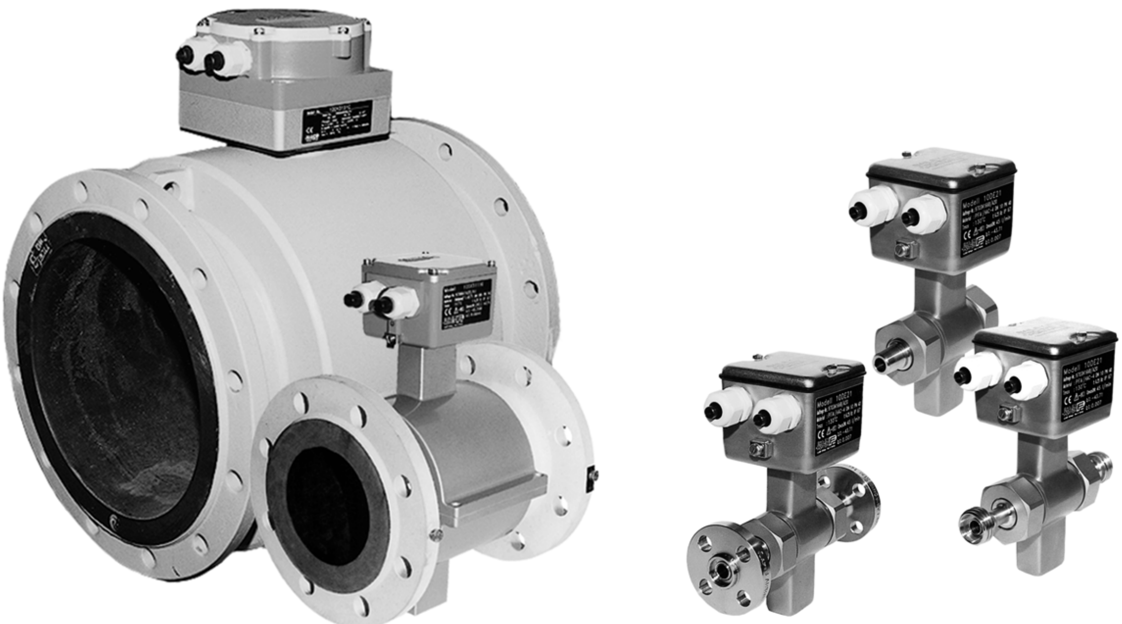
MAG-SM
FILL-MAG

Electromagnetic Flowmeter with AC Magnetic Field Excitation

Models: DS21_ / DS4_F

Instruction Bulletin

D184B064U02 Rev. 03 / 08.02



For Converters:

MAG-SM Model 50SM1000
FILL-MAG Model 50ES7000

You have purchased a high quality, modern Electromagnetic Flowmeter System from ABB Automation. We appreciate your purchase and the confidence you have expressed in us.

This Instruction Bulletin contains information relating to the assembly and installation of the instrument and the specifications as well the testing of this instrument design. ABB Automation reserves the right to make hardware and software improvements without prior notice. Any questions which may arise that are not specifically answered by these instructions should be referred to our main plant in Göttingen, Germany or to one of our Technical Sales Bureaus. Their addresses, telephone and FAX numbers may be found on the back cover.

This interference resistance of this converter complies with the NAMUR-Recommendations “EMC-Guidelines for Manufacturers and Users of Electrical Instruments and Equipment “ Part 1, 5/93 and EMC-Guideline 89/336/EWG (EN50081-1, EN50081-2)

Introductory Safety Notes for the EMF System

Regulated Usage

The Electromagnetic Flowmeter System (EMF) is manufactured to state of the art designs and is safe to operate.
The flowmeter is to be installed exclusively in applications which are in accord with the specifications.

Every usage which exceeds the specifications is considered to be non-specified. Any damages resulting therefrom are not the responsibility of the manufacturer.
The user assumes all risk for such usage.

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

Assembly, Start-Up and Service Personnel

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

Only qualified personnel should have access to the instrument.
The personnel should be familiar with the warnings and operating requirements contained in this Instruction Bulletin.

Assure that the interconnections are in accordance with the Interconnection Diagrams. Ground the flowmeter system.

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

Hazardous Material Information

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

a) all flowmeter primaries and/or flowmeter converters which are returned to ABB Automation Products for repair are to be free of any hazardous materials (acids, bases, solvents, etc.).

b) the flowmeter primaries must be flushed so that the hazardous materials are neutralized. There are cavities in the primaries between the metering tube and the housing. Therefore after metering hazardous materials, these cavities are to be neutralized (see Hazardous Material Law -GefStoffV). For two piece housings the housing screws should be loosened. For flowmeter primaries ≥ 14"/DN 350 the drain plug at the bottom of the housing is to be removed in order to neutralize any hazardous material in the magnet coil and electrode areas.

c) for service and repairs **written confirmation** is required that the measures listed in a) and b) have been carried out.

d) any costs incurred to remove and neutralize the hazardous materials during a repair will be billed to the owner of the equipment.

ABB

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

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

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

Modell: *Model:*	50SM1000 10DS21.. 10DS31.. DS21.. DS41..
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-2, 2/96 *
Richtlinie: *Directive:*	Niederspannungsrichtlinie 73/23/EWG * Low voltage directive 73/23/EEC *
Europäische Norm: *European Standard:*	EN 61010-1, 3/94 *

* einschließlich Nachträge
including alterations

Göttingen, 10.05.2000

....
Unterschrift / Signature

BZ-13-5101, Rev.2, 1699

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

Modell: *Model:*	50ES7000 10DS21.. 10DS31.. DS21.. DS41..
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-2, 2/96 *
Richtlinie: *Directive:*	Niederspannungsrichtlinie 73/23/EWG * Low voltage directive 73/23/EEC *
Europäische Norm: *European Standard:*	EN 61010-1, 3/94 *

* einschließlich Nachträge
including alterations

Göttingen, 10.05.2000

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Unterschrift / Signature

BZ-13-5103, Rev.1, 1699

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1. Flowmeter Primary and Converter Coordination

! Note

- This flowmeter system utilizes AC magnetic field excitation. The metering system consists of a flowmeter primary which is installed in the pipeline and a converter mounted separately. In order to assure trouble free operation it is essential to assure that only converters Model Numbers 50SM1000 or 50ES7000 are connected to the flowmeter primary. The complete Model Numbers are listed on the instrument tags of the instruments.

Flowmeter System with AC Magnetic Field Excitation

1.1 Application Areas for MAG-SM

These electromagnetic flowmeters provide an economical and precise means to meter the flow of liquids, slurries and sludges whose electrical conductivity is above 20 µS/cm (option, 0.5 µS/cm). The metering system is especially suitable for fast changing processes, two-phase liquids, continuous or pulsating flows (piston pump operation).

1.2 Application Areas for FILL-MAG

These electromagnetic flowmeters are especially designed for batch, fill and injection processes, for filling the smallest volumes all the up to the largest containers.

1.3 Model Number Coordination

Flowmeter Primary ⟷ **Converter**

Stainless Steel Housing Series 2000 10DS2111/10DS2112, DS21_	MAG-SM Fill-MAG	50SM1000 50ES7000
Aluminum Housing Series 3000/4000 10D1422/10DI1425/10DS3111/ 10DS3112/10DS3121/DS41F/DS44F	MAG-SM Fill-MAG	50SM1000 50ES7000

1.4 Instruction Bulletins

Flowmeter Primary ⟷ **Converter**

ABB Part No.: D184B064U01 Rev.02

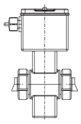
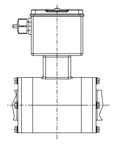
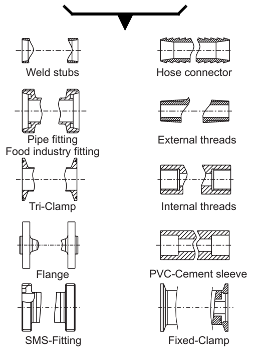
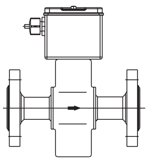
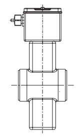
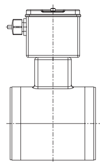
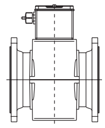
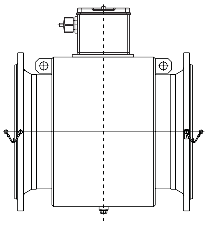
MAG-SM	ABB Part No.:	D184B085U01 Rev.01
Fill-MAG		D184B066U01

1.5 Specification Sheets, Metering System

MAG-SM	ABB Part No.:	D184S034U01 Rev.01
Fill-MAG		D184S033U01

Flowmeter Primary, Model DS21_/DS4_F

2. Overview, Flowmeter Primary Designs

Variable Connections	Connection Types	Fixed Flange	Wafer Design	Fixed Flange
 1/10"–1-1/2" / DN3-DN40  2"–4" / DN 50–DN 100	 See Spec. Sheet for more, others upon request		 1/10"–1-1/2" / DN3-DN40  2"–4" / DN 50–DN 100	 

Accuracy	1 % of rate										
Flowmeter primary housing mat'l	**Stainless Steel Housing Complete Series 2000**									**Alum Hsg. Series 4000**	
Flowmeter Primary											
Model Number	DS21*				DS21F		DS21W			DS41F	
Process Connections	Inch	DN	PN	*	Meter Size	Pres. Rtg.	Inch	DN	PN	Meter Size	Pres. Rtg.
Wafer Design		–		W	–		1/10–4	3–100	10–40	–	
Flanges DIN 2501		–		F	DN 3-100	PN10-40	–			DN 3–2000	PN 10–40
Flanges ANSI B16.5	1/10–4	3–100	10	F	1/10"–4"	CL 150–300	–			1/10"–40"	CL 150–300
Flanges FAB1B DIN 11864-2B	1/10–4	3–100	16	L	–		–			–	
Aseptic connection. DIN 11864-1B	1/10–4	3–100	10-40	A	–		–			–	
Food Industry fitting. DIN 11851	1–4	25–100	16	S	–		–			–	
Threaded connection. SMS 1145	1–4	25–100	16	D	–		–			–	
Weld stubs DIN 11850	1/10-4	3–100	10	R	–		–			–	
Weld stubs DIN 2463	1/10-4	3–100	10	Q	–		–			–	
Weld stubs ISO 2037	1–4	25–100	40	P	–		–			–	
Tri-Clamp DIN 32676	1–4	25–100	10	T	–		–			–	
Tri-Clamp ISO 2852	1/10-4	3–100	10-40	U	–		–			–	
Fixed clamp	3/8–1-1/2	10–40	10	C	–		–			–	
External threads ISO 228	1/10–1	3–25	10	E	–		–			–	
Internal threads ISO 228	1/10–1	3–25	10	I	–		–			–	
PVC-Cement sleeve	1/10–1	3–25	10	G	–		–			–	
Hose connector	1/10–1/2	3–15	10	H	–		–			–	
1/8" Sanitary connector	1/25–3/32	1–2	10	B	–		–			–	
Liner	PEEK, Torlon (<1/10" : DN3) PFA (>3/32" : DN2)				PFA		PFA			Hard and soft rubber, PTFE, PFA, others	
Conductivity	≥ 20 µS/cm Option ≥ 0.5 µS/cm										
Electrodes	SS 316Ti/1.4571, SS 1.4539, Hastelloy B-2/C-4, Platinum-Iridium, Tantalum, Titanium										
Process connection material	SS316L/1.4404, 304/1.4301				SS 316Ti/1.4571		–			Steel, SS 316Ti/1.4571	
Protection Class per EN 60529	IP 67 / IP 68				IP 67 / IP 68		IP 67 / IP68			IP 67 / IP 68	
Fluid temperature	-25 to 130 °C				-40 to 130 °C		-25 to 130 °C			-25 to 130 °C/180°C	
Approvals											
Hygienic and sterile requirements	CIP/SIP-capable FML, 3A, EHEDG (Cleanability)									CIP-capable	

! Note

- The maximum signal cable length between the flowmeter primary and the converter is 50 m. When a preamplifier is installed for low conductivity applications the max. signal cable length is 200 m. The flow velocity must be reduced, < 1 m/s, when the fluid conductivity is low and the εr value is high (for demineralized water εr = 78).

3. Functional Description

ABB Automation Electromagnetic Flowmeters »EMF« are the ideal flow metering instruments for liquids, slurries and sludges which have a specific minimum electrical conductivity. The instruments measure accurately, add no additional pressure drop, have no moving or protruding parts, are wear free and chemically resistant. The flowmeters can be readily installed in existing pipelines.

The ABB Automation EMFs have been proven over many years of service and are the preferred flowmeters in the Chemical Industry, Municipal Water and Waste Water treatment facilities, the Food and Beverage Industry as well as in the Pulp and Paper Industry.

Principle of Operation

The basis for the operation of electromagnetic flowmeters are Faraday's Laws of Induction. A voltage is induced in a conductor as it moves through a magnetic field.

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

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

The voltage which is induced in the fluid is measured at two electrodes located diametrically opposite to each other. This flow signal voltage $\mathbf{U_E}$ is proportional to the magnetic induction **B**, the electrode spacing **D** and the average fluid velocity **v**.

Noting that the magnetic induction **B** and the electrode spacing **D** are constant values indicates that a proportionality exists between the flow signal voltage $\mathbf{U_E}$ and the average flow velocity **v**. The equation for calculating the volume flowrate shows that the signal voltage $\mathbf{U_E}$ is linear and proportional to the volume flowrate.

$U_E \sim q_v$

Design

An electromagnetic flowmeter system includes a flowmeter primary and a converter. The flowmeter primary is installed in the pipeline while the converter which processes the flow signals can be mounted locally or in a central control room.

! Note:

Please observe the specified coordination between the flowmeter primaries and the converters shown on Page 1.

