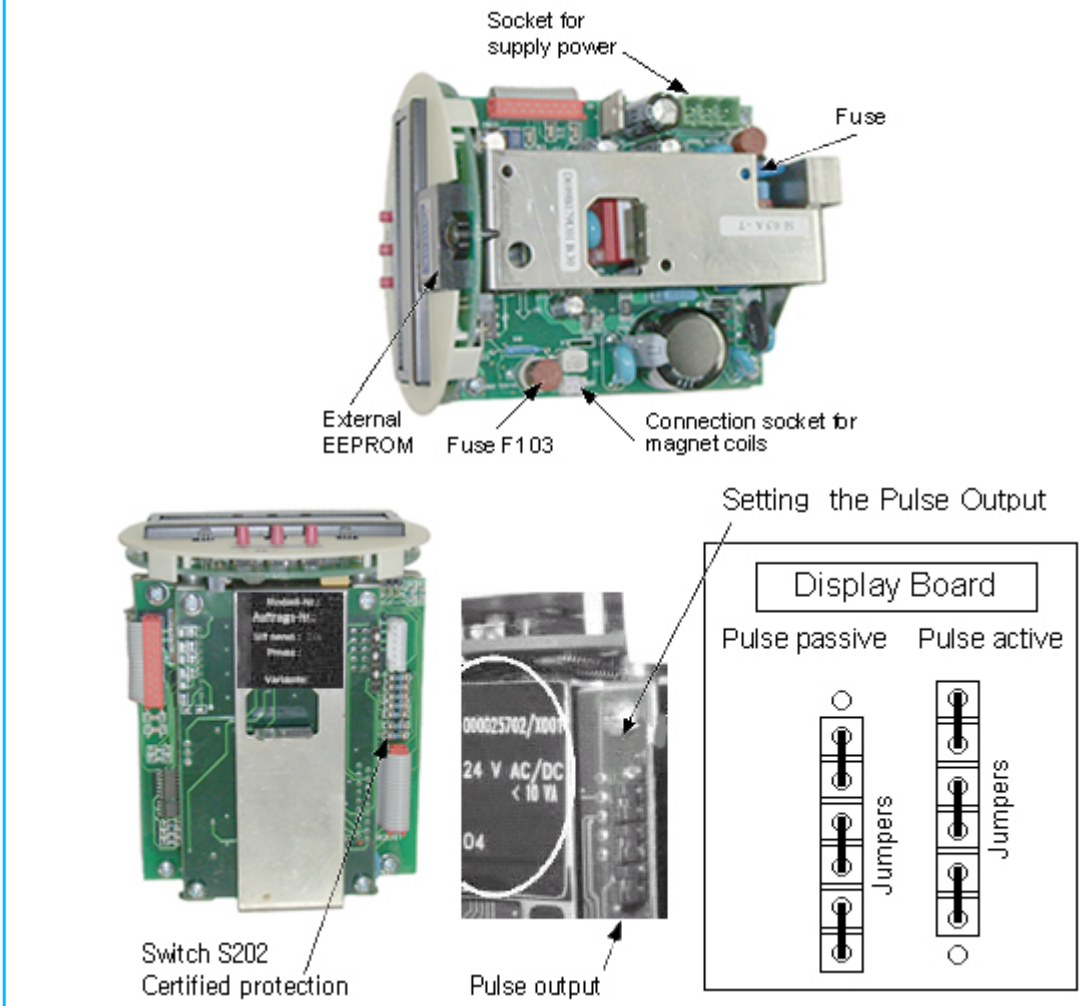
The flowmeter primary is essentially maintenance free. An annual check should be made of the ambient conditions (air flow, humidity), the seal integrity of the process connections, the condition of the cable connectors and the tightness of the screws and bolts, safety of the supply power. lightning protection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

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

Observe the information (Hazardous Material Regulation), if the flowmeter primary is to be returned to ientek Co., Ltd. Products for repair!

