Fill-MAG

Electromagnetic Flowmeter AC Magnetic Field Excitation with Microprocessor Converter

D184S033U02 Rev. 01 / 11.2001

Fig. 1

With this Fill-MAG Flowmeter System the flowrate of liquids, slurries and sludges whose electrical conductivity exceeds 20 µS/cm can be accurately measured. When a preamplifier is incorporated in the flowmeter primary the minimum conductivity limit is 5 µS/cm or 0.5 µS/cm.

- Especially suited for batch, filling and injection processes, from minute quantities to large container filling.
- Flowmeter primary size range: DN 1 – DN 400 [1/25”-16”].
- Flowmeter system with automatic zero adjustment.
- Especially suited for installations in the Food and beverage Industry, in the Pharmaceutical and Cosmetic Industry, as well as in the Chemical and Biochemical Industry.
- Easy, straight forward cleaning and sterilization - including automatic CIP-cycles - because of the smooth unobstructed metering tube in the flowmeter primary.
- Easy and clear data access and entry during on-line operation from the user friendly foil keypad on the converter with its lighted dot-matrix display or over a serial data link.
- Monitoring all batch cycle quantities for over- and underfilling.
- Remote recipe loading over the RS 485 data link.
- Centrallized parameter settings for up to 32 Fill-MAGs simultaneously with the Remote Operator Unit over the RS 485 data link.
- Metering of back flow.
- High system reliability assured through utilization of microprocessor controlled, digital signal processing. Automatic self monitoring with error diagnostics.
- Four programmable batch and anticipatory contact quantities.
- Automatic overrun corrections provide the capability fo fill small volumes with a high degree of precision.
- Reproducibility ± 0.2 % of rate.
- Fill-MAG also available in a certified design for custody transfer applications.
- Stainless steel design with 3A (28-03) and FML (Weihenstephan) certification, EHEDG.
- Communication: RS 485 with ASCII-Protocol.

Accuracy, Reference Conditions and Operating Principle

Operating Principle

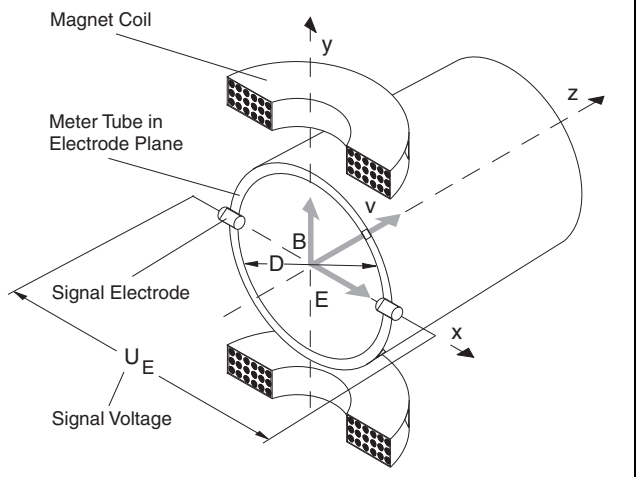
The Faraday Laws of Induction provide the basis for the electromagnetic flowmeter measurements. A voltage is generated in a conductor as it moves through a magnetic field.

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

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

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

The induced signal voltage is converted into scaled, analog and digital signals in the converter



U_E = Signal voltage
B = Magnetic induction
D = Electrode spacing
v = Average flow velocity
qv = Volumetric flow

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

$$qv = \frac{D^2 \pi}{4} \cdot v$$

$$U_E \sim qv$$

Fig. 2 Schematic of an Electromagnetic Flowmeter

Reference Conditions per EN 29104

Fluid Temperature
20 °C ±2K

Ambient Temperature
20 °C ±2K

Supply Power
Nominal voltage per Instrument Tag U_N ± 1 %

Installation Requirements
Upstream > 10 x DN long straight section,
Downstream > 5 x DN long straight section
DN = flowmeter primary size
Up- and downstream beginning from the Process connections of the primary

Warm-Up Time
30 min

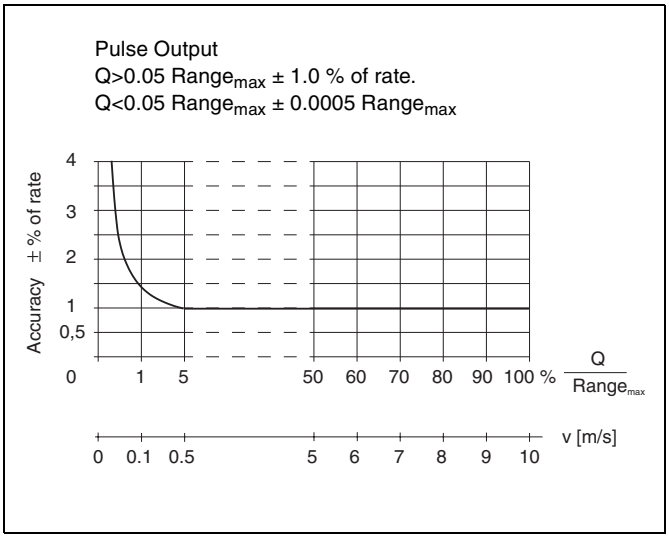
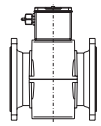
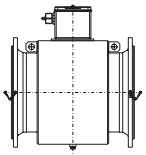
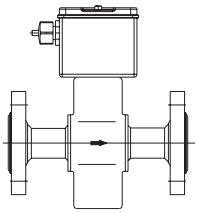
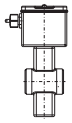
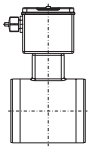
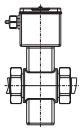
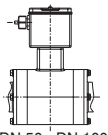
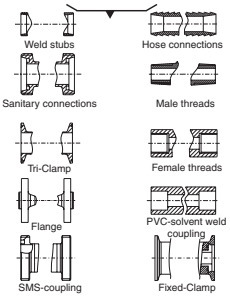
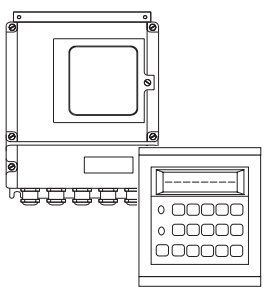


Fig. 3 Accuracy

Reproducibility
± 0.2 % of rate. (standard accuracy)
The continuous overrun volume corrections assure, when constant boundary conditions exist, that, instead of the above listed flowmeter/system accuracies (± 1 % of rate), a batch accuracy of < ± 0.2 % of rate can be achieved.

Requirement is the homogeneity of the product, without airbubbles or multiphase components.

Overview, Flowmeter Primary and Converter Designs

FiII-MAG	Fixed Flange	Fixed Flange	Wafer Design	Various Connections
	 DN 3 - DN 300  DN 350 - DN 400		 DN 3 - DN 40  DN 50 - DN 100	 DN 3 - DN 40  DN 50 - DN 100 
Accuracy	1 % of rate	1 % of rate	1 % of rate	1 % of rate
Reproducibility	0.2 % of rate	0.2 % of rate	0.2 % of rate	0.2 % of rate
Flowmeter Primary				
Model number	10DS3111	DS21F	DS21W	DS21L, -A,-D,-R,-S,-T,-U, -E,-I,-G,-H
Housing material	Aluminum	Stainless Steel		
	Size PN	Size PN	Size PN	Size PN
Wafer Design	–		DN3–100[1/8-4”]10–40	–
Flanges DIN 2501	3–400 10–40	3–100 10–40	–	–
Flanges ANSI B16.5	1/8”–16” CL 150–300	1/8”–4” CL 150–300	–	–
Flanges FAB1B DIN 11864-2	–	–	–	DN3–100[1/8-4”] 10
Aseptic connections DIN 11864-1	–	–	–	DN3–100[1/8-4”] 16
Food Industry fittings DIN 11851	–	–	–	DN3–100[1/8-4”] 10–40
Weld Stubs DIN 11850	–	–	–	DN3–100[1/8-4”] 10–40
Tri-Clamp DIN 32676	–	–	–	DN3–100[1/8-4”] 10
Male Threads ISO 228	–	–	–	DN3– 25[1/8-1”] 10
Female Threads ISO 228	–	–	–	DN3– 25[1/8-1”] 10
PVC-Cement Sleeve	–	–	–	DN3– 25[1/8-1”] 10
Hose Connector	–	–	–	DN3– 15[1/8-1/2”] 10
1/8” Threaded Nipples	–	–	–	DN1–2[1/25-3/32”] 10
Liner	Hard/soft rubber PTFE, PFA & others	PFA	PFA Ceramic upon request	PEEK, Torlon (<DN 3[1/8”]) PFA (>DN 2[3/32”])
Conductivity	> 0.5 µS/cm			
Electrodes	Stn. stl. No. 1.4571[316Ti], 1.4539, Hastelloy B2/C4, Platinum-Iridium, Tantalum, Titanium			
Process connection material	Steel, 1.4541[321], 1.4571[316Ti]	1.4571[316Ti]	–	1.4301[304],1.4404[316L], 1.4571[316Ti], POM, PVC
Protection class	IP 67/IP 68	IP 67/IP 68	IP 67/IP 68	IP 67/IP 68
Fluid temperature	-25 to +130 °C/180 °C	-40 to +130 °C		
Approvals				
3A, FML, EHEDG (Cleanability)	–	3A (28-03), FML (Weihenstephan), EHEDG		
Certified	Beer/KEG, Wort, Milk, Beverage Concentrates, Brine, Chemical fluids with conductivity >20 µS/cm			
Converter				
Model number	50ES7000			
Supply power	24 V, 115 V, 230 V AC			
Pulse output, unscaled	optocoupler			
Data link	RS 485			
Anticipatory/end contact	Optocoupler, relay			
Fluid monitor	yes, from DN 10[3/8”] (option)			
4 Batch quantities	yes			
Injections, fast batch cycles >0.5 s	yes			
Self monitoring	yes			
Local indication/totalization	yes			
19” Insert	yes			

Meter Size Table, Flow Ranges, Flowrate Nomograph

Flow Ranges, Meter Sizes and Pressure Ratings

Meter Size DN	Inch	Std. Press. Rating PN[1)]	Min. Flow Range Flow Veloc. 0 to 0.5 m/s	Max. Flow Range Flow Veloc. 0 to 10 m/s	Effective Flow Velocity for Flow Range 10 m/s	
					Model	
					DS21	10DS3111
1	1/25	10	0-0.03 l/min	0-0.6 l/min	10.61 m/s	–
1.5	1/16	10	0-0.05 l/min	0-1.0 l/min	9.43 m/s	–
2	3/32	10	0-0.1 l/min	0-2.0 l/min	10.61 m/s	–
3	1/8	40	0-0.2 l/min	0-4 l/min	9.43 m/s	9.43 m/s
4	5/32	40	0-0.4 l/min	0-8 l/min	10.61 m/s	10.61 m/s
6	1/4	40	0-1 l/min	0-20 l/min	11.79 m/s	10.05 m/s
8	5/16	40	0-1.5 l/min	0-30 l/min	9.95 m/s	9.95 m/s
10	3/8	40	0-2.25 l/min	0-45 l/min	9.95 m/s	7.89 m/s
15	1/2	40	0-5 l/min	0-100 l/min	12.55 m/s	10.38 m/s
20	3/4	40	0-7.5 l/min	0-150 l/min	9.82 m/s	8.55 m/s
25	1	40	0-10 l/min	0-200 l/min	7.37 m/s	6.53 m/s
32	1-1/4	40	0-20 l/min	0-400 l/min	9.43 m/s	7.26 m/s
40	1-1/2	40	0-30 l/min	0-600 l/min	9.82 m/s	7.92 m/s
50	2	40	0-3 m^3/h	0-60 m^3/h	9.61 m/s	8.00 m/s
65	2-1/2	40	0-6 m^3/h	0-120 m^3/h	11.04 m/s	9.54 m/s
80	3	40	0-9 m^3/h	0-180 m^3/h	11.63 m/s	10.64 m/s
100	4	16	0-12 m^3/h	0-240 m^3/h	9.21 m/s	8.14 m/s
125	5	16	0-21 m^3/h	0-420 m^3/h	–	9.40 m/s
150	6	16	0-30 m^3/h	0-600 m^3/h	–	9.15 m/s
200	8	10/16	0-54 m^3/h	0-1080 m^3/h	–	9.64 m/s
250	10	10/16	0-90 m^3/h	0-1800 m^3/h	–	9.95 m/s
300	12	10/16	0-120 m^3/h	0-2400 m^3/h	–	9.34 m/s
350	14	10/16	0-165 m^3/h	0-3300 m^3/h	–	10.49 m/s
400	16	10/16	0-225 m^3/h	0-4500 m^3/h	–	10.79 m/s

Larger meter sizes upon request

1) Values for Wafer Design, Weld Stubs, Fixed Flanges. Others, see Specifications, Flowmeter Primary.