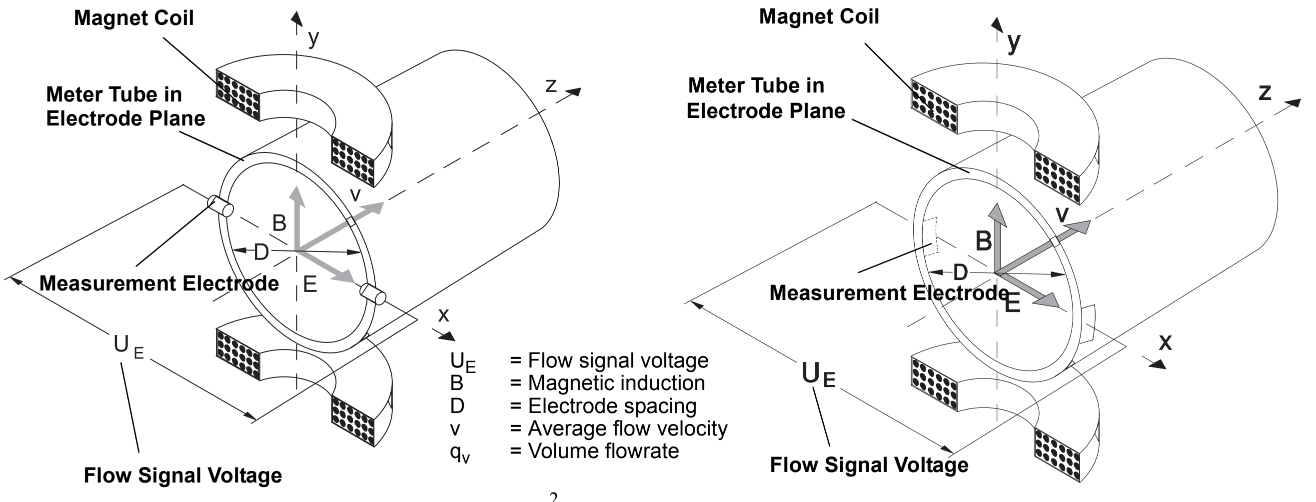
Principle of Operation MAG-SM with Capacitive Signal Measurements

The basis for the operation of electromagnetic flowmeters are Faraday's Laws of Induction. A voltage is induced in a conductor as it moves through a magnetic field.

The voltage which is induced in the fluid is measured at two electrodes located diametrically opposite to each other. The voltage is measured capacitively, i.e., the electrodes do not come in contact with the fluid.

Each electrode forms a coupling capacitor with the inside wall of the lined meter tube on which the flow signal potential exists whose dielectric is the liner material. The flowrate proportional measurement signal is fed to the input of an integrated preamplifier over this coupling capacitor.

This flow signal voltage $\mathbf{U_E}$ is proportional to the magnetic induction **B**, the electrode spacing **D** and the average fluid velocity **v**.



U_E = Flow signal voltage
B = Magnetic induction
D = Electrode spacing
v = Average flow velocity
q_v = Volume flowrate

$$*)\ q_v = \frac{D^2 \pi}{4} \cdot v$$

Fig. 1 Electromagnetic Flowmeter Schematic

4. Assembly and Installation

4.1 Inspection

Before installing the electromagnetic flowmeter primary check for mechanical damage due to possible mishandling during shipping. All claims for damage are to be made promptly to the shipper prior to installation.

4.2 Installation Requirements Flowmeter Primary

The flowmeter primary and the signal cables should not be installed in close proximity to strong electromagnetic fields.

The flowmeter primary must be installed so that the meter tube is always completely filled with fluid and cannot drain. A slight upward slope of approx. 3% is desirable to prevent gas build up within the flowmeter (Fig. 2).

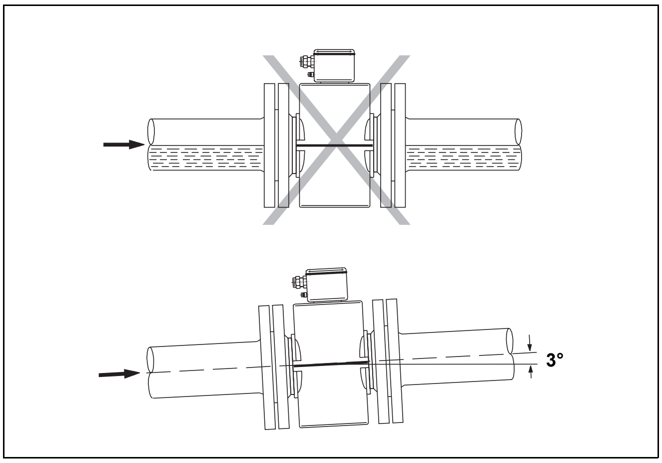


Fig. 2

Vertical installations are ideal when the fluid flows in an upward direction. Installations in drop lines, i.e., the fluid flows from the top to the bottom are to be avoided because experience has shown that it is not possible to guarantee that the pipeline will always remain 100% full and that an equilibrium condition between the upward flowing gas and the downward flowing fluid will not occur.

Generally, the flowmeter primary should be installed in the pipeline with the cable connectors pointing downward. If the flow direction with this arrangement does not agree with the flow direction indicated by the arrow on the flowmeter primary, the procedures described in Section Preliminary Checks should be employed.

! Comments

- The figures for the EMF flanged designs shown in Section Installation Requirements Flowmeter Primary also apply to the other process connection types e.g. Wafer Design, aseptic connections, 1/8“sanitary connections, hose connectors, Tri-Clamp, screwed flanges and others.

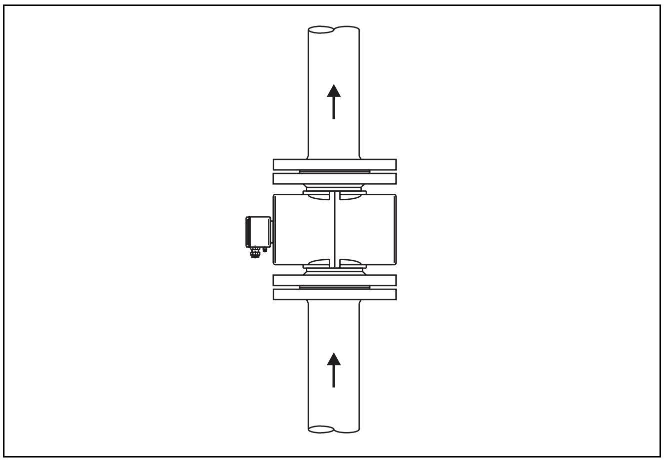


Fig. 3

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

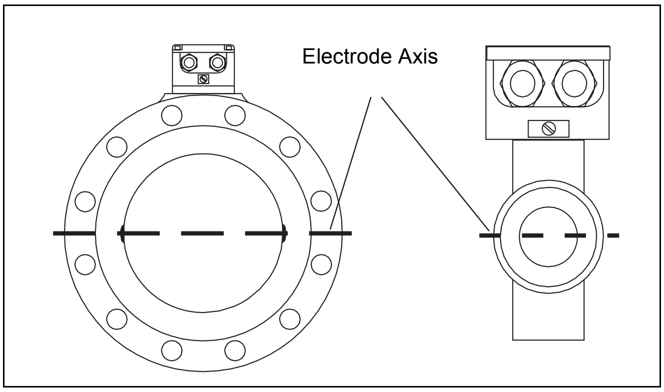


Fig. 4

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

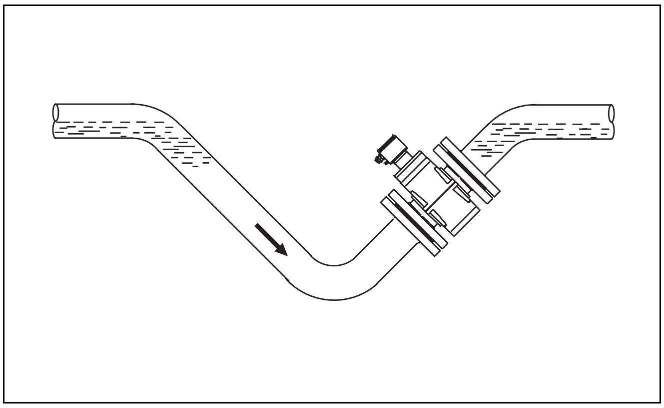


Fig. 5

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

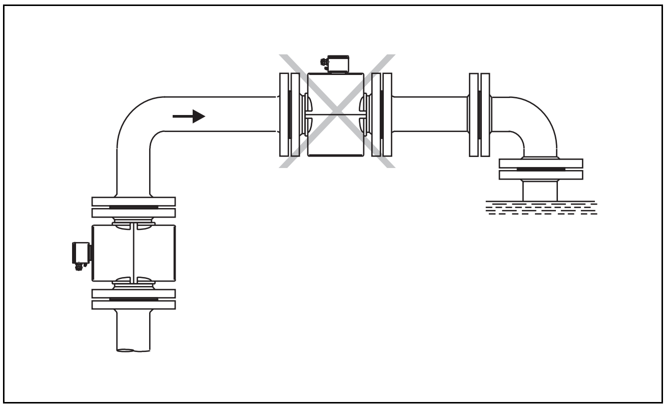


Fig. 6

The measurement principle is independent of flow profile as long as standing eddies do not extend into the measurement section (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 is sufficient (D = flowmeter primary size Fig. 7). The reference conditions for test stands, per DIN 19200, require a straight upstream length of 10 x D and a 5 x D straight length downstream. For Volume Flow Integrators additional installation requirements are mandatory. See Installation of the Certified Designs Section 4.2.5 on Page 9.

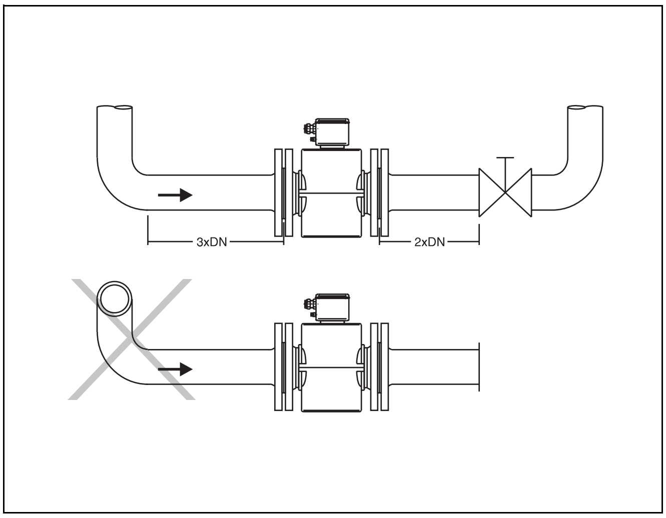


Fig. 7

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

An automatic empty pipe detector option is available in the converter which uses the existing electrodes for its input.

For heavily contaminated fluids a bypass line as shown in Fig. 8 , Design A is recommended, so that the flowmeter may be mechanically cleaned without shutting down the process.

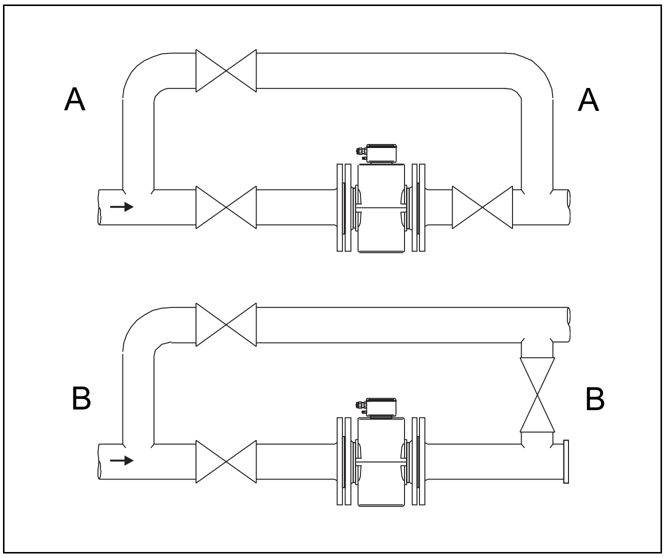


Fig. 8

When it is anticipated that the electrodes may become coated with an insulating layer, a bypass line as shown in Fig. 8 , Design B, should be installed. For flowmeter primaries installed in the vicinity of pumps or other vibrating equipment the utilization of mechanical dampers is advantageous (Fig. 9).

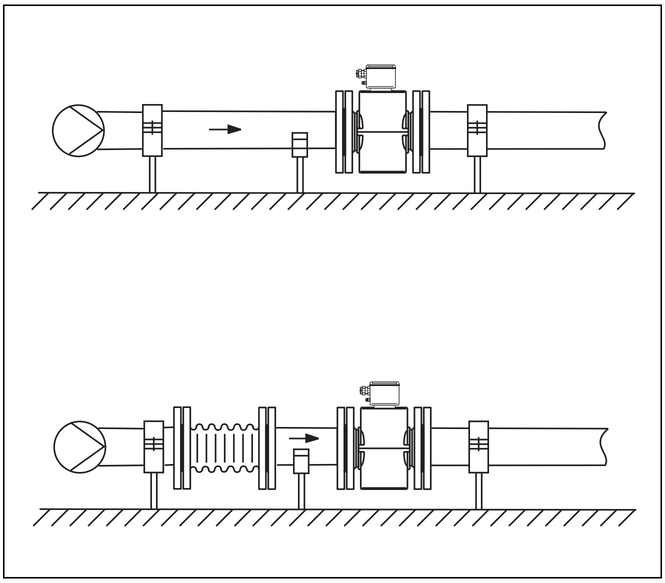


Fig. 9

Flowmeter Primary, Model DS21_/DS4_F

4.2.1 Installation of the Flowmeter Primary

The electromagnetic flowmeter can be installed at any arbitrary location in the pipeline as long as the installation requirements (Page 4) are satisfied. Installation dimensions may be found in the appropriate Specification Sheet. At the same time, care should be exercised when selecting the installation site to assure that moisture cannot enter into the connection area. Exercise care to assure that the housing cover gaskets are correctly seated when installing the covers after the installation and start-up have been completed.