8.1.2. Converter

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



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

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

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

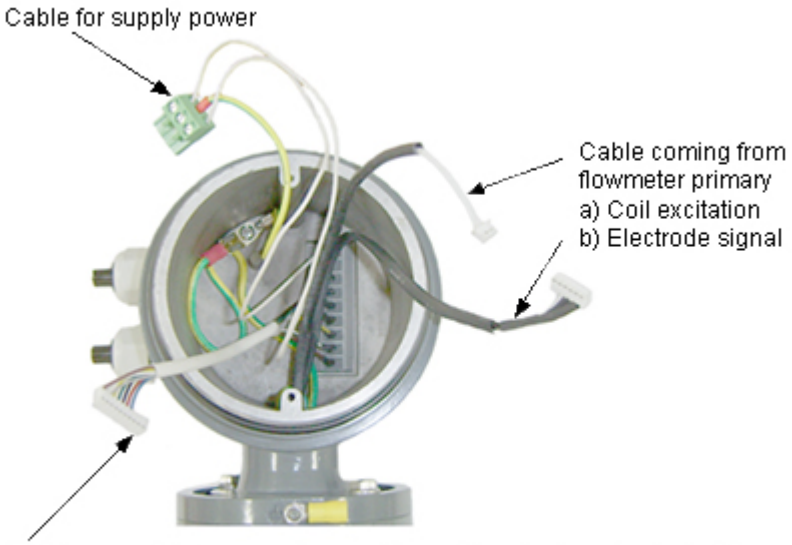
Variant 01	Current output + pulse output active + contact input + contact output
Variant 02	Current output + pulse output active + contact input + contact output + HART Protocol
Variant 03	Current output + pulse output passive + contact input + contact output
Variant 04	Current output + pulse output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

Fig. 49 :

9. Replaceable Parts List

9.1. Replaceable Parts List for Compact Design Instrument

	Description	Part No.
1	Cover with glass window	D614A023U01
2	O-Ring 100x3.5	D101A026U01
3	Cable connector M20x1.5	D150A008U15
4	Cover small	D379D134U02

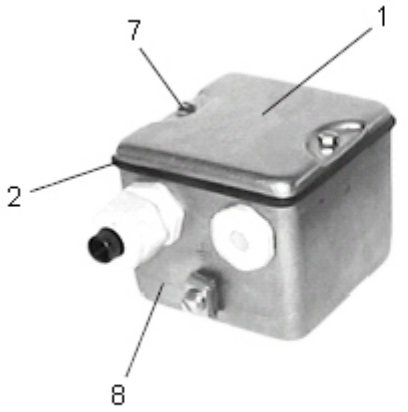


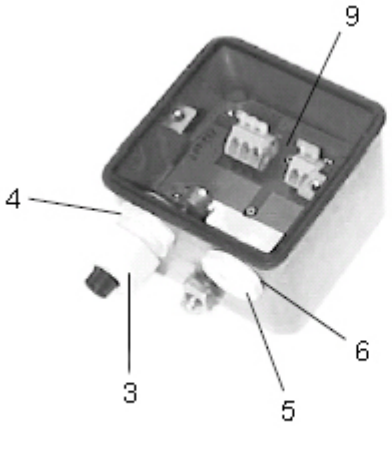
Variant	Cable Assembly for In-/Outputs	Part No.
01 - 04	Current output + pulse output active + contact input + contact output	D677A294U01
05	Current output + pulse output passive + contact output + RS 485	D677A294U04
06	Pulse output passive + contact output + PROFIBUS DP	D677A294U05
14	PROFIBUS PA 3.0	D677A294U08
15	FOUNDATION Fieldbus	D677A294U09
16	PROFIBUS PA 3.0 (with M12 plug)	D677A294U08

Fig. 50 :

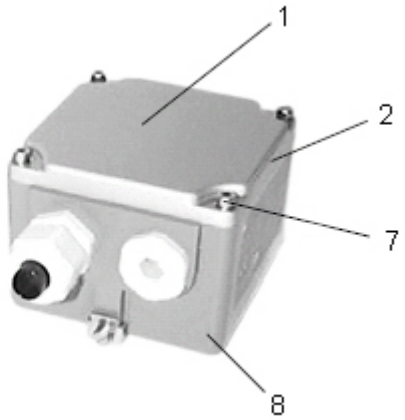
9.2. Replaceable Parts for Flowmeter Primary

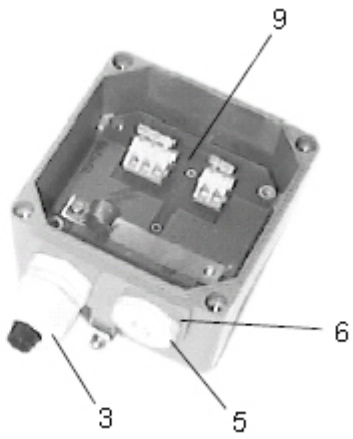
Connection box for flowmeter primary in stainless steel design