Flowrate Nomograph

The volumetric flowrate is a function of the flow velocity and the flowmeter size. The nomograph (Fig. 4) shows the flowrate ranges which can be metered with a specific flowmeter size and the flowmeter sizes which are suitable for a specific flowrate.

Example:

Flowrate = 120 l/min (maximum value = flow range end value). Suitable are flowmeter primaries sizes DN 20 to 65 [3/4" to 2-1/2"].

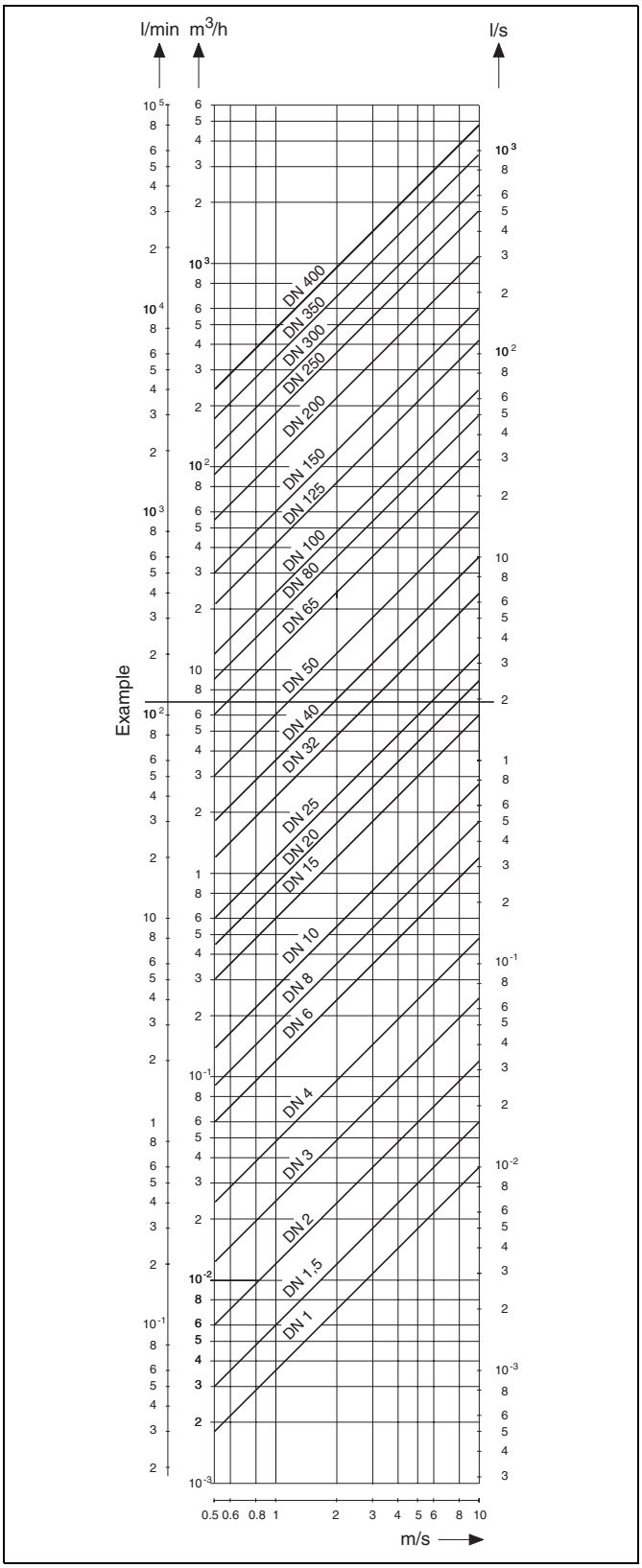


Fig. 4 Flowrate Nomograph DN 1 to DN 400 [1/25" to 16"]

Installation Requirements, Flowmeter Primary

In- and Outlet Sections

The metering principle is independent of the flow profile as long as standing eddies do no extend into the metering section, such as may exist after elbows, tangential in flow or partially open gate valves. In such situations measures to normalize the flow profile are required. Experience indicates, that generally a straight inlet section with a length of 3 x D (D = flowmeter size) and an outlet straight section with a length of 1 x D is sufficient.

The flowmeter primary must be installed in such a manner that the metering tube is always completely filled with fluid.

Valves or other shut off devices should be installed downstream from the flowmeter primary so that the meter cannot drain.

! Note:

For the Fill-MAG Volume Flowrate Integrator for certified applications expanded installation requirements apply! Please observe the notes on Page 7.

Installation of the Flowmeter Primary

The flowmeter primary should generally be installed in the pipeline in such a manner that the Pg-connectors point downward. If in this case, the flow direction does not coincide with the direction indicated by the arrow on the flowmeter primary, the following procedures should be followed. This is required so that the contact outputs do not respond to flow in the reverse direction.

Procedure:

a) In the standard flowmeter primaries the connections for the signal leads together with their shields are to be interchanged (only at the flowmeter primary).
Interchange Terminal 1 with Terminal 2
Interchange Terminal 1S with Terminal 2S.

b) For flowmeter primaries with preamplifiers only interchange Terminals 1 and 2 (only at the flowmeter primary) because the supply power of ± 12 V for the preamplifier is transmitted over Terminals 1S and 2S.

Grounding

The grounding of the flowmeter primary is not only essential for safety reasons but is also of importance to assure trouble free operation of the electromagnetic flowmeter. The ground screws on the meter primary are to be connected to the operating ground potential in accordance with VDE 0100, Section 540. For technical reasons this should be identical to the potential of the metering fluid if possible.

For plastic or insulated lined pipelines the fluid is grounded by utilizing a ground plate. When there are stray potentials present in the pipeline a ground plate is recommended at both ends of the flowmeter primary. As an option, the flowmeter primary is available with ground electrodes installed.

Control, Signal and Line Cables

! Note:

The flowmeter primary may not be installed in the vicinity of strong electromagnetic fields. It is recommended that the control cable, signal leads and the supply cables be shielded and installed separate from each other. It is advantageous to installed them in grounded metal conduits, in which multiple cables of the same type may be installed together.

In the system area, appropriate noise reduction measures should be employed, such as protection diodes, varistors, or RC-combinations (VDE 0580), for the valves and switch gear equipment.

! Note:

The instrument complies with the requirements of the EMC-Regulations and the NAMUR-Recommendations NE 21 3/93 “Electromagnetic Compatability of Process and Laboratory Equipment”.

Electrode Axis

When installing the flowmeter in horizontal pipelines assure that neither of the two electrodes is at the highest point. Gas bubbles which may be present in the fluid could interrupt the electrical connection between the electrodes and the fluid. An EMF installed in a vertical pipeline represents an ideal installation. Two preferred installations are shown in Fig. 5.

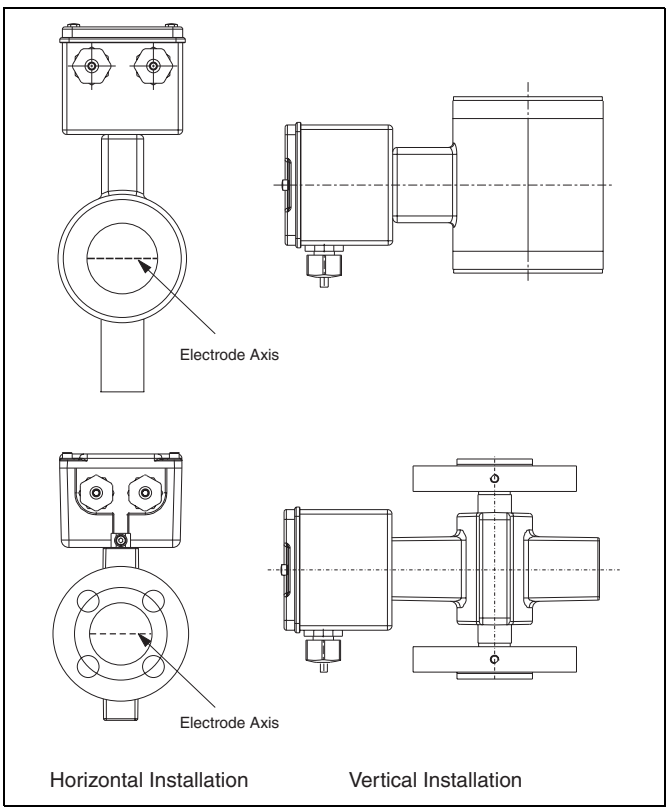


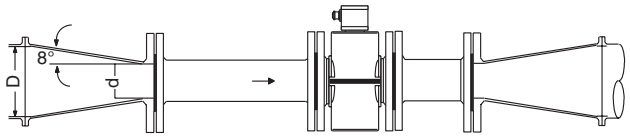
Fig. 5

Installation Requirements, Flowmeter Primary / Volume Flowrate Totalizer for Certified Custody Transfer

Installation in Larger Size Pipelines

The flowmeter primary can readily be installed in larger pipeline sizes by utilizing reducers (e.g. flanged reducers DIN 28545). The pressure drop which results from the reduction can be determined from the Nomograph Fig. 6. The pressure drop is determined in the following manner:

1. Calculate the diameter ratio d/D.
2. Determine the flow velocity as a function of the flowmeter size and the instantaneous flowrate:
   $v = \frac{Q \text{ (Instantaneous Flowrate)}}{\text{Flowmeter Primary Constant}}$
   The flow velocity can also be determined form the Flowrate Nomograph Fig. 4.
3. Read the pressure drop on the Y-Axis in Fig. 6 at the intersection of the "Diameter Ratio d/D" x-axis value and the flow velocity line.