Electrode Axis

For installations in horizontal pipelines make sure that neither electrode is located at the highest point. Any gas or air bubbles which may be present in the fluid could interrupt the electrical connection between the electrodes and the fluid. The ideal installation conditions for an EMF are assured in a vertical installation. The preferred orientations are shown in Fig. 10 .

Gaskets

It is essential to use the gaskets which are included with the flowmeter primary shipment. Only when these gaskets are used and the flowmeter primary has been installed correctly can leaks be avoided. Observe the information in Table 1.

Wafer Design flowmeter primaries with are shipped without gaskets. The installation (axisymmetric and parallel) is made directly into the pipeline without gaskets. Only when a grounding plate is installed is an additional gasket required (grounding plate / pipeline flange). See Table 3 for torque specifications.

For all other flanged flowmeter primary designs commercially available gaskets are to used made of materials compatible with the fluid being metered and suitable for the operating temperatures (rubber, It, PTFE, etc.). See Tables 2 and 3 for torque specifications.

! Note:

- Graphite should not be used to lubricate the flange or process connection gaskets because an electrically conductive coating could form on the inside surface of the meter tube adversely affecting operation.
  The flowmeter primary should not be installed in close proximity to strong electromagnetic fields. Steel parts (e.g. mounting brackets should be spaced at least 100 mm distant from the flowmeter primary). Vacuum shocks should be avoided to prevent damage to the liner.

Comment:
A vacuum resistant liner is available in the program.

FILL-MAG Flowmeter Primary Installation

Generally, the flowmeter primary should be installed in the pipeline with the cable connectors pointing downward.

If the flow direction with this arrangement does not agree with the flow direction indicated by the arrow on the flowmeter primary the following procedure can be employed so that the contact outputs respond correctly for reverse flow conditions.

Steps to reverse the direction indication:

a) For a Standard- and Ex-flowmeter primaries the shielded signal leads (only at the primary) are to be interchanged.
Interchange terminal 1 with terminal 2.
Interchange terminal 1S with terminal 2S.

b) For flowmeter primaries with preamplifiers only terminals 1 and 2 (at the flowmeter primary) are to be interchanged because terminals 1S and 2S are used for the preamplifier supply voltage U+ and U- of ±12 V DC.

Control, Signal and Supply Voltage Cables

! Note:

- The flowmeter primary should not be installed in close proximity to strong electromagnetic fields. It is recommended that the control-, signal- and supply power cables be routed separate from one another. It is advantageous to install the cables in grounded metal conduits. Multiple cables of the same type may be installed in the same conduit.

Any valves or relays used in the system should incorporate appropriate measures to reduce interference signals such as protection diodes, varistors or R-C combinations (VDE 0580)

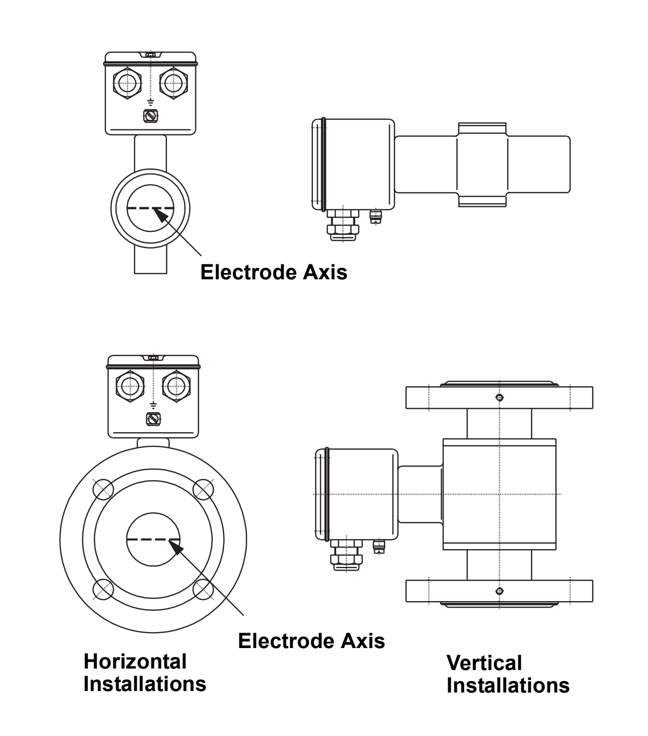
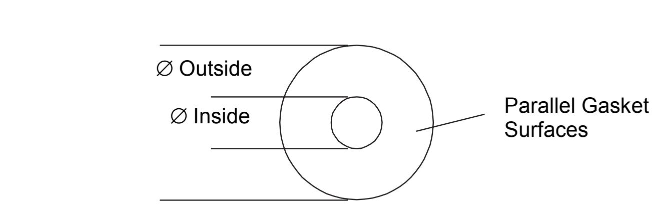


Fig. 10

Gasket Surfaces on the Mating Flanges

In all installations parallel mating flange surfaces should be provided and suitable gaskets used. Only then can leaks be avoided. The flange gaskets for the flowmeter primary must be installed concentrically to achieve optimum measurement results. The parallel gasket surface requirements for the mating flanges are:



Flowmeter Primary Inch	DN	Required Parallel Gasket Surface Ø Inside mm	Ø Outside mm
1/10 – 1/4	3 – 6	8	21.5
3/8	10	14	35
1/2	15	18	35
3/4	20	22	44
1	25	29	52
1-1/4	32	37	61
1-1/2	40	43	71
2	50	52	91
2-1/2	65	71	107
3	80	81	124
4	100	100	149

Table 1

Protection Plates

The protection plates for the PTFE/PFA/ETFE lined flowmeter primaries have been installed to prevent damage to the liner during shipment. Remove these protection plates only when ready to install the meter in the pipeline. Be careful not to cut or otherwise damage the liner in order to prevent leakage. The Dimension Drawings for your instrument design may be found in the Specification Sheet.

Torque Specifications for Flanges

The mounting bolts are to be tightened equally in the usual manner without excessive one-sided tightening. We recommend that the bolts be greased prior to tightening and that they be tightened using a wrench with a normal length, in a crisscross pattern as shown in Fig. 11 . Tighten the bolts during the first pass to approx. 50%, during the second pass to approx. 80% and only during the third pass to 100% of the max. torque value. The max. torque values should not be exceeded, see the following tables.

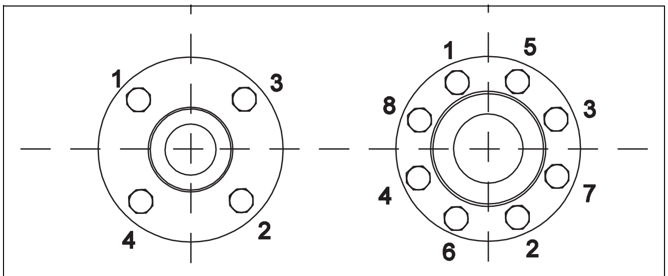


Fig. 11

Torque Specifications

Liner	Meter Size Inch	DN	Process Connection	Bolts	Torque Max. NM	PN bar
PFA/	1/10-3/8	3-10	Flanges,	4 x M12	8	40
PTFE/	1/2	15	Wafer	4 x M12	10	40
Hard	3/4	20	Design	4 x M12	16	40
Rubber	1	25		4 x M12	21	40
(≥ 1/2”:	1-1/4	32		4 x M16	34	40
DN 15)	1-1/2	40		4 x M16	43	40
ETFE	2	50		4 x M16	56	40
(≥ 1”:	2-1/2	65		8 x M16	39	40
DN 25)	3	80		8 x M16	49	40
PFA	4	100	Flanges	8 x M16	47	16
≥ 10”:	5	125	Wafer	8 x M16	62	16
DN 250	6	150	Design,	8 x M20	83	16
PTFE/	8	200	≤4”:DN100	12 x M20	81	16
Hard Rbr	10	250		12 x M24	120	16
ETFE	12	300		12 x M24	160	16
≤ 12”:	14	350		16 x M24	195	16
DN 300	16	400		16 x M27	250	16
PTFE	20	500	Flanges	20 x M24	200	10
≥ 32”:	24	600		20 x M27	260	10
DN 800	28	700		24 x M27	300	10
Hard	32	800		24 x M30	390	10
Rubber	36	900		28 x M30	385	10
	40	1000		28 x M33	480	10
	48	1200		32 x M36	640	10
	54	1400		36 x M39	750	10
	64	1600		40 x M45	1050	10
	72	1800		44 x M45	1100	10
	78	2000		48 x M45	1200	10
Hard	48	1200	Flanges	32 x M30	365	6
Rubber	54	1400		36 x M33	480	6
	64	1600		40 x M33	500	6
	72	1800		44 x M36	620	6
	78	2000		48 x M39	725	6

Table 2

Max. Torque Values for PTFE-Envelope Gaskets

Liner	Meter Size Inch	DN	Process Connection	Bolts	Torque Max. NM	PN bar
PFA	1/10-5/16	3-8	Wafer Design Variable Connections	4 x M12	2.3	40
PFA	3/8	10	Variable Connections Wafer Design	4 x M12	7.0	40
	1/2	15		4 x M12	7.0	40
	3/4	20		4 x M12	11.0	40
	1	25		4 x M12	15.0	40
	1-1/4	32		4 x M16	26.0	40
	1-1/2	40		4 x M16	33.0	40
	2	50		4 x M16	46.0	40
	2-1/2	65		8 x M16	30.0	40
	3	80		8 x M16	40.0	40
	4	100		8 x M20	67.0	40

Table 3

4.2.2 Installations for Protection Class IP 68

For flowmeter primaries for Protection Class IP 68 the maximum permanent submerged depth is 5 m. In place of the standard cable connectors, hose enclosed Pg-cable connectors are utilized. The cable is installed inside a 1/2” hose from connection box to the maximum water surface height. Above this level the cable is installed in a watertight cable connector included with the shipment. The 1/2” hose is then sealed and secured to the hose connectors using threaded hose clamps. After the installation has been completed the connection box cover must be carefully reinstalled.

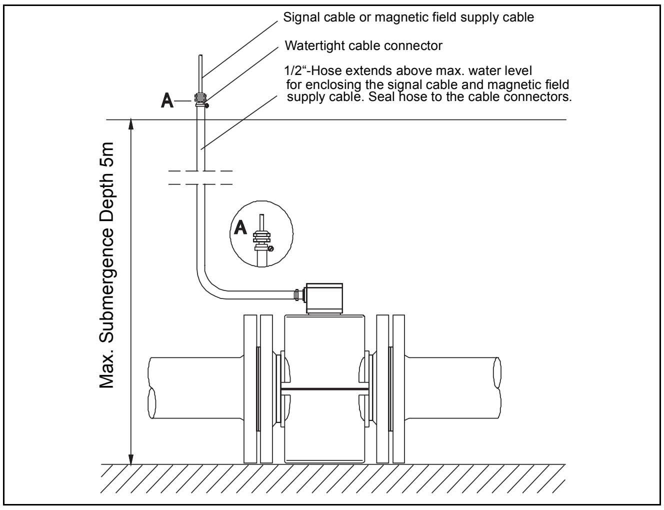


Fig. 12 Installation IP 68 (Hose Connections)

4.2.3 Installation of the High Temperature Design

Please see the Installation Notes in Sections 4.2 and 4.2.1 .

The connection box in the high temperature design for fluid temperatures <180 °C, is spaced away from the lower section of the flowmeter primary by a pipe nipple. This provides thermal insulation between the connection box and the lower section of the flowmeter primary. The insulation for the pipeline and the flowmeter primary should be installed as shown in Fig. 13 .