Connection box for flowmeter primary in Aluminum design



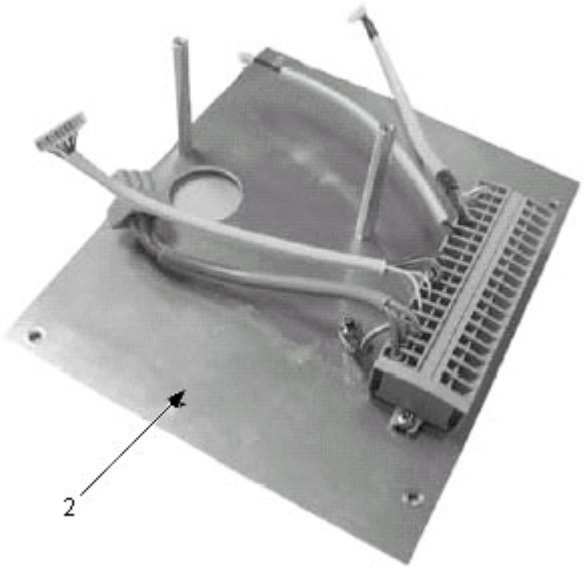


	Description	Connection Box for Series 3000 Part No.	Connection Box for Series 6000 Part No.
1	Housing cover	D612A127U01	D612A152U01
2	Housing cover gasket	D333F016U01	D333F022U01
3	Cable connector	D150A008U02	D150A004U14 (M20 x 1.5)
4	Seal ring for cable connector	D150Z007U06	-
5	Seal plug	D150Z007U05	D150Z007U08 (M20 x 1.5)
6	Gasket for seal plug	D150Z007U06	-
7	Screw M4 x 14 with flat washer and spacer	D396B013U01 and D115B004U01 and D375A018U01	D009G113AU20 D085A021BU20 D106A001U25
8	Connection box, lower section	D612A128U01	D612A153U09
9	Connection board, complete	D684A690U02	D685A862U02

Fig. 51 :