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

Pressure Drop Diagram for EMF
Flanged reducer with $\alpha/2 = 8°$

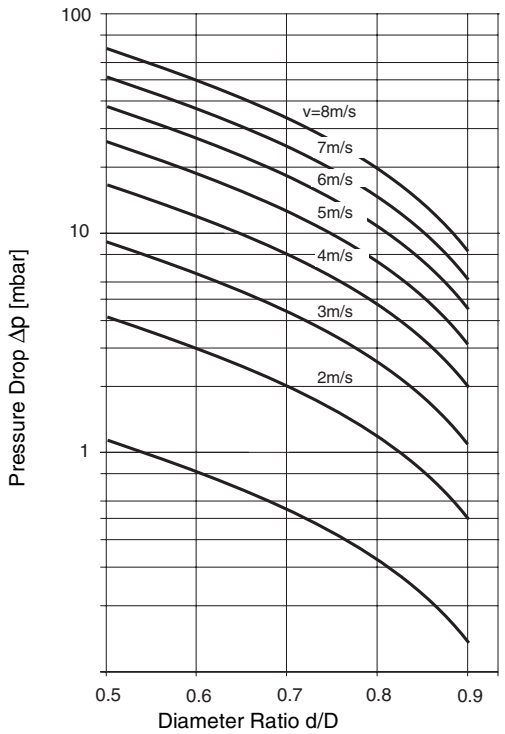


Fig. 6 Nomograph for Pressure Drop Determinations

The design of the "Electromagnetic Volume Flowrate Integrator with Electrical Counter" has been approved by the National Institute of Technology and Science at Braunschweig, Germany for certified interstate use. For the Volume Flowrate Integrator Fill-MAG, consisting of a flowmeter primary and converter, the following approvals have been granted:

5.721 / 86.02 Electromagnetic Volume Flowrate Integrator with Electrical Counter for barrel filling with **Beer**.

5.721 / 87.05 Electromagnetic Volume Flowrate Integrator with Electrical Counter for Liquids Other than Water (**Milk, Beverage Concentrates or Syrups, Beer, Wort, Brine).**

For the Volume Flowrate Integrator with Approval 5.721/87.05 Liquids Other than Water the Certification Regulation (EO) of 15.01.1975 applies, as additionally revised by the sixth Regulation for the revision of the Certification Regulation of 08.03.1985 (BGBI IS.568), and specifically the "General Requirements" (EO AV) and the Appendix 5 (EO 5) "Instruments for Determining the Volume of Mass of Flowing Liquids Other than Water" Paragraph 2, Section 1.

Approved Flowmeter Sizes for "Fluids Other than Water"

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

Minimum Flowrates and Fluid			
DN	Inch	Min. Flowrate	Fluid
25	1	2	Beer, Milk, Beverage Concentrate
32	1-1/4	5	Beer, Milk, Beverage Concentrate
40	1-1/2	20	Beer, Milk
50	2	200	Beer, Wort
65	2-1/2	500	Beer, Wort, Milk
80	3	500	Beer, Wort, Milk
100	4	2000	Wort, Brine
150	6	2000	Brine

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

Volume Flowrate Totalizer for Certified Custody Transfer

Note:

The flow ranges are those prescribed in the Table Page 6. Subsequent flow range changes require a recalibration on a certified test facility.

Please provide the desired flow range with the order in accordance with the table above. The allowable Qmax steps for the required flowmeter size are to be considered.

Example: DN 25 [1"], smallest approved flow range Qmax = 60 l/min; flow range changes can be made in steps of 10 l/min between 60 l/min to 200 l/min).

Certification

The certification of the Electromagnetic Volume Flowrate Integrator is made on the calibration stands at ABB in Göttingen, Germany which have been approved for certification calibrations. After the certification, the parameters which affect the certification, can only be changed in the presence of a certifying agency official.

Accessory Equipment

Accessory equipment such as volume flowrate indicators or recorders and control devices together and approved printers, volume setting devices or remote totalizers, may be connected to the Volume Flowrate Integrators.

The approved printers, volume setting devices and remote totalizers must be - if they are to be utilized - connected to the Volume Flowrate Integrator during the certification calibration.

Installation Requirements

Straight pipe sections with the same inside diameter as the inlet diameter of the flowmeter primary are to be installed up- and downstream. The length of the straight section upstream of the flowmeter primary must be at least 10 times the flowmeter size and the downstream length at least 5 times.

The flowmeter primary must be continually be completely filled with fluid.

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

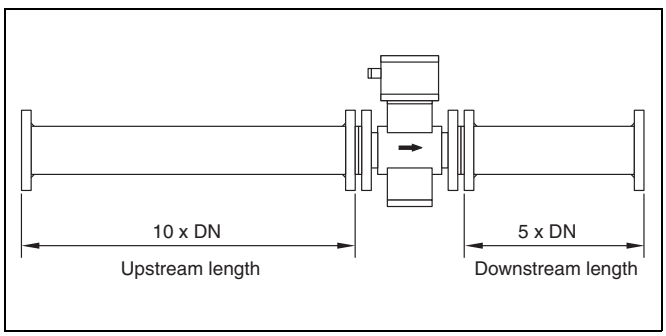


Fig. 7

KEG-Filling

Four barrel sizes with their corresponding beer volumes can be entered and selected from an external contact (e.g. opto-electrical barrel size recognition). The corresponding anticipatory contact quantities can also be individually entered. The automatic overrun corrections are continuously adjusted to the varying operating conditions.

When an underfill occurs the Fill-MAG checks to determine if the filled volume is within the allowable tolerances and activates an error signal. The same applies to overfills. The connection and integration of the Fill-MAG system into the control system is made in cooperation with the system 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:

For galvanic isolation the control inputs in the converter are configured as optocoupler inputs. For the various input functions a 24 V DC supply is required. It is to be provided by the customer.

Batch Start (Terminals G2, 68)

The batch cycle is initiated by an external start pulse (e.g. from a SPC).

Batch Stop (Terminals G2, 69)

The batch cycle is terminated from the external stop contact.

External Batch Quantity Selection (Terminals G2, A1, A2)

a) from a switch change
b) from ext. barrel size recognition[1)]

1)When ext. barrel size recognition is utilized a bypass switch for the filling the Certified-KEG (30 Liter) must be provided, because its size is that of a 50 Liter KEG.

Specifications: Flowmeter Primary, Fixed Flanges, Model 10DS3111

Max. Allowable Fluid Temperature and Pressure
(Standard design to 130 °C, high temperature design to 180 °C)

Liner	Meter Size DN Inch	$P_{Operate}$ at $T_{Operate}$ °C	
Hard rubber KTW approved	15 to 2501/2 - 10	40 bar	< 90
	300 to 40012 - 16	25 bar	< 90
Soft rubber KTW approved	65 to 2502-1/2 - 10	40 bar 10 bar	< 20 < 90
	300 to 40012 - 16	25 bar 10 bar	< 20 < 90
PTFE	10 to 4003/8 - 16	40 bar 25 bar	< 20 < 180
PFA	3 to 2501/8 - 10	40 bar 25 bar	< 20 < 180

(Other sizes, pressure ratings, Temperature Classes upon request)

Designs

DN 3 to DN 300 [1/8" - 12"]
Two piece clam shell housing: Cast Alum, painted
Connection box: Cast Alum., painted[1)]

Flanges
Zinc plated steel standard
Stn. stl. 1.4541/1.4571 [321/316Ti]

DN 350 to DN 400 [12" - 16"]
Welded steel construction, painted
Connection box: Cast Alum., painted[1)]

Flanges
Zinc plated steel standard
Stn. stl. 1.4541/1.4571 [321/316Ti]

1) Paint coat 60 µm thick, RAL 7012, RAL 9002

Materials

Liner Materials	Electrode Materials Standard	Others	Electrode Design
Hard rubber Soft rubber	SS No. 1.4571 [316Ti]	Hast. B-2/C-4 Titanium Tantalum Platinum-Iridium	Flat head std. Rounded head Pointed head Removable
PTFE, PFA	Hast. C-4	SS No. 1.4571[316Ti] Hast. B-2 Titanium, Tantalum, Platinum-Iridium	Flat head std. Rounded head Pointed head
Other parts	Standard	Others	
Flanges < DN 350 [14"] ≥ DN 350 [14"}	 Steel Zn.plated Steel Zn.plated	 SS No. 1.4541 / SS No. 1.4571 [316Ti] / [316Ti]	

Min. Allowable Absolute Pressure

Liner	Meter Size DN Inch	$P_{Operate}$ at $T_{Operate}$ °C mbar abs	
Hard rubber	15 to 4001/2 - 16	0	< 90
Soft rubber	65 to 4002-1/2 - 16	0	< 90
PTFE	10 to 4003/8 - 16	270 400 500 550	< 20 < 100 < 130 < 180
PFA	3 to 2501/8 - 10	270 400 500 550	< 20 < 100 < 130 < 180

Temperature Diagram

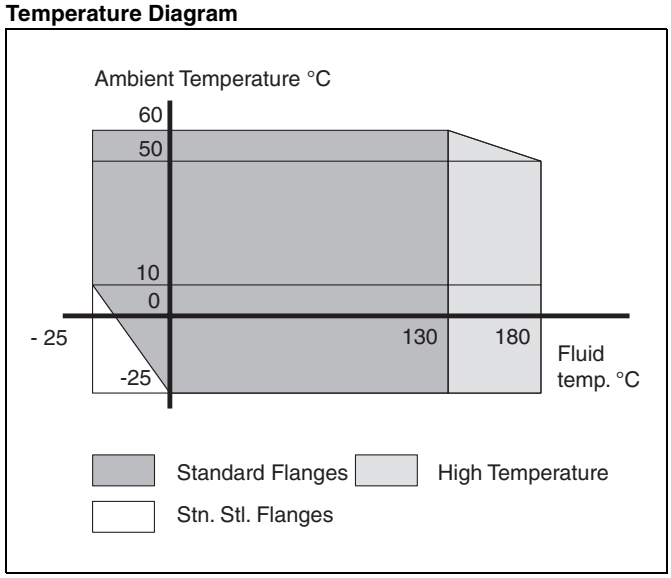


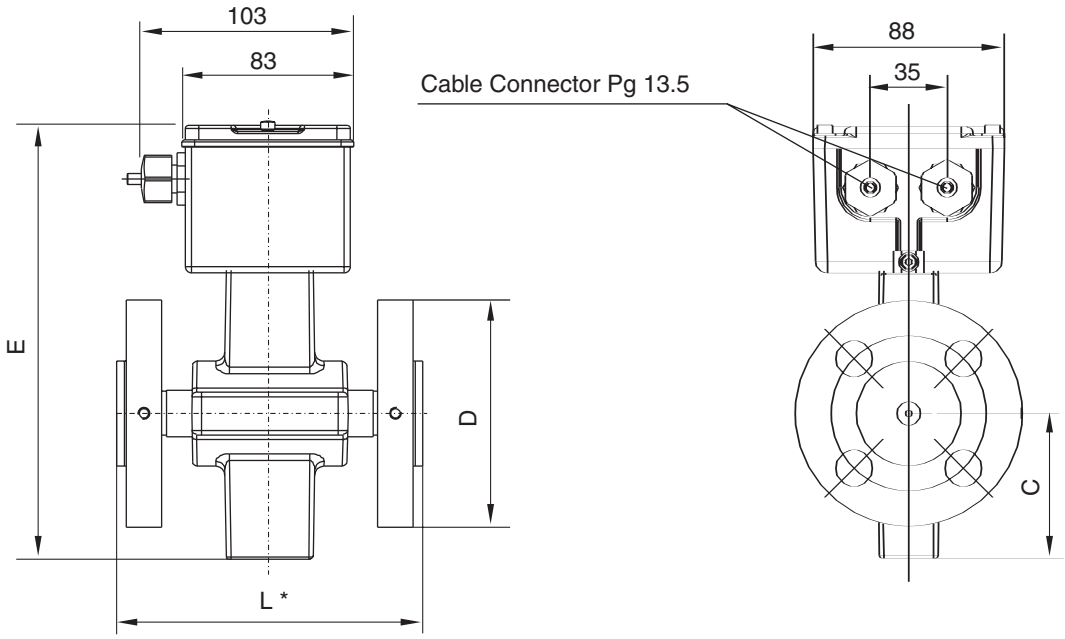
Fig. 8 Fluid Temperature as a Function of the Ambient Temperature