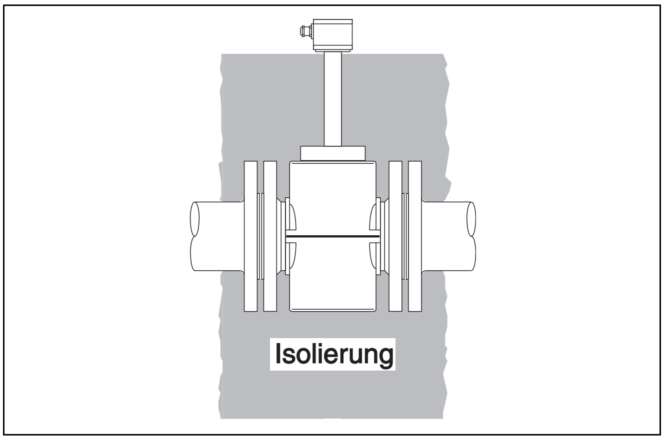


Fig. 13 Insulated Pipeline

4.2.4 Installation in Larger Size Pipelines

The flowmeter can readily be installed in larger size pipelines through utilization of flanged transition sections (e.g. Flanged Reducers per DIN 28545).The pressure drop resulting from the reduction can be determined from Diagram 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:

   $$v = \frac{Q \text{ (Instantaneous Flowrate)}}{\text{Primary Constant}}$$

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

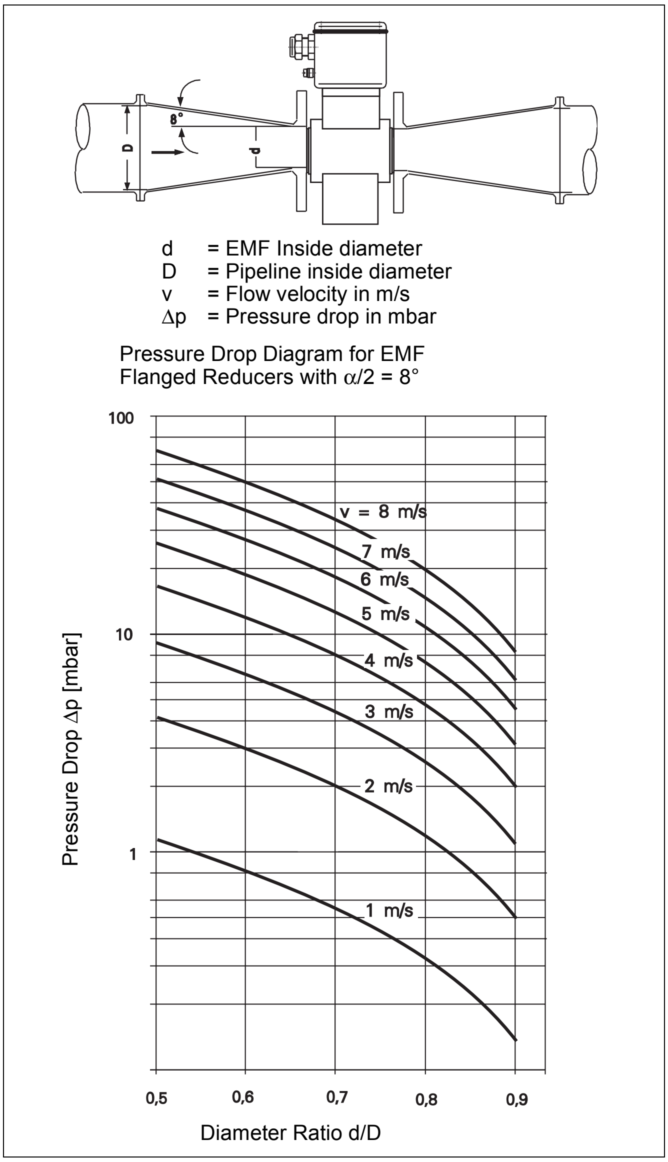


Fig. 14 Pressure Drop Nomograph

4.2.5 Installation of the Certified Designs

Essentially the installation requirements described in the Section Installation Requirements Flowmeter Primary also apply to the flowmeters certified for custody transfer. There are some additional requirements which must be observed that are listed in the Certification for Electromagnetic Volume Flow Integrators certified for intrastate custody transfer.

The instrument design "Electromagnetic Volume Flow Integrator with Electrical Counter" has been approved by the Physikalisch-Technischen Bundesanstalt [National Institute of Science and Technology] in Braunschweig, Germany for intrastate custody transfer. For the Volume Flow Integrator MAG-SM, consisting of a flowmeter primary and a converter, the following approvals have been granted.

5.721 / 86.02 — Electromagnetic Volume Flow Integrator with Electrical Counter for filling **Beer** Kegs

5.721 / 87.05 — Electromagnetic Volume Flow Integrator with Electrical Counter for **Liquids, other than Water (Milk, Beverage Concentrates or Syrups, Beer, Wort, Brine)**. The approval also applies to chemical liquids.

For the Electromagnetic Volume Flow Integrators with Electrical Counters with approval 5.721/87.05 Liquids other than Water, the Certification Regulation (EO) of 15 Jan. 1975 also applies, which was subsequently revised by the 6th Revision to the Certification Regulation of 08 Mar 1985 (BGBI IS.568), and specifically the "General Requirements" (EO AV) with Appendix 5 (EO 5) "Measurement Instruments for Determining the Volume or Mass of Flowing Fluids other than Water", Section 2, Part 1.

Approved Flowmeter Sizes for "Liquids other than Water"

Flowmeter Sizes and Maximum Approved Flowrates						
Inch	DN	Q_{max} Liter/min.				
1	25	selectable from	60 to	200	in steps of	10
1-1/4	32	selectable from	100 to	400	in steps of	10
1-1/2	40	selectable from	150 to	750	in steps of	50
2	50	selectable from	250 to	1000	in steps of	50
2-1/2	65	selectable from	400 to	2000	in steps of	100
3	80	selectable from	700 to	3000	in steps of	100
4	100	selectable from	900 to	4500	in steps of	100
6	150	selectable from	2000 to	10000	in steps of	500

Meter Size		Minimum Metered Flowrates	Fluids
Inch	DN	Liter/min.	Liquids other than Water, also Chemical Liquids - Examples:
1	25	2	Milk, Beverage Concentrate
		20	Beer
1-1/4	32	5	Beer, Milk
1-1/2	40	20	Beer, Milk
2	50	200	Beer, Wort
2-1/2	65	500	Beer, Wort, Milk
3	80	500	Beer, Wort, Milk
4	100	2000	Wort, Brine
6	150	2000	Brine

Min. flow range 2.5 m/s. Max. Flow Range10 m/s.

Note:

- The flow ranges are to be selected as prescribed in the above tables. Subsequent flow range changes require a recalibration on a certified test stand.

  Please specify the desired flow range in your order based on the specification in the above tables. Consideration should be given to the maximum flowrate for the particular size as well as to the prescribed flow range steps.

  Example: 1" : DN 25; minimum selectable flow range Qmax = 60 l/min; any flow range can be set between 60 l/min and 200 l/min in steps of 10 l/min.

Calibration

The calibrations of the Electromagnetic Volume Flow Integrator are carried out in the ABB test stands in Goettingen, Germany which have been approved for certified calibrations. After the calibration has been completed those parameters which impact the certification may only be changed in the presence of a Certification Official.

Accessories

Additional instruments such as volume flowrate indicators, recorders or controllers as well as approved printers, flow controllers or remote totalizers may be connected to the Volume Flow Integrator.

Printers, flow controllers and remote totalizers, when required, must be connected to the Volume Flow Integrator during its calibration.

Installation Requirements

Up- and downstream of the flowmeter primary straight pipe sections are to be installed with the same inside diameter as the inlet opening of the flowmeter. Upstream of the flowmeter primary the length must be at least 10 times the diameter of the flowmeter primary and the downstream length must be at least 5 times the diameter of the flowmeter primary, see Fig. 15 .

The flowmeter primary must always be completely filled with fluid.

The distance (signal cable length) between the flowmeter primary and the converter may not exceed 50 m.

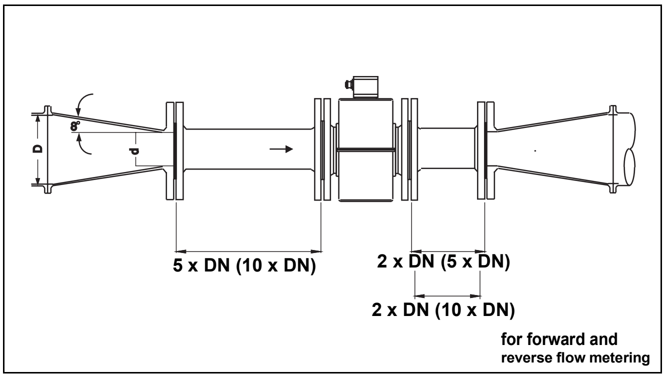


Fig. 15

KEG-Filling with the FILL-MAG System

Four keg sizes with their corresponding beer volumes can be entered and selected using the external contacts (e.g. optical beer keg size recognition). The corresponding anticipatory contact can also be individually set. The automatic overflow correction continuously reflects the current operating conditions.

When underfills occur the Fill-MAG checks if the fill volume is within the certified error limits and announces the error. The same applies to overfills. The coupling of the control technology and the integration of the Fill-MAG in the fill system is accomplished in cooperation with the equipment manufacturer.

Contact Outputs

Anticipatory Contact
E.g. 27 Liter (for 30 l KEG)
E.g. 47 Liter (for 50 l KEG)

End Contact
E.g. 30 Liter
E.g. 50 Liter

Control Inputs

! Note :

- To provide galvanic isolation the control inputs are designed as optocoupler inputs. The various input functions require a 24 V DC voltage supply which is to be provided by the customer.

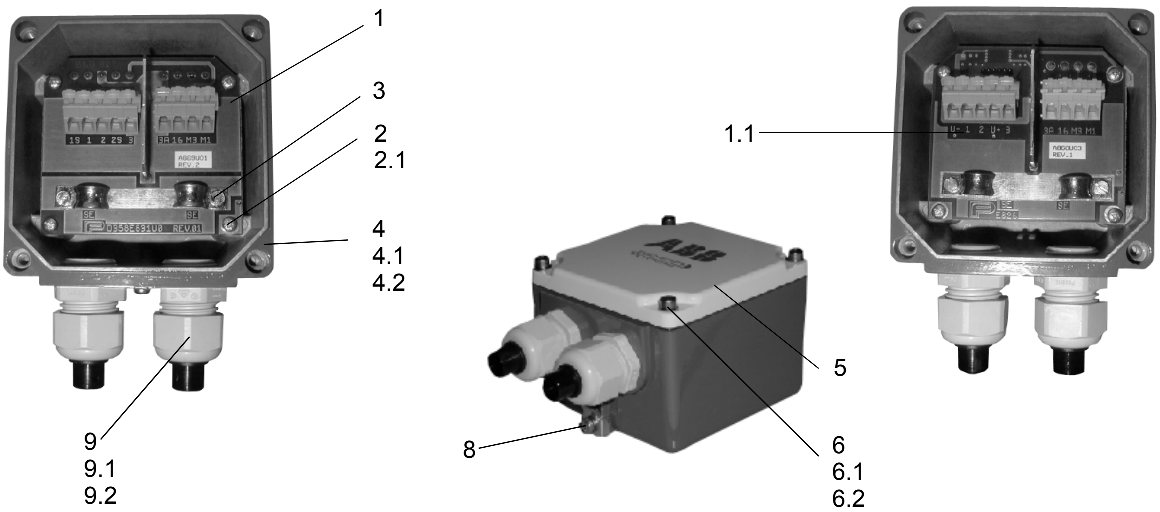
Fill (Batch) Start (Terminals G2, 68)
The fill or batch cycle is initiated by an ext. Start pulse (e.g. from a SPC).

Fill (Batch) Stop (Terminals G2, 69)
The fill or batch cycle is terminated by an ext. Stop contact.

External Fill Volume Selection (Terminals G2, A1,A2)
a) from a switch
b) from a keg size recognition device[1)]

[1)] For ext. keg size recognition a separate override switch must be included for filling a Certified-KEG (30 Liter), because its size is equivalent to a 50 Liter KEG.

4.3 Replaceable Parts List, Connection Box, Aluminum Housing ≤ 12" / DN 300



Item No.	Description	Part No.
1	Connection board, standard 3/4" - 12" : DN 20 - 300 Connection board, standard 1/10" - 1/2" : DN 3 - 15	D685 A869U01 D685 A869U03
1.1	Connection board, preamplifier 3/4" - 12" : DN 20 - 300 Connection board, preamplifier 1/10" - 1/2" : DN 3 - 15	D685 A868U03 D685 A868U05
2	Sheet metal screw 2.9 x 6.5 DIN 7981	D055E106CZ01
2.1	Serrated washer A 3.2 DIN 6798	D085G017AU32
3	Slotted cheese head screw M§ x 8 DIN 84	D002F107AU20
4	Lower section with cable connector M20 x 1.5	D612A153U01
4.1	Lower section with cable connector Pg 13.5	D612A153U02
4.2	Lower section with cable connector, hose Pg 13.5 and IP 68	D612A153U18
5	Cover complete.	D612A152U01
6	Cap screw, hex socket head M 4 x 18 DIN 912	D009G113AU20
6.1	Flat washer B 4.3 DIN 125	D085A021BU20
6.2	Security ring	D160A001U25
7	Cover gasket	D333F022U01
8	Ground accessories	D614L607U01
9	Cable connector M20 x 1.5	D150A008U15
9.1	Cable connector Pg 13.5	D150A008U02
9.2	Cable connector, hose Pg 13.5 and IP 68	D150A006U02
9.2.1	Hose nipple IP 68 Stn Stl	D365A027U01
9.2.2	Screw hose clamp SGL 12 - 20 Stn Stl	1D108D1016
9.2.3	PE - hose 5/8" 16 x 13 mm, black UV-resistant	D109A001U07
9.2.4	Hose nipple IP 68 Stn Stl for the Pg at the end of the cable	D365A020U01