9.3. Replaceable Parts List for Converter E4

9.3.1. Field Mount Housing

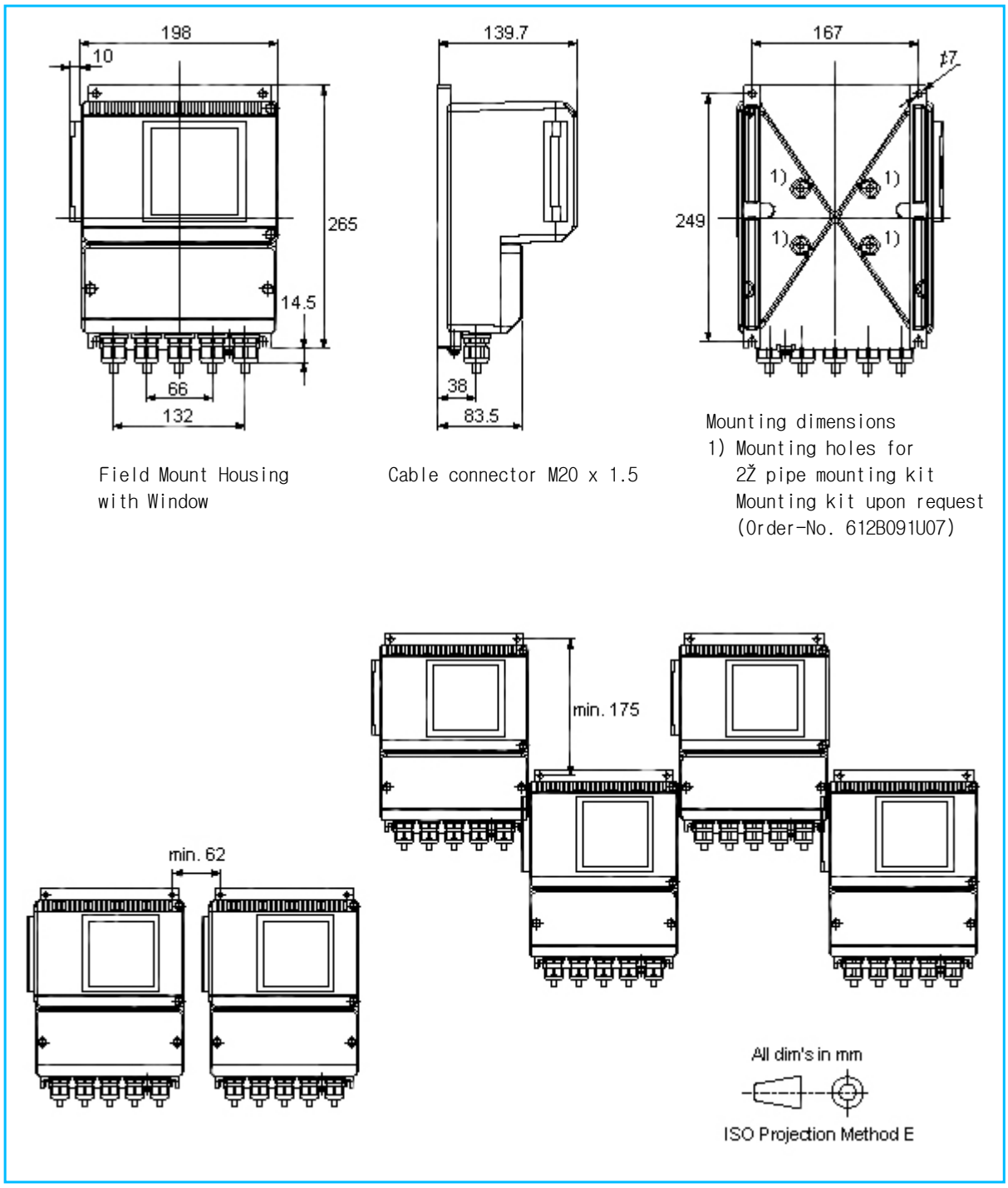


No.	Description	Part No.
1	Field mount housing M20x1.5 complete (empty), without converter module, without Connection board.	D641A033001
2	Connection board complete including cable assembly for standard outputs incl. HART (Variant 01-04) Connection board complete including cable assembly for RS845 (Variant 05) Connection board complete including cable assembly for PROFIBUS DP (Variant 06) Connection board complete including cable assembly for PROFIBUS PA or FOUNDATION Fieldbus (Variant 14-16)	D674A861U01 D674A861U92 D674A861U03 D674A861U04
3	Cover small	D641A029U01
4	Cable connector M20x1.5	D150A008U15
5	Mach, screw, Philips, phillister head M4x10	D004G108AU01
6	Spring washer	DC85D020AU20

Fig. 52 :

10. Dimensions

10.1. Dimensions Converter Remote Type



Field Mount Housing
with Window

Cable connector M20 x 1.5

Mounting dimensions
1) Mounting holes for
2Ž pipe mounting kit
Mounting kit upon request
(Order-No. 612B091U07)

Fig. 53 : Dimensions Converter Field Mount Housing, Mounting Options

11. Accuracy

Reference conditions per EN 29104

Fluid Temperature

20 ° C ± 2 K

Supply Power

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

Installation Requirements, Straight Sections

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

Warm Up Phase

30 min

Effect on Current Output

Same as pulse output plus ± 0.1 % of rate

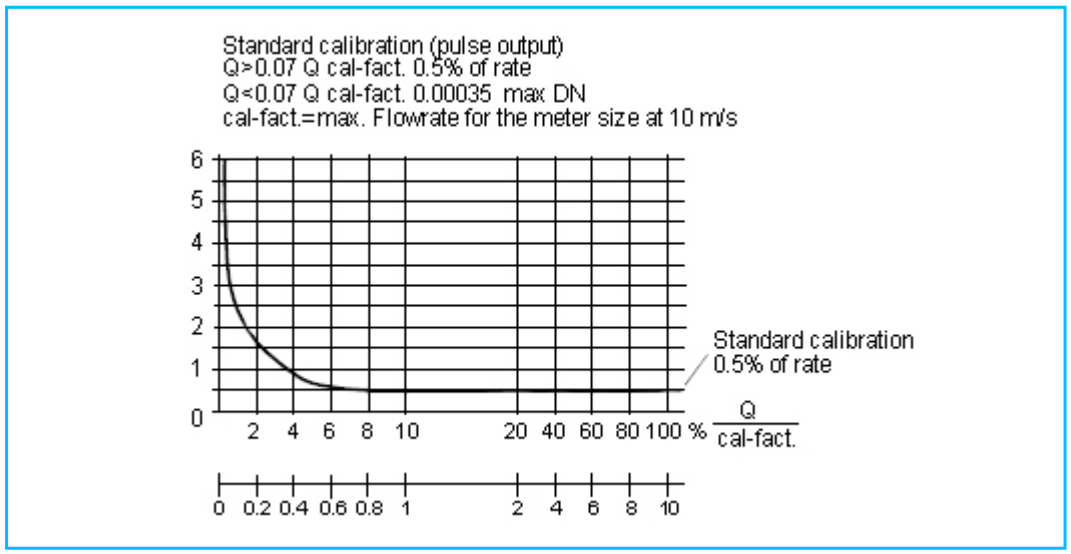


Fig. 54: Metering System Accuracy COPA-XE / MAG--XE)