Minimum Conductivity/Preamplifier

Meter Size	Preamplifier		
	Without	With Typ* "B"	With Typ* "G"
DN 3 – DN 8[1/8" - 5/16"]	Not available	≥ 20 µS/cm	≥ 0.5 µS/cm
≥ DN 10 [3/8"]	≥ 20 µS/cm	≥ 5 µS/cm	≥ 0.5 µS/cm

*Type see Ordering Information 10DS3111

Dimensions: Flowmeter Primary, DN 3 - DN 100 [1/8“-4“], Fixed Flanges per DIN and ANSI, Mod. 10DS3111



Tolerance L* +0 –3

All dim´s in mm

ISO Projection Method E

DIN Flanges

Dimensions						Weight
DN	PN[1)]	D	L[2)]	C	E	ca. kg
3–8	10–40	90	130	62	124	4
10–15	10–40	95	200	62	124	4.5
20	10–40	105	200	73	146	5
25	10–40	115	200	73	146	5.5
32	10–40	140	200	78	156	7
40	10–40	150	200	82	164	7.5
50	10–40	165	200	90	180	9
65	10–40	185	200	104	298	13
80	10–40	200	200	110	220	16
100	10–16	220	250	130	355	17

ANSI Flanges

Dimensions							Weight
		CL 150	CL 300				ca. kg
DN	Inch	D	D	L[2)]	ca. kg	ca. kg	
3–8	1/2	89	96	130	5.5	5.5	4
10–15	1/2	89	96	270	5.5	5.5	4.5
20	3/4	98	118	270	6	6	5
25	1	108	124	270	6.5	6.5	5.5
32	1 1/4	118	134	280	8	8	7
40	1 1/2	127	156	280	8.5	8.5	7.5
50	2	153	165	280	10	10	9
65	2 1/2	178	191	330	14	14	13
80	3	191	210	340	17	17	16
100	4	229	254	400	18	18	17

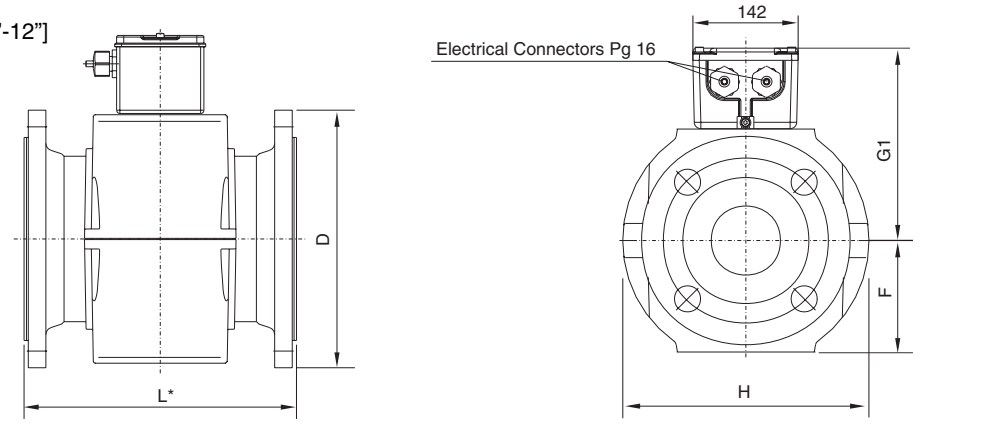
For dimensions C, E see DIN Flanges Table

1) Other pressure ratings upon request.
2) When a ground plate is installed on one flange, increase the dimension L as follows: DN 3 to DN 100 [1/8”-4”] by 3 mm.
When a protection flange is installed, increase the dimension L as follows: DN 3 to DN 100 [1/8”-4”] by 6 mm.
A ground plate is then not required!
Also available in the dimensions for the flowmeter primary Series 1000.

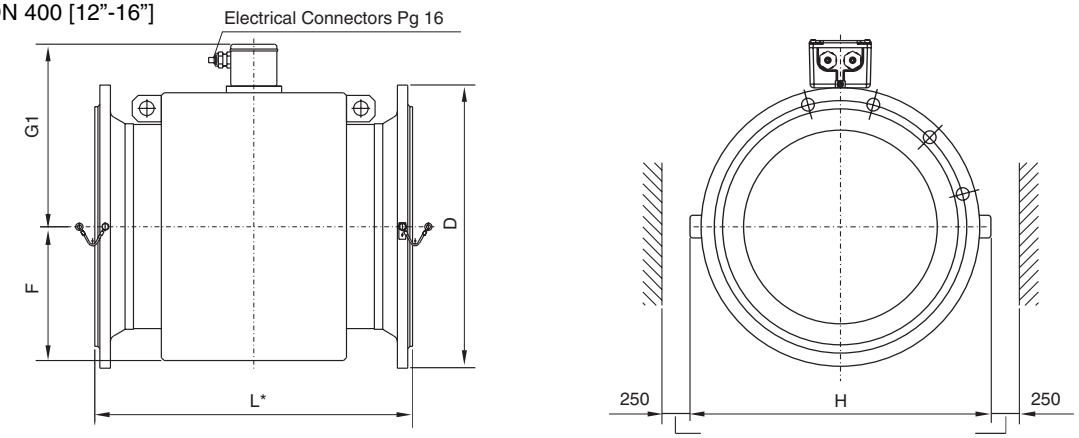
Fig. 9 Flowmeter Primary DN 3 to DN 100 [1/8” - 4”]

Dimensions: Flowmeter Primary, DN 125 - DN 400 [5“-16“], Fixed Flanges per DIN and ANSI, Mod. 10DS3111

DN 125 - DN 300 [5”-12”]

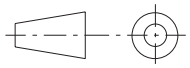


DN 350 - DN 400 [12”-16”]



Tolerances L* to DN200[8”] +0 –3 DN250 - DN400[10”-16’} +0 –5

All dim´s in mm



Flanges per DIN 2501

Dimensions							Weight
DN	PN[1)]	D	L[2)3)]	F	G1	H	ca. kg
125	10–16	250	250	148	237	250	28
150	10–16	285	300	179	257	285	30
200	10	340	350	179	289	340	54
200	16	340	350	207	289	340	54
250	10	395	450	250	317	405	79
250	16	405	450	250	317	405	79
300	10	445	500	250	360	445	83
300	16	460	500	250	360	460	92
350	10	505	550	250	369	620	129
350	16	520	550	250	369	620	143
400	10	565	600	275	395	671	155
400	16	580	600	275	395	671	175

ANSI Flanges

Dimensions						Weight	
		CL 150	CL 300			CL 150	CL 300
DN	Inch	D	D	L[3)]	G1	ca. kg	ca. kg
125	5	254	280	450	237	36	38
150	6	280	318	450	257	38	40
200	8	343	381	500	289	66	74
					289		
250	10	407	445	550	317	98	118
					317		
300	12	483	521	620	360	124	180
					360		
350	14	533	–	650	369	178	–
					369		
400	16	597	–	700	395	225	–
					395		

≥ DN 350[14”] the dim. H applies only to removable electrodes.

1) Other pressure ratings upon request.

2) When a ground plate is installed on one flange, increase the dimension L as follows:
DN 125 – DN 300 [5”-12”] by 5 mm.
Ground plate >DN 350 upon request.

For ANSI flange dimensions F and H see DIN Flanges Table.

3) When a protection flange is installed, increase the dimension L:
DN 125 – DN 300 [5” - 12”] by 10 mm,
DN 350 – DN 400 [14” - 16”] by 25 mm.
A ground plate is then not required!

Fig. 10 Flowmeter Primary DN 125 to DN 400 [5” - 16”] Fixed Flanges per DIN and ANSI

Flowmeter Primary: Flowmeter Primary, DN 3 - DN 400 [1/8“-16“], Fixed Flanges, Mod. 10DS3111

In addition to the Ordering Number please provide the following information:
Fluid, fluid temperature, operating pressure, pipeline (ground plate, ground electrodes)[1)]

Ordering Number	**10DS3111**															
Design Level		**D**														
Design																
Lay length Series 3000 (short design) ≥ DN10[3/8”] standard			**A**													
W/ preamp.DN3–8[1/8-5/16”] ≥20 µS/cm; ≥ DN10[3/8”] ≥ 5 µS/cm			**B**													
With preamplifier ≥ 0.5 µS/cm			**G**													
Lay length Series 1000 (only for replacements)			**C**													
Liner Material																
Hard rubber	(DN 15 to DN 400 [1.2”-16”])			**A**												
Soft rubber	(DN 65 to DN 400 [2-1.2”-16”])			**B**												
PTFE	(DN 10 to DN 400 [3/8”-16”])			**E**												
PFA	(DN 3 to DN 200 [1/8” - 8”])			**K**												
Others				**Z**												
Meter Size																
DN 3	1/8”				**01**											
DN 4	5/32”				**02**											
DN 6	1/4”				**04**											
DN 8	5/16’				**05**											
DN 10	3/8”				**06**											
DN 15	1/2”				**07**											
DN 20	3/4”				**08**											
DN 25	1”				**09**											
DN 32	1-1/4”				**10**											
DN 40	1-1/2”				**11**											
DN 50	2”				**12**											
DN 65	2-1/2”				**13**											
DN 80	3”				**14**											
DN 100	4”				**15**											
DN 125	5”				**16**											
DN 150	6”				**17**											
DN 200	8”				**18**											
DN 250	10”				**19**											
DN 300	12”				**20**											
DN 350	14”				**21**											
DN 400	16”				**22**											
Pressure Rating																
DIN PN 10						**C**										
DIN PN 16						**D**										
DIN PN 25						**E**										
DIN PN 40						**F**										
ANSI CL 150[2)]						**P**										
ANSI CL 300[2)]						**Q**										
Others						**Z**										
Flange Materials																
Steel							**1**									
Stn. stl. No. 1.4541 [321] available from DN 150 [6”]							**2**									
Stn. stl. No. 1.4571 [316Ti]							**3**									

Continued on next page

1) If a ground plate or ground electrodes are required, please provide additional Ordering Information.
The standard ground plate is made of stn. stl. No. 1.4571 [316Ti], ground electrodes of stn. stl. No. 1.4401[316L].
Other materials and ground plates ≥ DN 350 [14”] upon request.

2) Lay length for Series 1000.