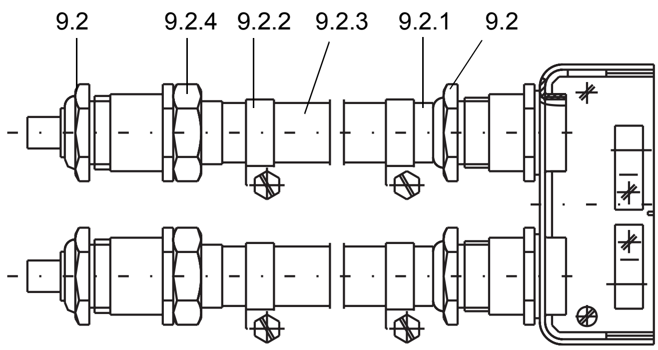
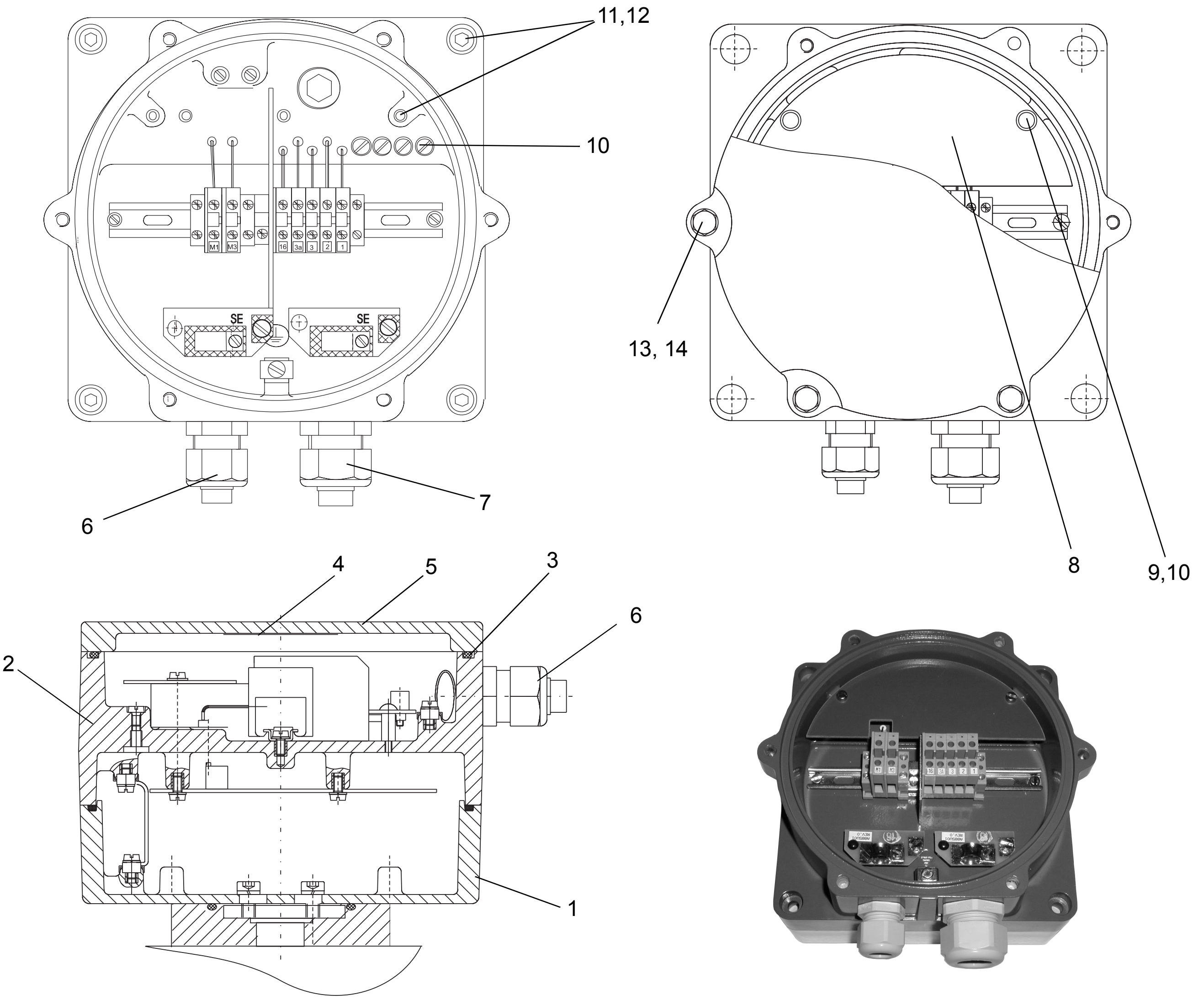


Fig. 16

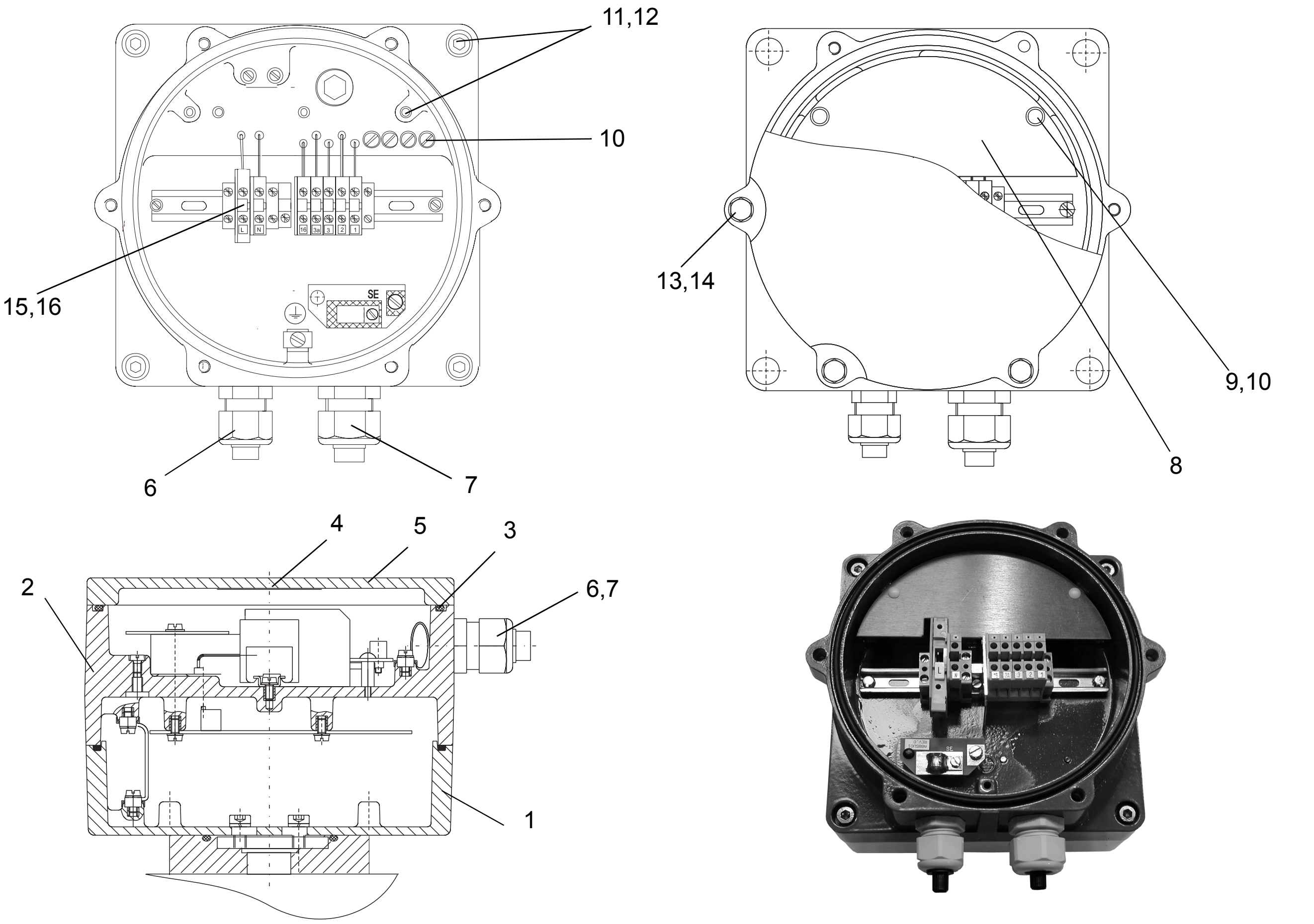
4.4 Replaceable Parts List, Connection Box, Aluminum, Flowmeter Primary 14” - 16” : DN 350 - 400



Item No.	Description	Part No.
1	Lower section	D323D550U01
2	Center section	D674A613U02
3	O-Ring	D101A019U01
4	Interconnection Diagram	D338C499U01
5	Cover	D612A126U02
6	Cable connector	D150A008U02
7	Cable connector	D150A008U08
8	Cover plate	D351A025U01
9	Spring washer M4.0 DIN 137	D085D020AU20
10	Slotted cheese head screw M4.0 x 6 DIN 84	D002G106AU20
11	Lock washer M6.0 x DIN 7980	D085L026ZU20
12	Cap screw, hex socket head M6.0 x 30 DIN 912	D009J118AU20
13	Lock washer M 6.0 DIN 7980	D085L026ZU20
14	Slotted cheese head screw M6.0 x 25 DIN 7964	D024J116AU20

Fig. 17

4.5 Replaceable Parts List, Connection Box, Aluminum, Flowmeter Primary ≥ 20” : DN 500



Item No.	Description	Part No.
1	Lower section	D323D550U01
2	Center section	D674A613U02
3	O-Ring	D101A019U01
4	Interconnection Diagram	D338C499U01
5	Cover	D612A126U02
6	Cable connector	D150A008U02
7	Cable connector	D150A008U08
8	Cover plate	D351A025U01
9	Spring washer M4.0 DIN 137	D085D020AU20
10	Slotted cheese head screw M4.0 x 6 DIN 84	D002G106AU20
11	Lock washer M 6.0 x DIN 7980	D085L026ZU20
12	Cap screw, hex socket head M6.0 x 30 DIN 912	D009J118AU20
13	Lock washer M6.0 DIN 7980	D085L026ZU20
14	Slotted cheese head screw M6.0 x 25 DIN 7964	D024J116AU20
15 (230 V)	Fuse 5 x 20 MM 0.160 A-slow blow	D151B001U09
16 (230 V)	Fuse identification tag	1D338C1201
15 (115 V)	Fuse 5 x 20 MM 0.315 A-slow blow	D151B001U01
16 (115 V)	Fuse identification tag	1D338C1195

Fig. 18

4.6 Replaceable Parts, Flowmeter Primary

When repairs to the liner, electrodes or magnet coils are required, the flowmeter primary must be returned to the ABB Factory in Göttingen, Germany. Please note the information in the “Introductory Safety Notes for the EMF System”

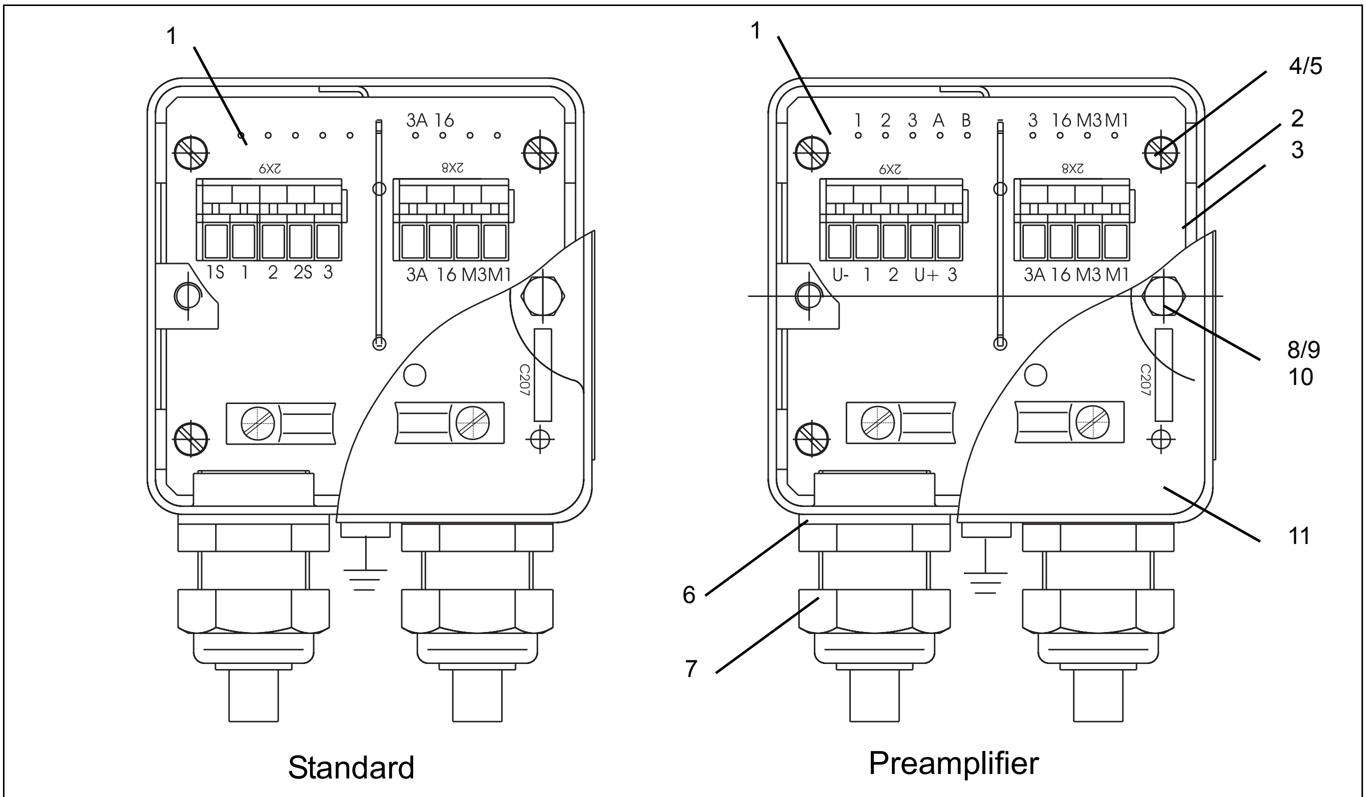


Fig. 19 Connection Box, Stainless Steel

Replaceable Parts, Connection Box, Stainless Steel Flowmeter Primary ≤ 4” : DN100

Item No.	Description	Part No.
1 1	Connection board standard Connection board with preamplifier	D685A869U01 D685A698U03
2	Lower section SS 304 / No. 1.4301 Models 10DS2111/2112, DS21_ Model 10DS3112 1/10” - 1/2” : DN 3-15 Model 10DS3112 /34” - 1-1/2” : DN 20-40 Model 10DS3111	 D612A128U01 D612A128U03 D612A128U04 D612A128U05
3 4 5	Gasket (conductive) Phillister head screw M3 x 6 DIN 7985 Serrated washer A3.2 DIN 6798	D333F016U01 D004F106AU20 D085G017AU32
6 7 8	Connection thread gasket ring PE Pg 13.5 Cable connector Pg 13.5 plastic gray Spacer	D150Z007U06 D150A008U02 D375A018U01
9 10 11 12	Machine screw, hex hd M4 x 14 DIN 7964 SS Washer “Nyltite-Siegel“ F.M4 Cover SS 304 / No. 1.4301 Interconnection Diagram Std.	D024G110AU20 D115B004U01 D612A127U01 D338D293U01

IP 68 design upon request

4.7 Replaceable Parts List with Preamplifier

Flowmeter primary for metering fluids with a conductivity from 0.5 µS/cm.