12. Specifications Converter

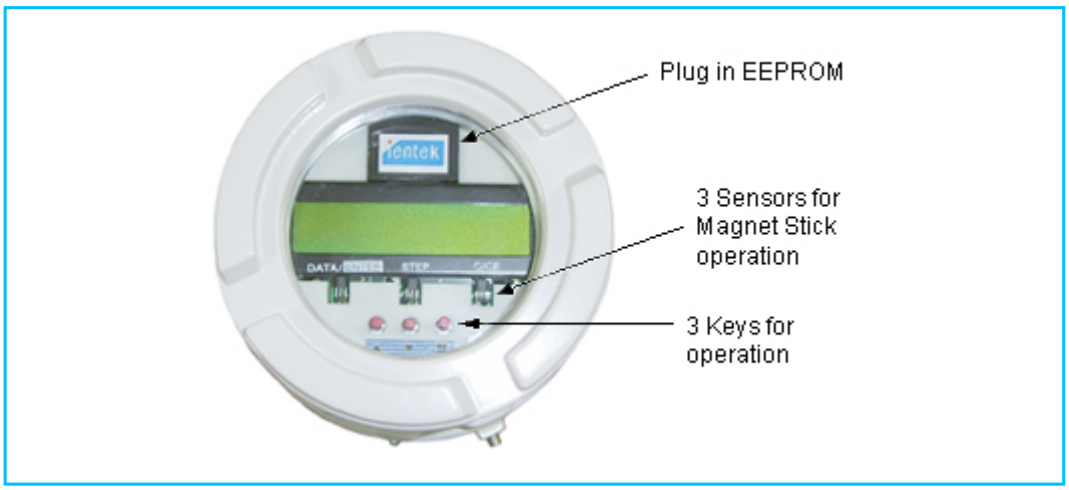


Fig. 55 : Converter Keypad and Display

Flow Range
Continuous settings between 0.5 and 10 m/s

Max. Measurement Deviation of the Metering System
≤0.5% of rate(0.25 % option)

Reproducibility
≤0.15% of rate

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

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

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

Magnetic Field Supply
6 1/4 Hz, 7 1/2 Hz, 12 1/2 Hz, 15 Hz, 25 Hz, 30 Hz (50/60 Hz supply power)

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

Ambient Temperature
-20 to +60℃

Electrical Connections
Screwless spring loaded terminals

13. Overview Parameter Settings and Flowmeter Design Options

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

Parameter		Entry Range
Prog. Prot. Code	...	0-255 (0=factory default setting)
Language	...	German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish
Meter size:	...	DN 3 - 1000 [1/10" - 40"]
Range:	...	0.05 Cal-factor -1 Cal-factor
Pulse factor:	...	0.001 - 1000 pulses/unit
Pulse width	...	0.100 - 2000 ms
Low flow cut-off:	...	0 - 10 % of flow range end value
Damping:	...	0.125 - 99.99 seconds
Filter:	...	ON/OFF
Density:	...	0.01 g/cm3 - 5.0 g/cm3
Unit range:	...	l/s, l/min, l/h, hl/s, hl/min, hl/h, m3/s, m3/min, m3/h, igps, igpm, igph, mdg, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, ml/s, ml/min, ml/h, Ml/min, Ml/h, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, kgal/s, kgal/min, kgal/h,
Unit totalizer:	...	l, hl, m3, igal, gal, mgal, bbl, bls, g, kg, t, ml, uton, lb, kgal
Max. Alarm:	...	%
Min. Alarm:	...	%
Terminals P7/G2:	...	Max. Alarm, Min. Alarm, Max./Min. Alarm, General Alarm, empty pipe, F/R-Signal, no function
Terminals X1/G2:	...	External zero return, totalizer reset, no function
Current output:	...	0/4-20 mA, 0/2-10 mA, 0-5 mA, 0-10-20 mA, 4-12-20 mA
Iout at Alarm:	...	0 %, 130 %, 3.8 mA
Detector e. pipe:	...	ON/OFF
Alarm e. pipe	...	ON/OFF
Iout at e. pipe:	...	0 %, 130 %, 3.8 mA
Threshold:	...	2300 Hz
Adjust e. pipe:	...	Software potentiometer
Totalizer function:	...	Standard, difference totalizer
1st Display line:	...	Q (%), Q (unit), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
2nd Display line:	...	Q (%), Q (unit), Q (mA), totalizer F/R, TAG-Number blank line, Bargraph
1st line Multiplex:	...	ON/OFF
2nd line Multiplex:	...	ON/OFF
Operating mode:	...	Standard/fast
Flow indication:	...	Forward/reverse, forward
Flow direction:	...	Standard, opposite
Store data in ext. EEPROM:	...	Yes/No

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