Flowmeter Primary: Flowmeter Primary, DN 3 - DN 400 [1/8“-16“], Fixed Flanges, Mod. 10DS3111

Ordering Number	**10DS3111**															
Flange Accessories																
None									**A**							
Protection flanges	stn. stl. No. 1.4571[316Ti] (only DIN flanges and short design)								**B**							
Ground plate	stn. stl. No. 1.4571[316Ti][3]								**C**							
Protection flanges	stn. stl. No. 1.4571[316Ti][4]								**D**							
Electrode Designs																
Standard										**2**						
Removable, stn. stl. No. 1.4571[316Ti][6]										**4**						
Rounded										**7**						
Pointed head[7]										**8**						
Others										**9**						
Signal Electrode Material		**/ Ground Electrode Material[9]**														
Stn. stl. No. 1.4571[316Ti] std. hard rubber/soft rubber		/ none									**B**					
Hastelloy B-2		/ none									**C**					
Hastelloy C-4 standard PTFE/PFA		/ none									**D**					
Titanium		/ none									**E**					
Tantalum		/ none									**F**					
Platinum-Iridium		/ none									**H**					
Stn. stl. No. 1.4539[5]		/ none									**R**					
Stn. stl. No. 1.4571[316Ti] std. hard rubber/soft rubber		/ with									**K**					
Hastelloy B-2		/ with									**L**					
Hastelloy C-4 standard PTFE/PFA		/ with									**N**					
Titanium		/ with									**P**					
Tantalum		/ with									**Q**					
Platinum-Iridium		/ with									**T**					
Stn. stl. No. 1.4539[5]		/ with									**W**					
Approvals																
Standard (none)												**A**				
Inspection Certificate EN 10204 – 3.1B[8]												**E**				
Protection Class																
IP 67													**2**			
IP 68													**3**			
Temperature Range																
Standard design ≤ 130 °C														**1**		
Line Frequency																
50 Hz															**1**	
60 Hz															**3**	
Instrument Tag																
German																**1**
English																**2**
French																**3**

3) Ground plate for PTFE/PFA mounted to flanges, ≥ DN 350 [14”] and other materials upon request.
4) Lay length Series 1000 or ANSI Flanges.
5) Only for CIP-cleaning.
6) Only for hard rubber lined meters ≥ DN 300 [12”].
7) Use for high fat content applications.
8) Certificate for metering tube and flanges, presently DN 10 to DN 300 [3/8”-12”], other flowmeter sizes, please provide additional Ordering Information.
9) Ground electrodes DN 3 – DN 300 [1/8” - 12”].

Specifications: Stainless Steel Flowmeter Primary, Model DS21, DN 3 - DN 100 [1/8“-4“]

Ambient Conditions

Ambient Temperature
-25 °C to +60 °C

Fluid Temperature
-40 °C to +130 °C, CIP-cleanable, see Temperature Diagram and max. allowable cleaning temperature.

Maximum allowable ambient temperature as a function of the fluid temperature for stainless steel process connections and Wafer Design.

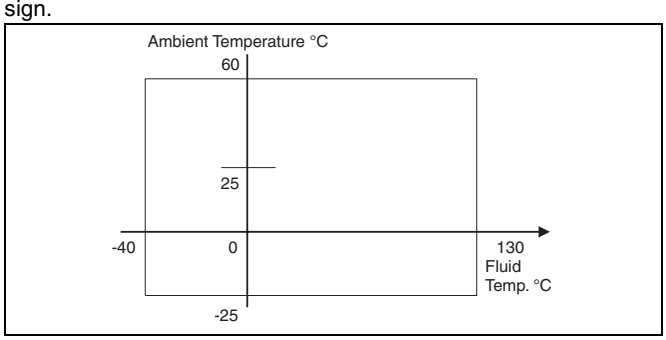


Fig. 11 Temperature Diagram

Storage Temperature
-25 °C to +70 °C

Minimum Allowable Absolute Pressure

Liner	Meter Size DN	Inch	$P_{Operate}$ mbar abs	at $T_{Operate}$ °C
PFA/PEEK/Torlon	1 – 100	1/25 – 4	0	< 130

Maximum Allow. Fluid Temperature and Pressure

Process connections Liner PFA/PEEK/Torlon	Meter Size DN	Inch	$P_{Oper.}$ bar	at	$T_{Oper.}$ °C
Wafer Design, Weld Stubs, Flanges DIN 2501/ANSI	3 – 100	1/8 – 4	40 30 10	≤ ≤ ≤	20 130 130
Flanges FAB1 DIN 11864-2B	3 – 100	1/8 – 4	10	≤	130
Aseptic connections DIN 11864-1	3 – 100	1/8 – 4	16	≤	130
Food Industry fittings DIN 11851	3 – 40 50 – 100	1/8–1-1/4 2 – 4	40 25	≤ ≤	130 130
Tri-Clamp	3 – 100	1/8 – 4	10	≤	130
Male-/female threads	3 – 25	1/8 – 1	10	≤	130
PVC-cement sleeve	3 – 25	1/8 – 1	10 1	≤ ≤	20 60
Hose connectors	3 – 15	1/8 – 1/2	10	≤	130
1/8” Threaded nipples	1 – 2	1/25–3/32	10	≤	130

Maximum Allowable Cleaning Temperature

CIP-Cleaning	Liner Flowmeter Primary	T_{max} °C	t_{max} minutes	T_{Amb} °C
Steam cleaning	PFA, PEEK	150	60	25
Liquid cleaning	PFA,	150	60	25
	PEEK, Torlon	140	60	25

If the ambient temperature >25 °C, the max. cleaning temperature is to be reduced by subtracting the difference: $T_{max} - \Delta$ °C.
Δ °C = $T_{Ambient.}$ -25 °C.

Maximum Allowable Shock Temperature

Liner	Temp.-Shock max. Temp.-Diff. °C	Temp.-Gradient °C/min
PFA/PEEK/Torlon	arbitrary	arbitrary

Specifications Flowmeter Primary

Materials Flowmeter Primary

Liner Material	Electrode Material Standard	Others	Electrode Design Standard	Others
PFA/PEEK/ Torlon	Hast. C4 (1.4539 for pipe couplings & Tri-Clamp	Hast. B2 SS 1.4539 SS 1.4571[316Ti] Tant., Titan., Platinum-Iridium	Flat head	Pointed head (≥ DN 10 [3/8”])

Process Conn. Material	Standard	Option
Wafer Design	none	
Weld stubs, flanges, Pipe couplings Tri-Clamp Male/female threads, Hose connector	SS No. 1.4301[304] SS No. 1.4404[316L] for flanges	SS No.1.4404[316L] Others
PVC-cement sleeve	PVC	–
1/8” Threaded nipples	SS No.1.4571[316Ti]	POM
Connection Box	Stn. stl.	–
Metering tube	SS No. 1.4301[304]	–
Pg-Connector	Polyamide	PVDF
Primary housing	Deep drawn stn. stl. housing 1.4301[304]	

Gasket Material, Electrical Connections, Weight and Design

Process Connection Material	Material
Wafer Design,	none
Weld stubs, flanges, pipe couplings Tri-Clamp Male/female threads, Hose connector PVC-cement sleeve	EPDM (Ethylene-Propylene) std. with FDA-Approval Silicone (option) with FDA-Approval
1/8” Threaded nipples	PTFE
Housing flat gasket	Silicone

Supply Power
From converter

Weight
See Dimensions starting on Page 14

Process Connections DN 1 – 100 [1/25” – 4”]
Wafer Design, Flanges, Tri-Clamp, Pipe couplings, Female/male threads, PVC-cement sleeve, Hose connector, 1/8” Threaded nipple, others upon request

Protection Class
IP 67 Standard
IP 68 (Option)

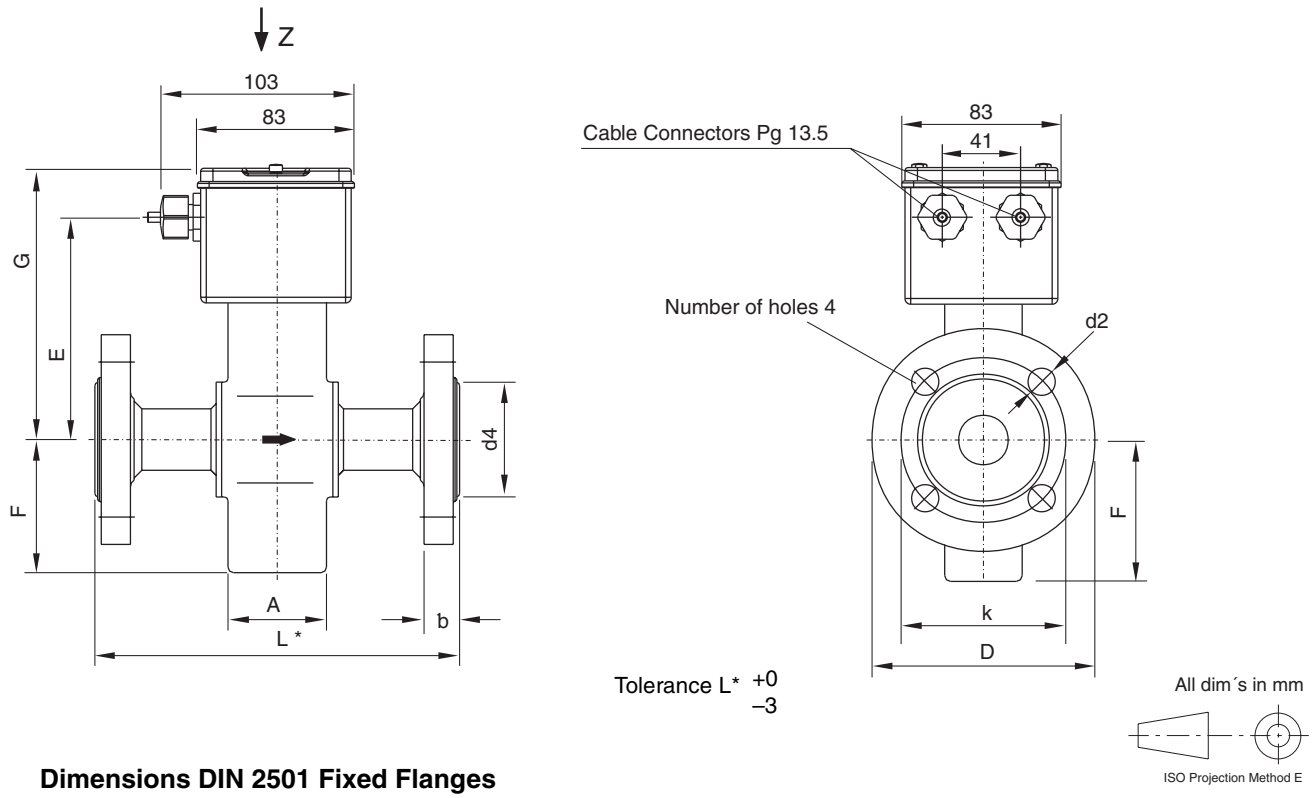
Minimum Conductivity/Preamplifier

Meter Size DN Inch	Preamplifier None	w/Type* “B/D/S/T”	w/ Type* “E/F/U/V”
DN 1– DN 21/25–3/32	not available	≥ 20 µS/cm	≥ 5 µS/cm
DN 3–DN 81/8–5/16	not available	≥ 20 µS/cm	≥ 0.5 µS/cm
≥ DN 103/8	≥ 20 µS/cm	≥ 5 µS/cm	≥ 0.5 µS/cm

*Type see Ordering Information DS21

Dimensions: Stainless Steel Flowmeter Primary, Model DS21F, DN 3 - DN 40 [1/8“-1 1/4“]

Fixed Flange DIN 2501 and ANSI



Dimensions DIN 2501 Fixed Flanges

Liner PFA												Weight
DN	PN	L	A	b	D	k	E	F	G	d2	d4	ca. kg
3–8	10–40	130	37	17.5	90	60	116	62	132	14	36	2
10		200	37	17.5	90	60	116	62	132	14	36	2
15		200	37	19.5	95	65	116	62	132	14	36	2
20		200	42	19.5	105	75	120	66	136	14	41	3.5
25		200	54	19.5	115	85	127	73	143	14	54	4
32		200	62	19.5	140	100	132	78	148	18	64	5
40		200	67	19.5	150	110	136	82	152	18	74	5.5