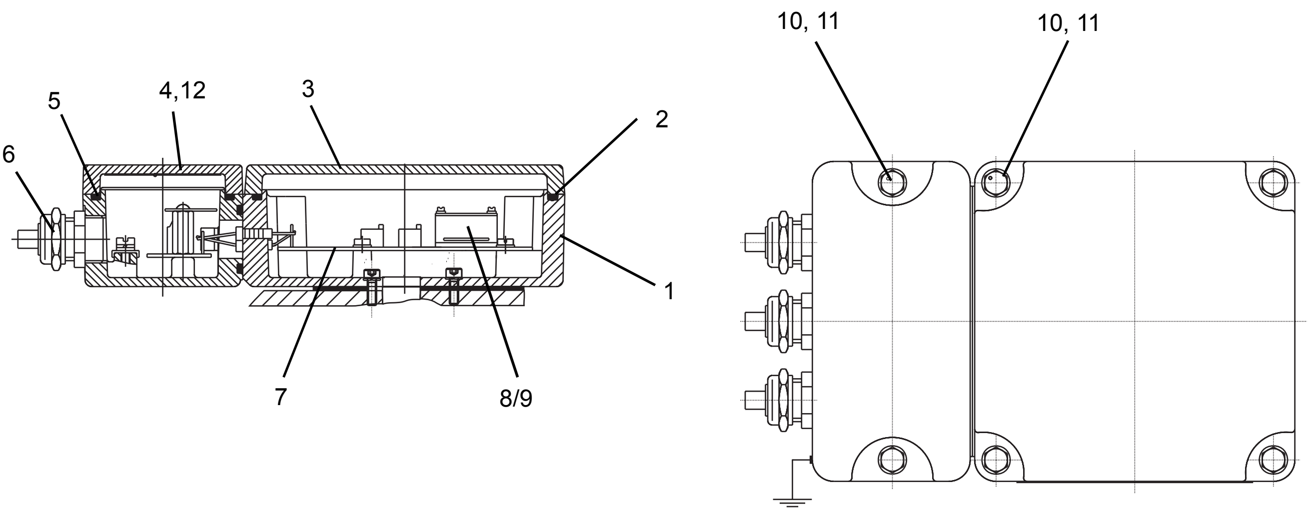


Fig. 20 Connection Box and Electronic Area

Replaceable Parts

Item No.	Description	Part No.
1	Lower section with connection box	D612A111U01
2	O-Ring	D101A009U01
3	Cover, large	D612A182U01
4	Cover, small	D379D024U02
5	Gasket	D333F004U01
6	Cable connector M20 x 1.5	D150A008U15
7	Preamplifier board	D685A442U02
8	Preamplifier input	D685A859U03
9	Cover	D379B037U01
10	Hex head screw M6 x 16 DIN 33 Stn Stl	D022J112AU20
11	Spring washer DIN 137 Stn Stl	D085D026AU20
12	Interconnection Diagram	D338C330U01

5. Safety Relevant Section of the Instruction Bulletin

5.1 Electrical Connections Anschluss

5.1.1 Grounding

The grounding procedure described is to be observed. According to VDE 0100, Part 540 a Cu-wire with a cross section of at least 4 mm^2 is to be connected between the ground screw on the flowmeter primary (on the flange or the housing) and ground. For measurement reasons the ground potential should be identical to the pipeline potential if possible. An additional ground connection at the terminals is not required.

When installed in plastic or lined insulating pipelines the connections to ground are made from a grounding plate or grounding electrode. If there are stray potentials in the fluid the installation of a grounding plate on both sides of the flowmeter primary is recommended.

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

! Note:

- The ground screw in flowmeter primaries Model DS21_ is located on the lower section of the connection box. For instrument designs with aseptic connectors, Tri-Clamp and hose connectors the meter tube is in electrical contact with the fluid. It is only necessary to connect the ground connection on the flowmeter primary to ground, see Fig. 32 and Fig. 33 .

a) Metal pipe with fixed flanges

1) Drill blind holes in the flanges on the pipeline (18 mm deep).

2) Tap 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 4 mm^2 CU wire between the ground connection on the flowmeter primary and a good ground.

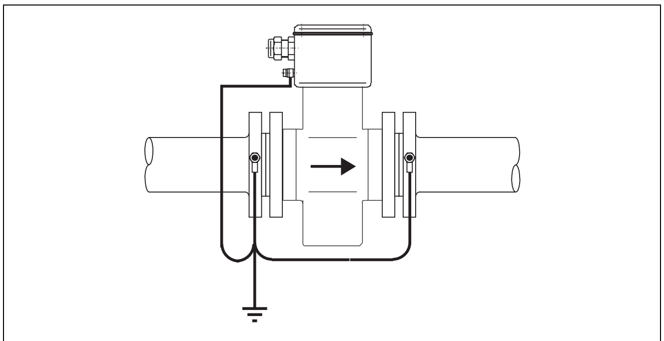


Fig. 21 Flowmeter Primary 1/10” – 1-1/2” : DN 3 – 40, Flanged

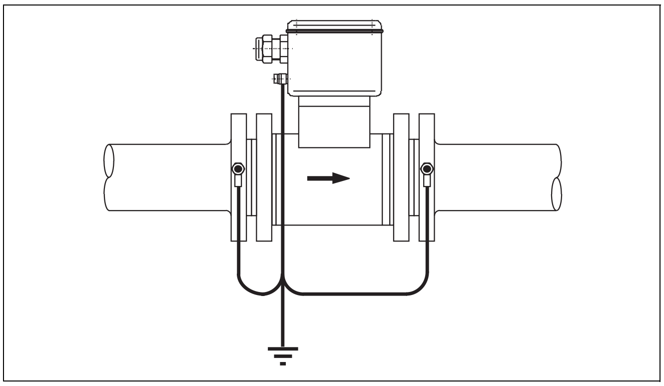


Fig. 22 Flowmeter Primary 2” – 4” : DN 50 – 100, Wafer Design

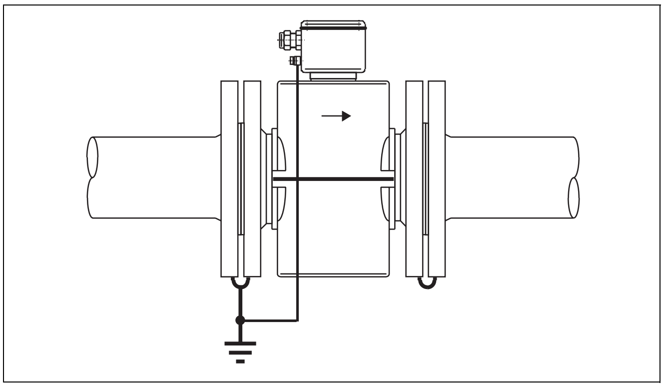


Fig. 23 Flowmeter Primary 3/8”-12” : DN10 - 300, Two Piece Housing and Flanged

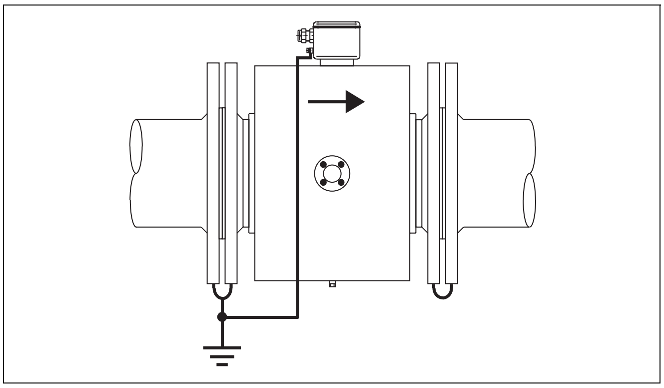


Fig. 24 Flowmeter Primary from 14“ : DN 350, Welded Steel Design

b) Metal Pipe 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, M6 threaded studs should be welded to directly to the pipeline.

2) Attach the ground strap to the flange using a nut, spring washer and flat washer and connect to the ground connection on the flowmeter primary.

3) Connect a 4.0 mm^2 CU wire between the ground connection on the flowmeter primary and a good ground.

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 the ground strap.

3) Connect a 4.0 mm^2 CU wire between the ground connection on the flowmeter primary and a good ground.

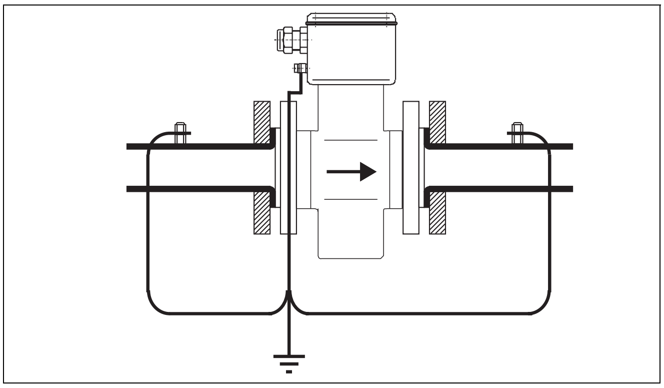


Fig. 25 Flowmeter Primary 1/10" - 1-1/2" : DN 3 - 40, Screwed Flanges

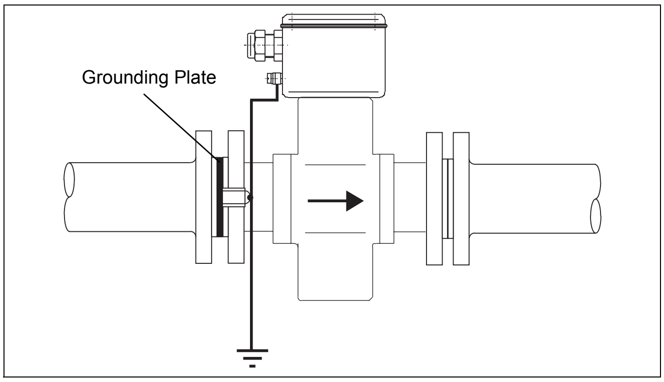


Fig. 28 Flowmeter Primary 1/10" – 1-1/2" :DN 3 – 40, Flanged

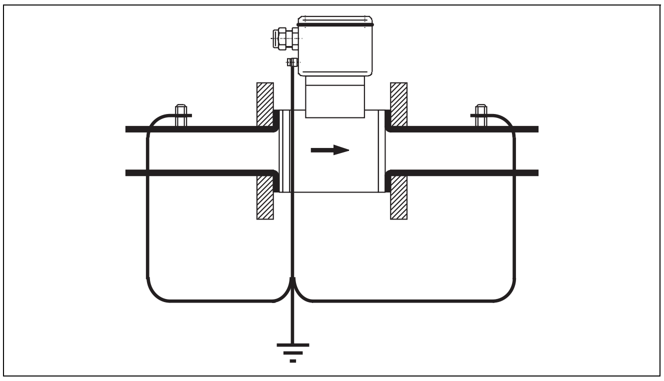


Fig. 26 Flowmeter Primary 2" – 4" : DN 50 – 100, Wafer Design

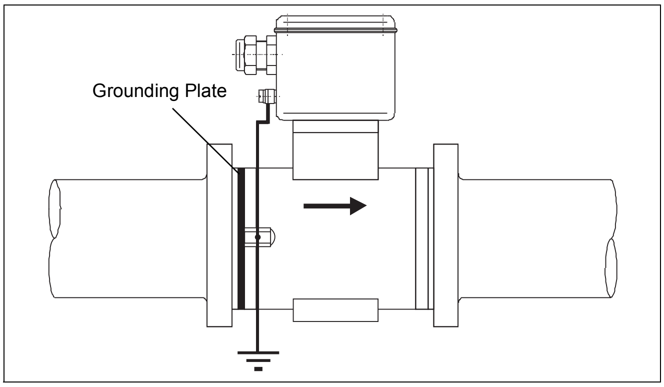


Fig. 29 Flowmeter Primary 2" – 4" : DN 50 – 100, Wafer Design

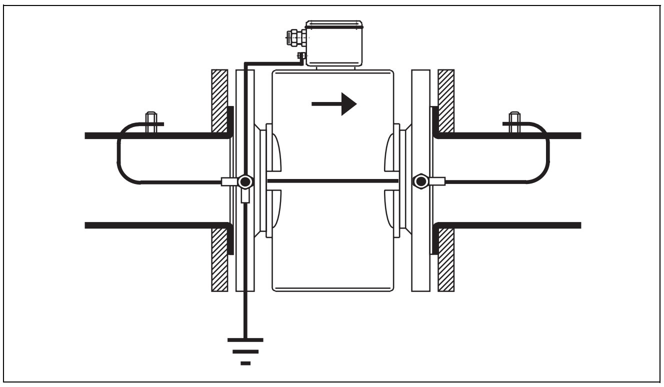


Fig. 27 Flowmeter Primary 3/8" – 12" : DN 10 – 300, Two Piece Housing and Flanges

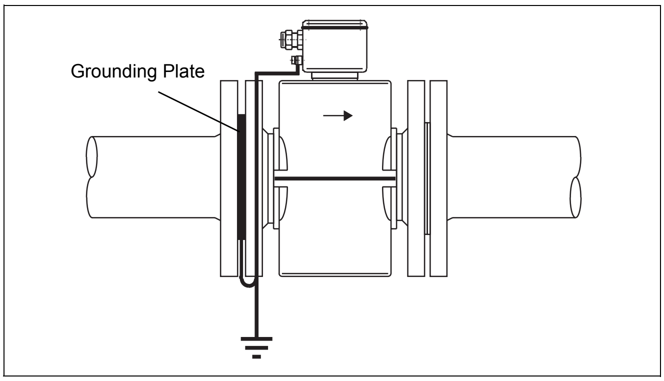


Fig. 30 Flowmeter Primary 3/8" – 12" : DN 10 – 300, Two Piece Housing and Flanged

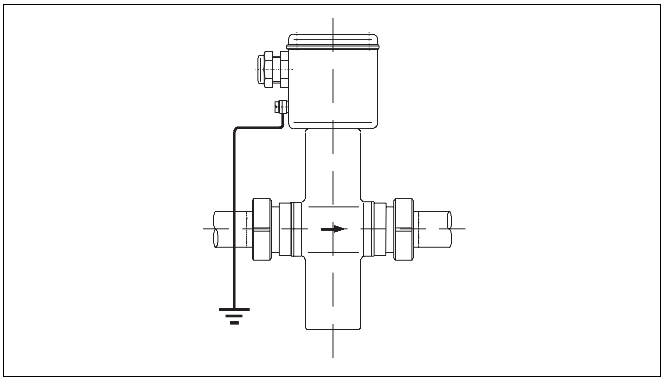


Fig. 32 Flowmeter Primary 1/10” - 4” :DN 3 -100,
Aseptic Pipe Connections

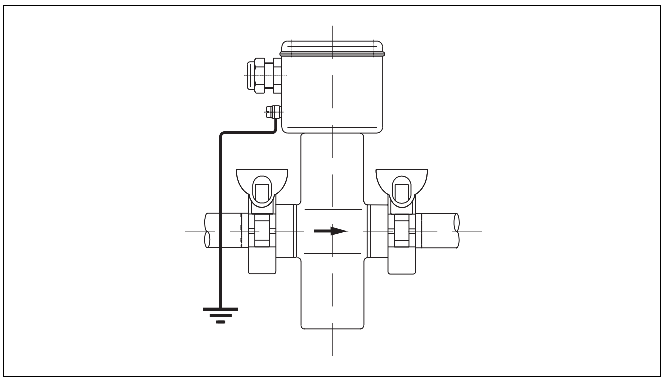


Fig. 33 Flowmeter Primary 1/10”- 2-1/2” : DN 3- 65,
Tri-Clamp Connections

5.1.2 Supply Power Connections

The supply power is connected in accord with the specifications on the Instrument Tag to terminals L (phase) and N (Neutral), L+ and L-, or 1L1 and 1L2 at the flowmeter converter over a main fuse and a main switch.

The Electromagnetic Flowmeter Primary is connected to the converter using a signal/reference voltage and a supply cable. For detailed interconnection cabling information see the appropriate Instruction Bulletin for the converter.

5.1.3 Magnet Coil Supply

The type of supply power to the magnet coils is a function of the size of the flowmeter primary. The appropriate Interconnection Diagram should be used!

Flowmeter Primary 1/25” to 16” : DN 1 to 400:

The supply power for the magnet coils is provided by the converter directly over terminals M1, M3 with a cable, e.g. shielded 2 x 1.5 mm^2 .

Flowmeter Primary 20” to 40” : DN 500 to 1000:

The magnet coils are supplied directly from the line and not from the converter. It is essential that both the flowmeter primary and the converter be supplied from the same main fuse and main switch.

5.1.4 Power Consumption

The values for the supply voltage and current are specified on the instrument tag on the flowmeter primary. The cable cross section and the fuse rating must be compatible (VDE 0100). The power is ≤ 30 VA (flowmeter primary including the converter).

5.1.5 Signal Cable Connections

! Warning:

The signal cable connections vary with the size of the flowmeter primary. The appropriate Interconnection Diagram should be used!

The signal cable conducts signals of only a few millivolts and should therefore be installed using the shortest path. 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. The signal cable should not be fed through branch fittings or terminals strips.

The maximum allowable signal cable length is 50 m for designs without a preamplifier, Ex-Instruments and certified Volume Flow Integrators. If a preamplifier is installed in the flowmeter primary for low conductivity metering, the maximum signal cable length limit is increased to 200m. A shielded reference voltage cable is located parallel to the signal leads in the cable assembly so that only two cables (a signal/reference voltage cable and a supply cable for the magnet coils) are required between the flowmeter primary and the converter. The signal cable is designed with a woven copper shield (common potential) which surrounds the individually shielded signal leads and the shielded reference voltage leads. The signal lead shields serve as “Driven Shields” for the flow signal transmission.

To shield against magnetic pickup the cable incorporates an outer steel shield which is to be connected to the SE Terminals.

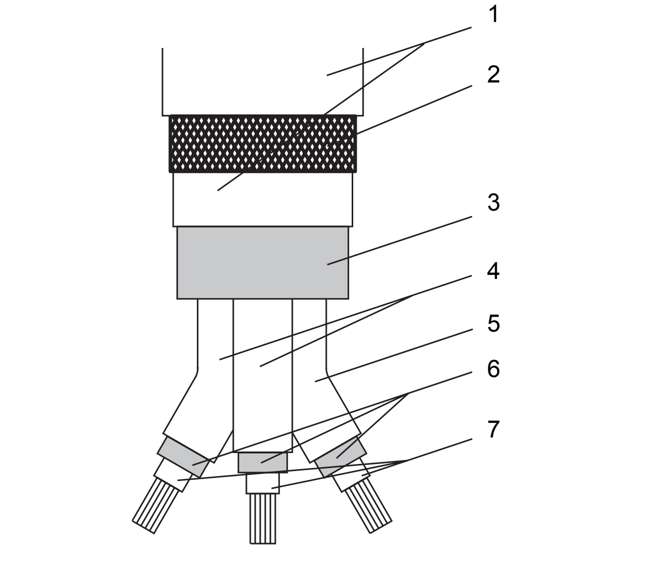
! Note:

- If plant conditions make it impossible to avoid proximity to electrical machinery or switch gear equipment, it is advisable to install the signal cable in a grounded metallic conduit.

  The preamplifiers in the flowmeter primaries, when this option are supplied with a DC voltage at terminals U- and U+.

The signal-/reference voltage cable connections at the flowmeter primary and converter are to be made in accordance with the appropriate Interconnection Diagram. If the actual flow direction does not agree with the flow direction arrow on the flowmeter primary connections at terminals 1 and 1S must be interchanged with 2 and 2S at one end of the cable. In flowmeter primaries with preamplifiers only terminals 1 and 2 should be interchanged.

The potential on terminal 3 is at the common of the flowmeter primary and is connected to ground or PA per VDE 0100/VDE 0160.



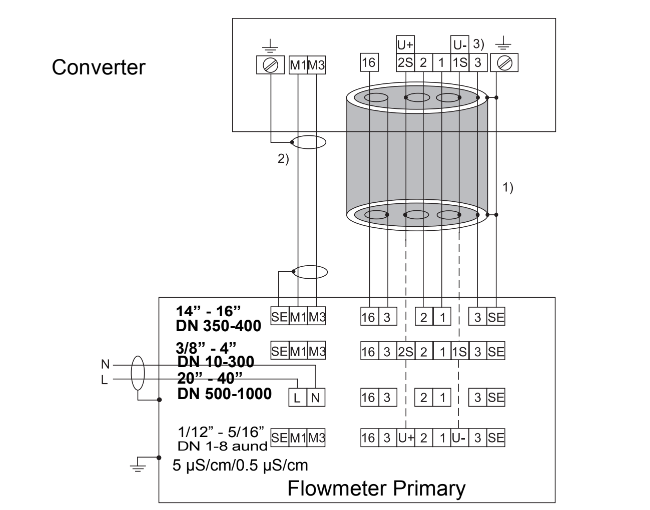
1	PVC jacket, white	5	Reference voltage jacket, white
2	Woven steel wire, natural ϕ 0.15 mm	6	1x each shielded, woven Cu wire, natural ϕ 0.1 mm
2	Woven copper wire, natural ϕ 0.13 mm	7	Polyethylene, natural
4	Electrode flow signal ϕ 0.75 mm (red and blue)		

Fig. 34 Signal Cable Construction D173D018U02

! Note:

- The shields of the signal leads may not contact each other or the outer shield (signal short circuit).

5.1.6 Interconnection Diagram



1) Shielded Signal Cable
Part No. D173D018U02

2) Excitation Cable e.g. shielded
2 x 1.5 mm^2, terminals M1, M3

3) Voltage supply for preamplifier
1/25” - 5/16” : DN 1 - 8 standard and ≥ 3/8” : DN 10

5.1.7 Connection Area

The signal cable leads should be installed using the shortest path to the connection terminals. Loops are to be avoided, (see Fig. 37 and Fig. 38).

Connection Box with Screwless Spring Loaded Terminals

Operation: Lead (2), with the insulation stripped, can be inserted into the terminal when spring (1) is depressed. Release the pressure (3) on the spring (Fig. 35).

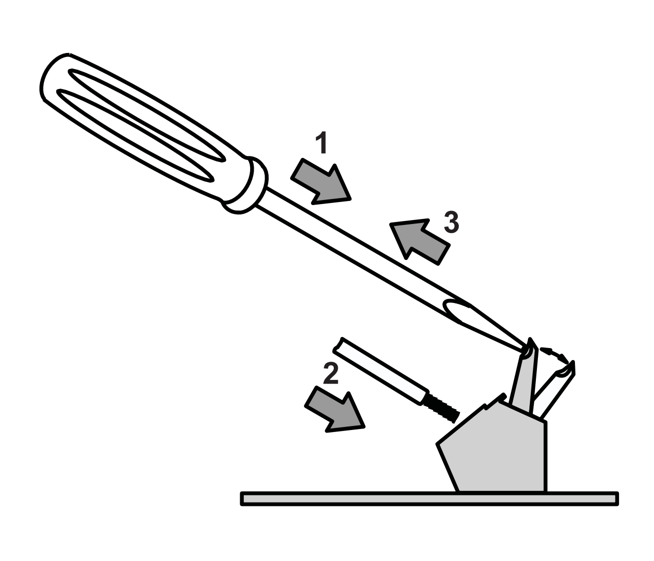


Fig. 35 Cable Insertion in the Screwless Spring Loaded Terminals

When replacing and tightening the cover care should be exercised. Check that the gasket is properly seated. Only then will Protection Class **IP 67** be assured.

! Note:

- When installing the signal/excitation cable to the flowmeter primary a water trap should be provided, (Fig. 36).

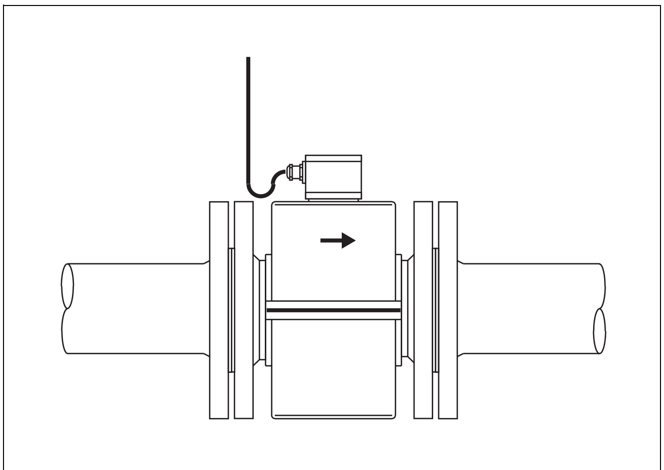
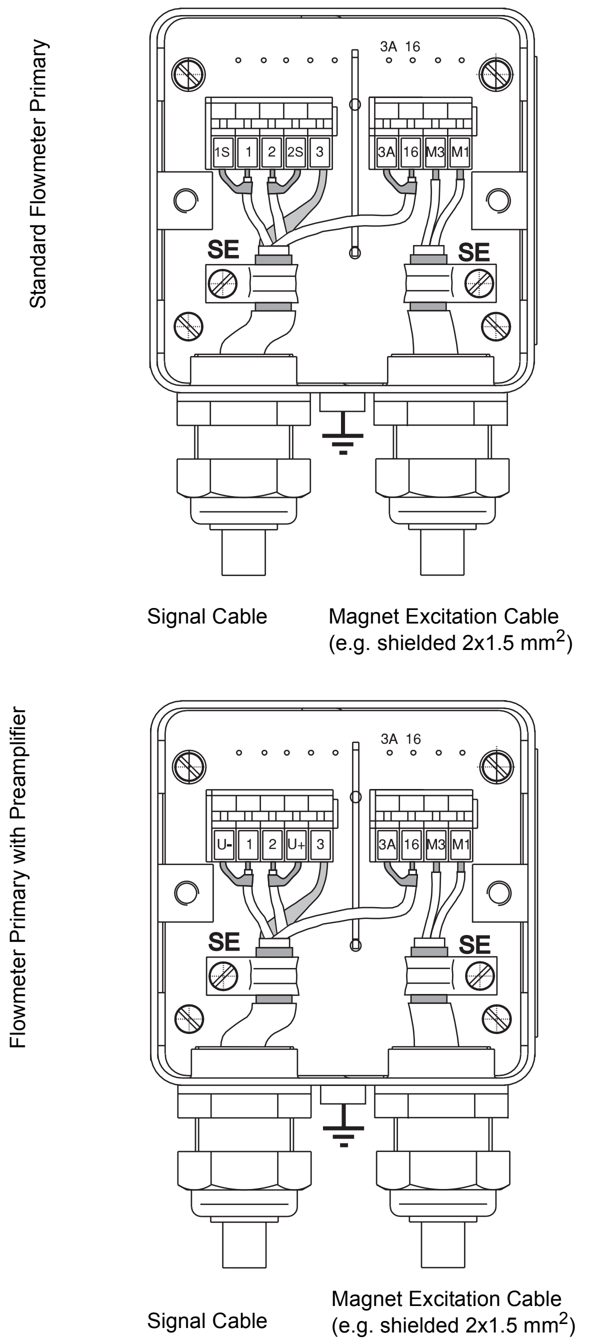