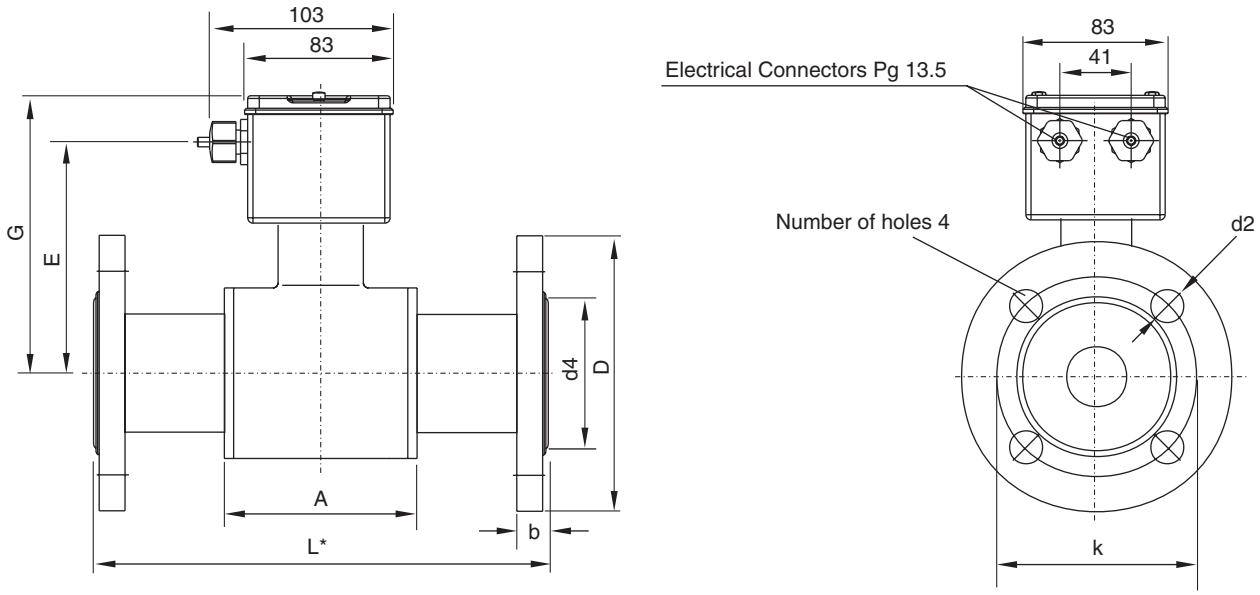
Dimensions ANSI Fixed Flanges

Liner PFA													Weight
Inch	DN	PN	L	A	b	D	k	E	F	G	d2	d4	ca. kg
1/2”	3–8	CL 150	130	37	12.6	88.9	60.3	116	62	132	15.9	34.9	2
	10–15		200	37	12.6	88.9	60.3	116	62	132	15.9	34.9	2
3/4”	20		200	42	14.2	98.4	69.8	120	66	136	15.9	42.9	3.5
1”	25		200	54	15.8	108	79.2	127	73	143	15.9	50.8	4
1 1/4”	32		200	62	17.4	117.5	88.9	132	78	148	15.9	63.5	5
1 1/2”	40		200	67	19	127	98.6	136	82	152	15.9	73.0	5.5
1/2”	3–8	CL 300	130	37	15.8	95.2	66.7	116	62	132	15.9	34.9	2
	10–15		200	37	15.8	95.2	66.7	116	62	132	15.9	34.9	2
3/4”	20		200	42	17.4	117.5	82.5	120	66	136	19	42.9	3.5
1”	25		200	54	19.0	123.8	88.9	127	73	143	19	50.8	4
1 1/4”	32		200	62	20.5	133.3	198.4	132	78	148	19	63.5	5
1 1/2”	40		200	67	22.1	155.6	114.3	136	82	152	22.2	73.0	5.5

Fig. 12 Dimensions Model DS21F, Stainless Steel, DN 3 to DN 40 [1/8” to 1-1/4”], Fixed Flanges

Dimensions: Stainless Steel Flowmeter Primary, Model DS21F, DN 50 - DN 100 [2“-4“]

Fixed Flanges DIN 2501 and ANSI



Tolerance L* +0 / –3

Lay length with two ground plates
L + 6 mm

All dim´s in mm

ISO Projection Method E

Dimensions DIN 2501 Fixed Flanges

Liner PFA												Weight
DN	PN	L	A	b	D	k	N	d2	E	G	d4	ca. kg
50	10–40	200	100	24	165	125	4	18	135	161	104	8
65	10–16	200	107	26	185	145	4	18	149	175	124	10
	25–40	200					8	18				10
80	10–40	200	107	28	200	160	8	18	155	181	139	12
100	10–16	250	159	24	220	180	8	18	175	201	161	18
	25–40	250	159	24	235	190	8	22	175	201	167	18

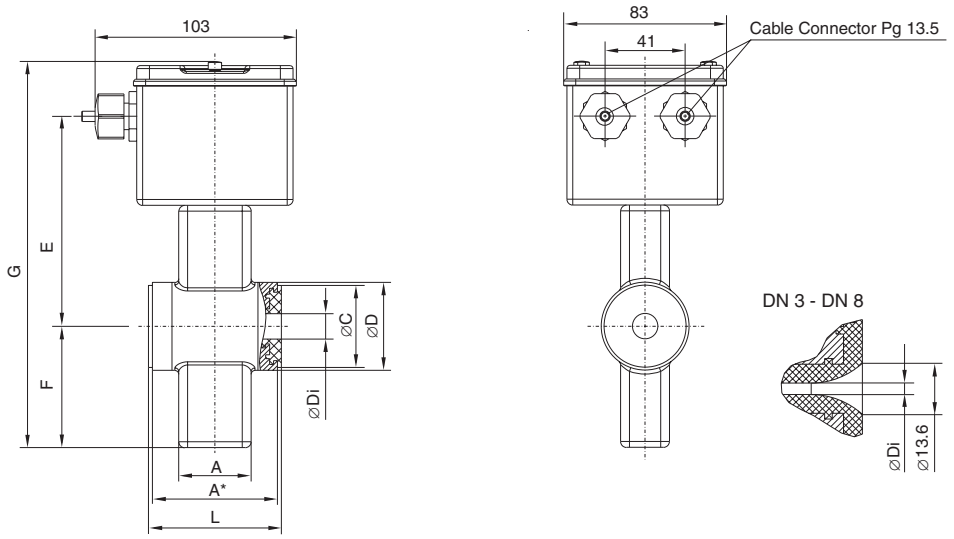
Dimensions ANSI Fixed Flanges

Liner PFA													Weight
Inch	DN	PN	L	A	b	D	k	N	E	G	d2	d4	ca. kg
2”	50	CL 150	200	100	23	152	121	4	135	161	19	99	8
2 1/2”	65		200	107	26	178	140	4	149	175	19	118	10
3”	80		200	107	28	191	152	4	155	181	19	131	12
4”	100		250	159	28	229	190	8	175	201	19	171	18
2”	50	CL 300	200	100	26	165	127	8	135	161	19	102	8
2 1/2”	65		200	107	27	191	149	8	149	175	22	124	10
3”	80		200	107	32	210	168	8	155	181	22	143	12
4”	100		250	159	36	254	200	8	175	201	22	177	18

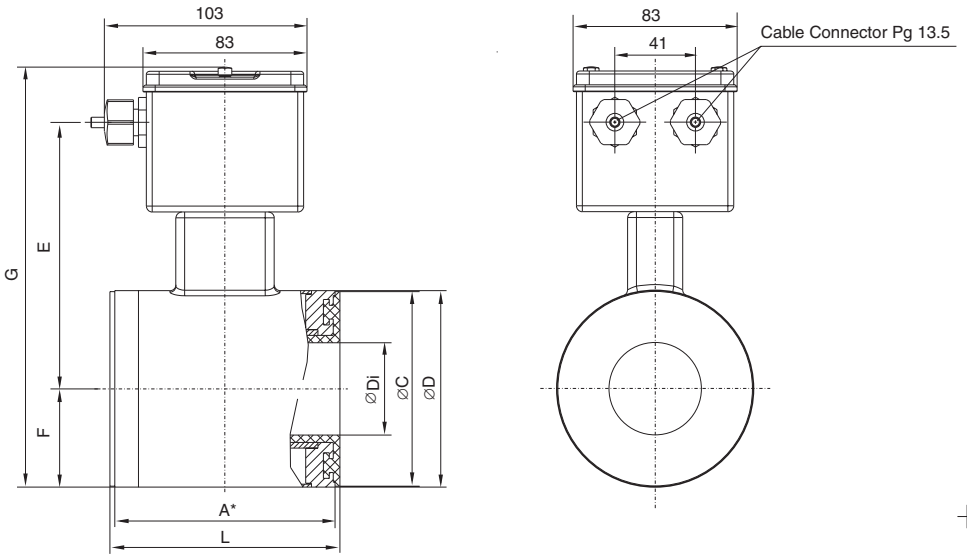
Fig. 13 Dimensions Model DS21F, Stainless Steel, DN 50 to DN 100 [2” to 4”], Fixed Flanges

Dimensions: Stainless Steel Flowmeter Primary, Model DS21W, DN 3 - DN 100 [1/8“-4“], Wafer Design

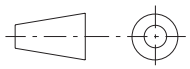
DN 3 – DN 40
[1/8” - 1-1/4”]



DN 50 – DN 100
[2” -4”]



All dim´s in mm



Mounting dimensions upon request

DN	Inch	PN	A*	A	∅C	∅Di	∅D	E	F	G	L[1)]	kg
3 4 6 8 10 15	1/8 5/32 1/4 5/16 3/8 1/2	10–40 CL 150/ CL 300	64	37	42	3 4 6 8 10 13	45	108	62	197	68	1.5
20	3/4		74	42	50	18	54	112	66	205	78	2.0
25	1		86	54	59	24	63	119	73	219	90	2.0
32	1-1/4		94	62	69	30	73	124	78	229	98	2.5
40	1-1/2		99	67	77	36	82	128	82	237	103	3.0
50	2		112	–	95	47	100	136	50	213	117	4.0
65	2-1/2		99	–	111	62	116	150	58	235	103	4.5
80	3		99	–	128	74	133	157	66.5	250	103	6.5
100	4		129	–	155	96	160	176	80	283	133	8.5

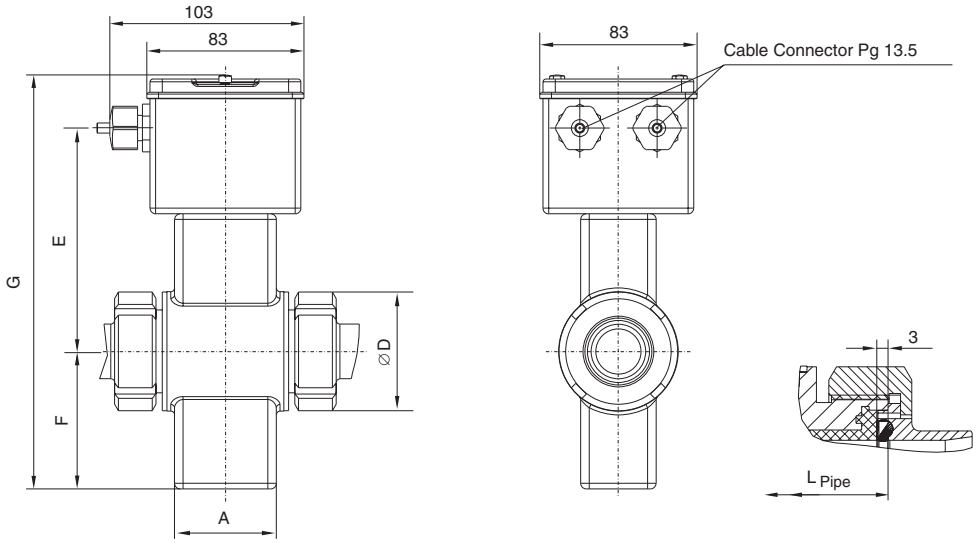
1) Lay lengths with 2 ground plates L + 3 mm

Fig. 14 Dimensions, Model DS21W, DN 3 to DN 100 [1/8” to 4”], Wafer Design

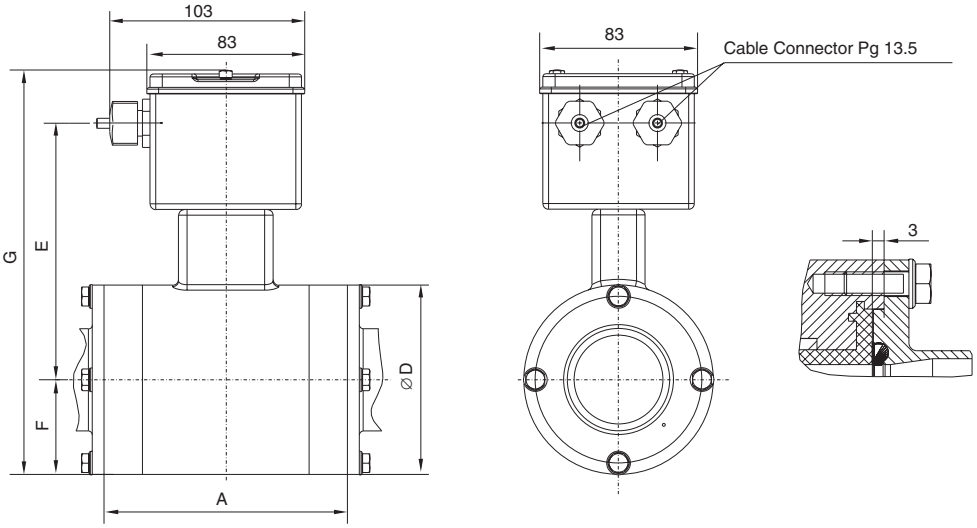
Dimensions: Flowmeter Primary, Various Process Connections

Models DS21, -L, -A, -D, -R, -S, -T, -U, -E, -I, -G, -H

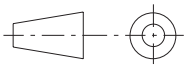
DN 3 – DN 40
[1/8" - 1-1/4"]



DN 50 – DN 100
[2" - 4"]



All dim´s in mm



ISO Projection Method E

Mounting dimensions upon request

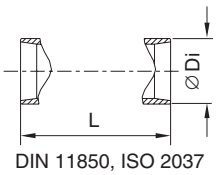
DN	Inch	A	∅D	E	F	G	L_{pipe}	kg[1)]
3–10	1/8–3/8	37	44	108	62	197	85	1.5
15	1	37	44	108	62	197	85	1.5
20	3/4	42	63	112	66	205	90	2.0
25	1	54	63	119	73	219	105	2.0
32	1-1/4	62	78	124	78	229	120	2.5
40	1-1/2	67	78	128	82	237	125	3.0
50	2	128	100	136	50	213	–	4.0
65	2-1/2	114	116	150	58	235	–	4.5
80	3	114	133	157	66.5	250	–	6.5
100	4	144	160	176	80	283	–	9.0

Lay lengths with process connections see Page 19
1) Plus process connection weight see Page 19

Fig. 15 Dimensions, Model DS21, DN 3 to DN 100 [1/8" to 4"], Various Process Connection

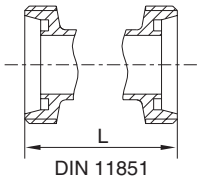
Dimensions: Stainless Steel Flowmeter, Adapters for Various Process Connections, Model DS21

Size		Weld Stubs			Food Indus. Fittings		Ascept.Connection		Tri-Clamp	
		DIN 11850		Wgt.	DIN 11851	Wgt.	DIN 11864-1	Wgt.	DIN 32676	Wgt.
DN	Inch	∅Di	L	kg[1)]		kg[1)]	Form B	kg[1)]		kg[1)]
3–10	1/8 - 3/8	10	127	0.4	169	0.5	161	0.5	163	0.5
15	1/2	16	127	0.4	169	0.5	161	0.5	163	0.5
20	3/4	20	132	0.7	180	0.9	170	0.9	168	0.7
25	1	26	149	0.7	207	0.9	197	0.9	192	0.8
32	1-1/4	32	166	1.0	230	1.4	220	1.4	209	1.5
40	1-1/2	38	171	1.0	237	1.4	227	1.4	214	1.4
50	2	50	173	1.0	243	1.4	233	1.4	216	1.2
65	2-1/2	66	165	1.4	245	2.2	233	2.2	221	1.6
80	3	81	169	2.0	259	3.2	245	3.2	225	2.4
100	4	100	199	2.6	307	4.4	291	4.4	255	3.1



Weld Stubs

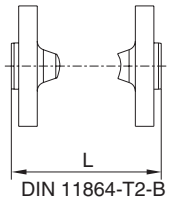
DIN 11850, ISO 2037



Pipe Fittings

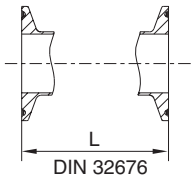
DIN 11851
DIN 11864-1-B

Flanges			
DN	Inch	DIN 11864-T2-B	Weight kg[1)]
10	3/8	183	0.9
15	1/2	183	1.0
20	3/4	188	1.3
25	1	207	1.6
40	1-1/2	229	1.8
50	2	231	2.2
65	2-1/2	223	3.0
80	3	227	4.0
100	4	257	5.0



Flanges

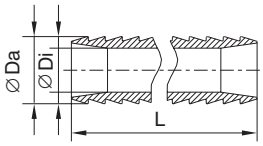
DIN 11864-T2-B



Tri-Clamp

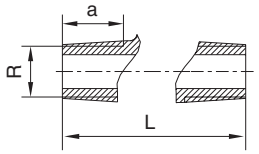
DIN 32676

Hose Connector					
DN	Inch	Di	Da	L	Weight kg[1)]
3–10	1/8 - 3/8	10	14.5	159	0.4
15	1/2	16	21	159	0.4



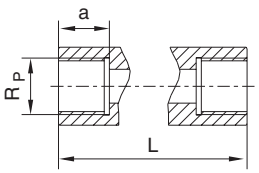
Hose Connector

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



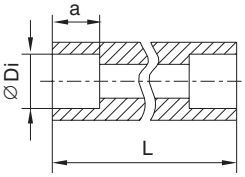
Male Threads

Female Threads ISO 228 / DIN 2999					
DN	Inch	R	a	L	Weight kg[1)]
3–10	1/8 - 3/8	3/8”	15	139	0.5
15	1/2	1/2”	15	139	0.5
20	3/4	3/4”	22	164	0.9
25	1	3/4”	22	179	0.8



Female Threads

PVC-Cement Sleeve					
DN	Inch	Di	a	L	Weight kg[1)]
3–10	1/8 - 3/8	16	14	143	0.4
15	1/2	20	16	159	0.4
20	3/4	25	19	164	0.6
25	1	32	22	199	0.6



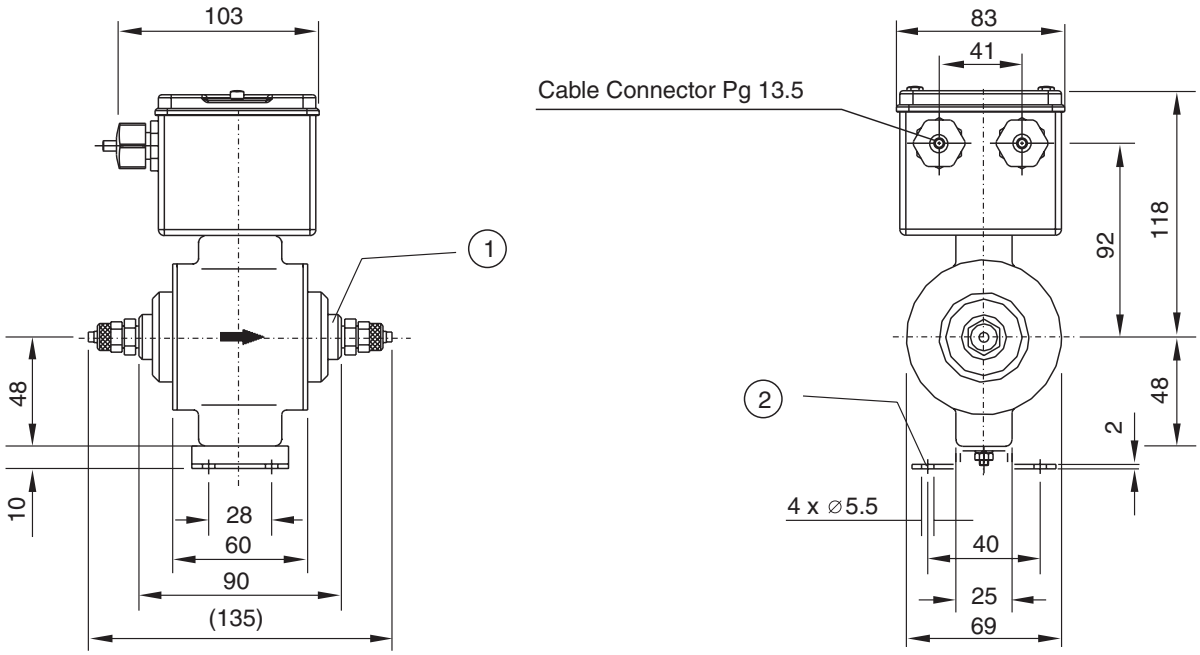
PVC-Cement Sleeve

1) Weight per pair

Fig. 16 Dimensions, Model DS21, DN 3 to DN 100 [1/8” to 4”], Adapters for Various Process Connections

Dimensions: Stainless Steel Flowmeter Primary, Model DS21B, DN 1 - DN 2 [1/25“ - 3/32“]

1/8”-Threaded Nipples



Note:
The flowmeter primary generally includes ground electrodes made of the same material as the signal electrodes.