Fig. 36 Cable Installation

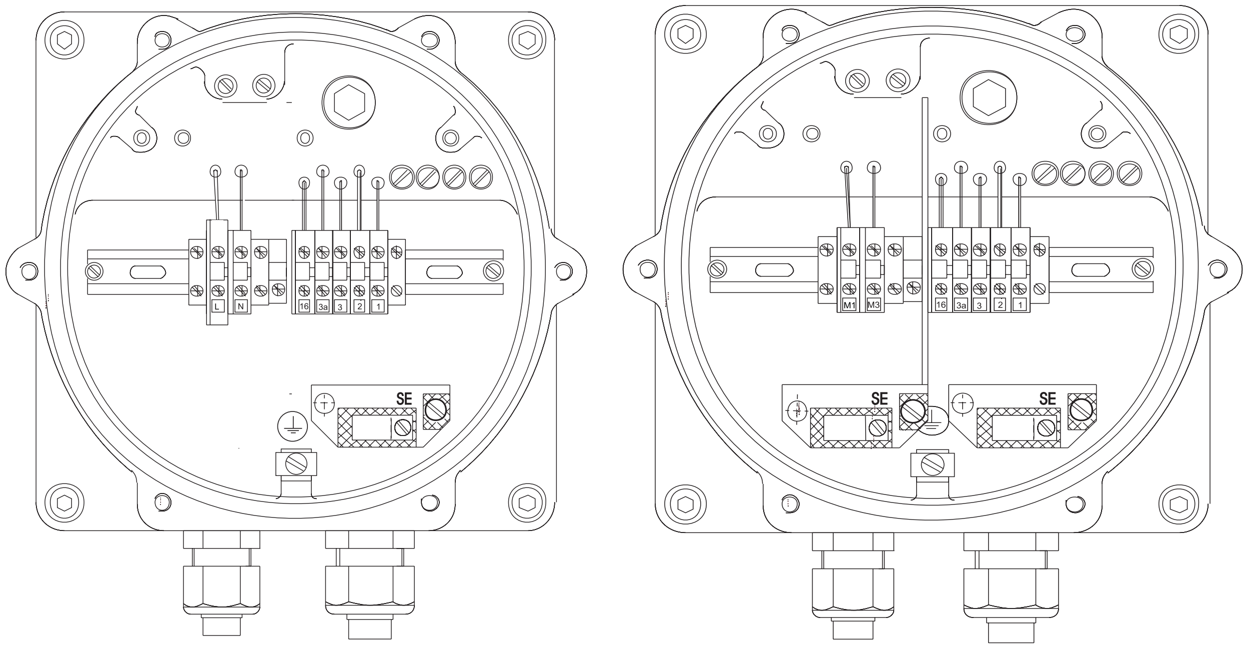


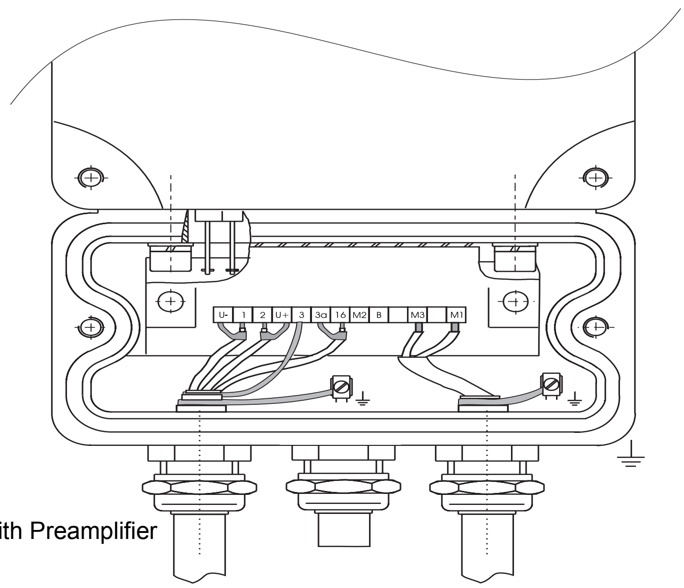
Terminal Designation	Connection
1 + 2	Electrode flow signal leads (red and blue)
1S, 2S	Signal lead shields
U+/U-	Voltage supply for preamplifier over signal cable shields
16	Reference voltage lead (white)
3A	Reference voltage lead shield
3	Inner cable shield (copper) Common potential
SE	Outer shield (steel)
M1 + M3	Connections for magnetic field excitation (from converter)

Fig. 37 Connection Area for Flowmeter Primaries ≤ **12”:DN 300**

≥ 20” : DN 500 *)

< 20” : DN 500





Flowmeter Primary with Preamplifier

Terminal Designation	Connection
1 + 2	Electrode flow signal leads
1S + 2S (U+/U-)	Electrode flow signal lead shields ( ) voltage supply for preamplifier
16	Reference voltage lead
3a	Reference voltage lead shield
3	Inner shield (copper) common potential
M1 + M3	Connections for magnetic field excitation (from converter)
*) L + N	for ≥ 20”:DN 500 supply power see Instrument Tag
M2 + B	Test point

Fig. 38 Connection Box Flowmeter Primary

6. Start-Up

The start-up procedure of the EMF system can be initiated after the installation of the flowmeter primary and converter have been completed. A preliminary check of the flowmeter primary should be made. Checking of the flowmeter primary with the converter is described in Section 7. Testing and Error Search of the Flowmeter Primary Using the Converter*).

6.1 Preliminary Checks

Check to assure that

- the flow direction of the fluid agrees with the direction indicators in the display.
- the installation requirements in Section 4.2 have been considered.
- the cable connections agree with the Interconnection Diagram.
- the ambient conditions do not exceed the specified limits.
- the ground connections agree with the specifications in 5.1.1 .
- the configured parameters agree wiht the operating conditions.
- the system zero software adjustment was completed, (see Section 6.2 Zero Check).
- that the parameters Flowmeter Primary Model and Operating Mode are correctly entered in the converter.

! General Information:

- If the flow direction indicators in the display do not agree with the actual flow directions it may be because the signal lead connections were interchanged. Interchange the connections at terminals 1 with 2 and 1S with 2S at the flowmeter primary.

  For the designs with a preamplifier only connections at terminals 1 and 2 should be interchanged.

  The coordination between the flow direction and the direction indicators in the display can also be reversed in the parameter “Flow Direction” by selecting “Normal or Inverse”.

6.2 Zero Check

During start-up or when checking the system the System Zero is to be set in the conveter after the warm up phase has been completed. The fluid in the flowmeter primary must be at an absolute standstill and the meter tube must be completely filled with fluid. The parameter “System Zero” in the converter can then utilized to manually set or automatically adjust the zero. Select the parameter using ENTER and with the arrow keys select either “automatic” or “manual” and accept by pressing ENTER. During an automatic adjustment the converter counts in the second display line from 0 to 256 seven times, after which the automatic zero adjustmnet is completed. The adjustment procedure takes approx. 20 seconds and the resultant value should be within the range of ±1500 Hz.

6.3 Maintenance

The flowmeter primary is essentially maintenance free. The ambient conditions (air circulation, humidity), seal integrity of the process connections, cable connectors and cover screws, functional reliability of the supply voltage, lightning protection and the grounds should be checked annually.

The electrodes should be cleaned if the flow indicated by the converter changes even though the flowrate has not. Higher flow indications are due to insulating coatings while decreases in the indications are due to conductive coatings.

! Note:

- Repairs or maintenance tasks should only be performed by qualified personnel.

  See the note (Hazardous Material Information), if the flowmeter primary is to be returned to the ABB Factory in Göttingen, Germany!

7. Testing and Error Search of the Flowmeter Primary Using the Converter*)

Warning

When the housing cover is removed the EMC and Personnel Contact protection is voided.

Connections agree with the Interconnection Diagram? Was the total measurement system checked?	no	Check the complete measurement system. See the Instruction Bulletin for the converter under “Error Search”.
yes		
Connect an oscilloscope from 16 to 3 or from TP102 to TP101[1]. Is the AC voltage a few millivolts? (50-150 mV_{eff}). Connect a digital voltmeter on the AC range across terminals 16 and 3. Is the reference voltage approx. 50-150 mV_{rms}? Check the voltage supply to the magnet coils, is the AC voltage approx. 60 V_{rms}.	no	Excitation voltage source defective. Break in the excitation cable. Calibration Unit defective. Fuse in converter housing blown. Unsolder the magnet coil leads (M1, M3). After the connection board has been removed the solder connections are accessible. The insulation resistance to the housing must be greater that 10 MOhm, otherwise short circuit to common.
yes		
Disconnect the signal cable at the flowmeter primary. (Turn off supply power). Measure the electrode resistance with an ac bridge under a full pipe condition. [3] Are the measured values from electrode 1 to 3 and from electrode 2 to 3 the same within ± 5%.	no	Electrodes are contaminated, conduct a CIP-Cleaning or clean with normal cleaning fluids and water. Electrodes leak. Flowmeter primary must be returned to the factory for repair.
yes		
Disconnect signal cable. Turn on power. Connect an oscilloscope across TP5 to TP101[2]. Is the measured voltage less than 70 mV_{rms} at zero flowrate?	no	Check grounds, max. noise voltage is exceeded.
yes		
Measure the reference voltage and the magnet coil current. These values are used to calculate the Calibration Factor $C = \frac{I_{Coil}}{U_{Ref}}[S]$ I_{Coil} is measured in series with the cable connected to M1 or M3 and U_{Ref} across connection terminals 16-3A[4] using a high impedance digital AC multi meter. These connections are located in the calibration unit of the flowmeter primary. Does the calculated Calibration Factor agree with the value recorded in the Calibration Report?	no	New calibration
yes		
Flowmeter primary operational.		

*) Checks for 10DS3111, 10DI1425, DS41 ≥ D20” : DN 500 upon request.

1) Test points are located on the analog board in the converter.

2) TP5 is located on the preamplifier and integrator module (see Fig. 39). TP101 is located on the analog board.

3) Not used for flowmeter primaries with preamplifiers.

4) Test points see Page 20.

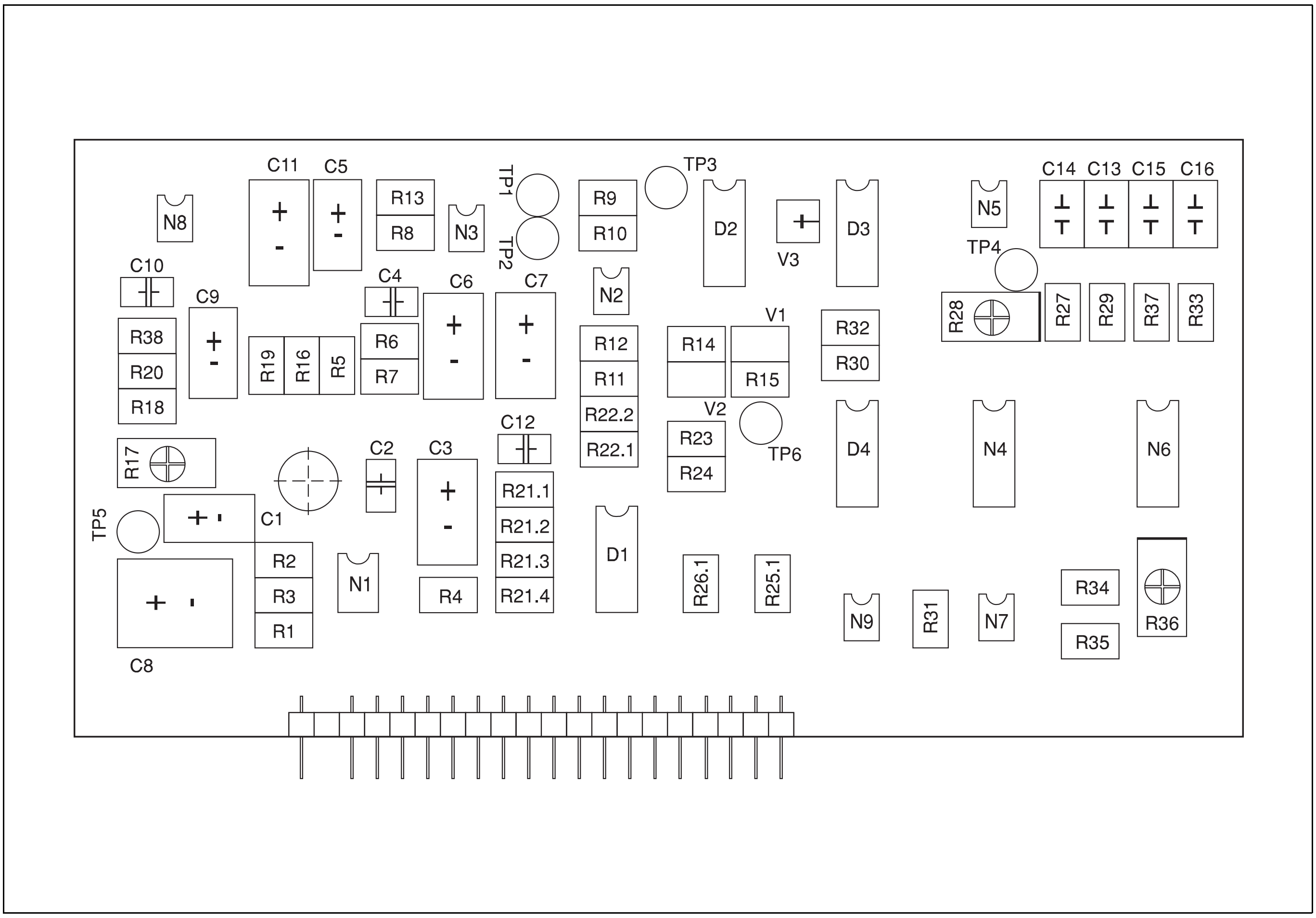


Fig. 39 Preamplifier and Integrator Module

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