Comment:
1) Connection dimensions for pipe connections G 1/8” female threads
2) Mounting device optional

Liner PEEK/Torlon				
DN	Inch	PN	Process Conn.	Weight ca. kg
1–2	1/25 - 3/32	10	Threaded nipples	1.5

All dim´s in mm

ISO Projection Method E

Fig. 17 Dimensions, Model DS21B, DN 1 to DN 2]1/25” to 3/32”], 1/8” Threaded Nipples

Ordering Information: Stainless Steel Flowmeter

In addition to the Ordering Number please provide the following information:
Fluid, fluid temperature, operating pressure, pipeline (ground plate, ground electrodes)[1)]

Ordering Number		**DS21**
Process Connections		
Wafer Design		**W**
Fixed flanges DIN 2501/ANSI		**F**
Flanges Type APV FAB1 DIN 11864-2-B		**L**
Aseptic connections DIN 11864-1-B		**A**
Weld stubs DIN 11850		**R**
Pipe connections DIN 11851		**S**
Tri-Clamp DIN 32676		**T**
Male threads ISO 228/DIN 2999	(DN 3 – 25 [1/8”-1”])	**E**
Female threads ISO 228/DIN 2999	(DN 3 – 25 [1/8”-1”])	**I**
PVC-cement sleeve	(DN 3 – 25 [1/8”-1”])	**G**
Hose connectors	(DN 3 – 15 [1/8”-1/2”])	**H**
1/8” Threaded nipples	(DN 1 – 2 [1/25”-3/32”])	**B**
Others		**Z**
Liner Material		
PFA (DN 3 - 100 [1/8”-4”])		**P**
PEEK (DN 1 - 2 [1/25”-3/32”])		**K**
Torlon (DN 1 - 2 [1/25”-3/32”])		**N**
Meter Size		
DN 1	1/25”	**01**
DN 1.5	1/16”	**1S**
DN 2	3/32”	**02**
DN 3	1/8”	**03**
DN 4	5/32”	**04**
DN 6	1/4”	**06**
DN 8	5/16”	**08**
DN 10	3/8	**10**
DN 15	1/2	**15**
DN 20	3/4	**20**
DN 25	1	**25**
DN 32	1-1/4	**32**
DN 40	1-1/2	**40**
DN 50	2	**50**
DN 65	2-1/2	**65**
DN 80	3	**80**
DN 100	4	**1H**
Signal Electrode Mat’l	**/Ground Electrode Material[2)]**	
SS No.1.4571[316TI]	/none	**S**
Hastelloy B-2	/none	**B**
Hastelloy C-4	/none Standard	**H**
Titanium	/none	**M**
Tantalum	/none	**T**
SS No. 1.4539	/none (Food Industry applications)	**F**
Platinum-Iridium	/none	**P**
Stn. stl.l	/with	**E**
Hastelloy B-2	/with	**N**
Hastelloy C-4	/with Standard	**O**
Titanium	/with	**I**
Tantalum	/with	**Q**
SS No. 1.4539	/none (Food Industry applications)	**R**
Platinum-Iridium	/with	**G**

Continued on next page

1) Only required for Wafer Designs and insulated pipelines and for PVC-cement sleeve.
2) Ground electrodes available from DN 3 [1/8”]. Model DS21B includes ground electrodes as standard.

Ordering Information: Stainless Steel Flowmeter

Ordering Number	**DS21**																			
Pressure Rating	Standard for flanges DIN 11864-2																			
PN 10	Tri-Clamp, male/female threads,																			
PN 16						**D**														
PN 25	Only Wafer Design, pipe connections, fixed flanges,					**E**														
PN 40	and weld stubs					**F**														
JIS K10						**K**														
ANSI CL 150	Only DS21W or DS21F					**P**														
Process Connection Material																				
None	(Only Wafer Design)						**0**													
SS No. 1.4571[316Ti]	Standard for DS21F and DS21B						**3**													
SS No. 1.4404[316L]	Standard for flanges						**4**													
SS No. 1.4301[304]	Standard						**6**													
PVC	(Only PVC-cement sleeve)						**7**													
POM	(Only DS21B)						**8**													
Others							**9**													
Conductivity [1]	**/ Mounting or Flange Accessories**																			
≥20 µS/cm (DN 10 - DN 100[3/8”-4”])	/ none							**A**												
≥20 µS/cm (≤DN 8[5/16”]); ≥5 µS/cm (≥DN 10[3/8”])	/ none							**B**												
≥20 µS/cm (DN 10 - DN 100[3/8”-4”])	/ with							**C**												
≥20 µS/cm (≤DN 8[5/16”]); ≥5 S/cm (≥DN 10[3/8”])	/ with							**D**												
≥5 µS/cm (≤DN 8[5/16”]); ≥0.5 S/cm (≥DN 20[3/4”])[3]	/ none							**E**												
≥5 µS/cm (≤DN 8[5/16”]); ≥0.5 S/cm (≥DN 20)[3/4”][3]	/ with							**F**												
≥20 µS/cm (DN 10 - DN 100[3/8”-4”])	/ Prot. flg.[2] SS No.1.4571[316Ti] (only DS21F)							**Q**												
≥20 µS/cm (DN 10 - DN 100[3/8”-4”])	/ Grd. plt.[2] SS No.1.4571[316Ti] (only DS21F)							**R**												
≥20 µS/cm (≤DN 8[5/16”]); ≥5 µS/cm (≥DN 10[3/8”])	/ Prot. flg.[2] SS No.1.4571[316Ti] (only DS21F)							**S**												
≥20 µS/cm (≤DN 8[5/16”]); ≥5 µS/cm (≥DN 10[3/8”])	/ Grd. plt.[2] SS No.1.4571 (only DS21F)							**T**												
≥5 µS/cm(≤DN 8[5/16”]); ≥0.5µS/cm(≥DN 20[3/4”])[3]	/ Prot.flg.[2] SS No.1.4571[316Ti](only DS21F)							**U**												
≥5 µS/cm (≤DN 8[5/16”]); ≥0.5µS/cm(≥DN 20[3/4”])[3]	/ Grd. plt.[2] SS No.1.4571[316Ti](only DS21F)							**V**												
Temperature Range																				
Standard design <130 °C									**S**											
Approvals																				
Standard (none)										**A**										
Certifiable, Liquids other than Water (Milk, Concentrates, Wort, Beer, Brine)										**C**										
Inspection per 3.1B per EN 10204										**D**										
Certifiable, Liquids other than Water (Beer, KEG-Filling)										**E**										
Protection Class																				
IP 67											**2**									
IP 68											**3**									

1) A preamplifier is installed in flowmeter primaries with Ordering Information codes B, D, E, F, S, T, U and V .
The converter must be ordered with a preamplifier power supply.
2) Protections flanges are mounted to the flanges on both sides, the ground plate on one side.
3) Flowmeter primaries DN 10 - DN 15 [3/8” - 1/2”] for conductivities ≥ 0.5 µS/cm upon request.

Specifications: Converter 50ES7000

Fig. 18 Converter

Minimum Conductivity
See Tables on Pages 8 and 13

Flow Range
Continuous, 0.05 $Range_{max}$ to 1.0 $Range_{max}$, whereby the flowrate measurements can be made for short periods of time to 130 % of the range setting.

Minimum Response Time
10 ms

Supply Power

AC Voltage
24 V, 115/120 V, 230 V

Allowable Voltage Variations
+10 % / –10 %

Line Frequency
50/60 Hz ± 6 %

Power Consumption
≤ 30 VA (flowmeter primary and converter)

Ambient Temperature
-10 °C to +50 °C

Protection Class per EN 60529
IP 65 for Wall mount housing
IP 00 for 19”-plug-in unit
IP 65 for Stainless steel enclosure
IP 65 for Panel mount enclosure

Designs and Weights

Wall Mount Housing
Painted cast light metal. Paint coat 60 µm thick, lower section light gray (RAL 9002). Upper section dark gray (RAL 7012).
For dimensions see Page 30, weight approx. 4.2 kg.

19”-plug-in unit 28 TE
(21 TE converter and 7 TE control card), 3HE, 167 mm deep, therefore 3 units per card frame. Dimensions Page 30, Weight ca. 1.8 kg. Designs with relay contact output/optocoupler contact output only available as a replacement instrument!

19”-plug-in unit 21 TE
(Only converter module without control card) 3HE, 167 mm deep, therefore 4 units per card frame. Dimensions see Page 30. Weight approx. 1.6 kg. Contact output only available with optocoupler.

Panel Mount Enclosure
3-piece housing, door with window, center section with 2x2 mounting clamps, pivoting rear section (material SS No. 1.4301 [304]) for installation of a 19”-Insert cassette or a 19”-Report Printer. Dimensions see Page 31, empty weight approx. 3.7 kg.

Stainless Steel Hings Enclosure
3-piece 19”-pivoted housing consisting of a wall element, pivoting element and a viewing door with window (material SS No. 1.4301 [304]) for installation of a number of 19”-Insert cassettes. Dimensions see Page 31.

3 HE Empty weight approx. 18 kg
6 HE Empty weight approx. 36 kg
9 HE Empty weight approx. 54 kg
12 HE Empty weight approx. 72 kg

Electrical Connectors

Field Mount Enclosure
Cable entry Pg 13.5, screw terminals

19”-plug-in unit
Screw terminals, plugable

Stainless Steel Enclosure
Cable entry 3 HE: 10 x Pg 13.5 and 5 x Pg 16
Cable entry 6 HE: 15 x Pg 13.5 and 5 x Pg 16
Cable entry 9 HE: 20 x Pg 13.5 and 7 x Pg 16
Cable entry 12 HE: 25 x Pg 13.5 and 10 x Pg 16

Panel Mount Enclosure
Cable entry 5 x Pg 13.5

Signal Cable
A 10 m long signal cable is shipped with each flowmeter. The maximum signal cable length is a function of the flowmeter primary design:

- Max. 50 m for the standard design (≥ 20 µS/cm,) and for the certified Volume Flowrate Integrator.
- Max. 200 m for the designs with a preamplifier see Tables on Pages 8 and 13 (Ordering No. see Footnote Page 32).

Specifications: Converter 50ES7000

Forward/Reverse Flow Metering
A direction indicator is displayed on the converter by the +/- signs which precede the flowrate values. It should be noted that the converter always operates in the forward flow direction and the switch contacts are not activated by reverse flow.

Batch Cycles
4 different batch quantities together with their corresponding anticipatory quantities, for fine batches, can be entered. In addition 4 separate batch time limits can be entered for safety shut down.

For each batch quantity there are incorporated in the converter: a total quantity totalizer which sums the volumes for all the batch cycles; a counter which registers the total number of batch cycles; and an individual counter to register the number of overfills and underfills.

Display
2 x 16 character Dot-Matrix display with background lighting.

Parameter Settings
Data is entered over a user friendly foil keypad (16 keys) or over a serial data link.

Display of the Instantaneous Flowrate and Totalizer Values
Instantaneous flowrate in %. Internal flow totalization in a variety of engineering units.

The following units can be selected using the arrow keys.The units apply to $Range_{max}$ and Q_{max}

Totalizer Units	Units Q_{max}			
Unit	./Second	./Minute	./Hour	/Day
Milliliter	ml/s	ml/min	ml/h	
Liter	l/s	l/min	l/h	
Hectoliter	hl/s	hl/min	hl/h	
Cubic meter	m^3/s	m^3/min	m^3/h	
Imperial-gallon per	igps	igpm	igph	
U.S.-mill-gallon per day				mgd
U.S.-gall per		gpm	gph	
Barrel-Brewery	bbl/s	bbl/min	bbl/h	
Barrel-Petrochemical		bls/min	bls/h	bls/day
Gram	g/s	g/min	g/h	
Kilogram	kg/s	kg/min	kg/h	
Ton (metric)	t/s	t/min	t/h	

Option: Unscaled Pulse Output Optocoupler (0-10 kHz)
Optocoupler

Data Link
RS 485 max. cable length 1200 m
max. number of instruments in parallel 32,

! Notes:

The instrument complies with the NAMUR Recommendation “EMC-Guidelines for Manufacturers and Users of Electrical Instruments and Systems” Part 1.

Observed that the instrument should not be installed in the vicinity of power devices such as thyristor controls, motors, or other elements.

Input Signals

Batch Start (Terminals G2, 68)
Optocoupler input 5 V < U_E < 32 V; 1 mA < I_E < 10 mA

Batch Stop (Terminals G2, 69)
Optocoupler input 5V < U_E < 32 V; 1 mA < I_E < 10 mA

Batch Quantity Selection (Terminals G2, A1, A2)
Batch quantity 1, 2, 3 or 4
Optocoupler input 5 V < U_E < 32 V; 1 mA < I_E < 10 mA

Automatic Zero Adjust, External
Using both the start and stop inputs the external zero adjustment can be initiated.

The adjustment conditions are a full metering tube and zero flowrate. In order to initiate the adjustment procedure the start and stop inputs must be activated for at least 2 seconds, and it is important to note that the stop input must be activated at least 100 ms before the start input. The adjustment procedure takes 10 seconds and cannot be interrupted.

Both inputs must be reset during this 10 second period.

Output Signals

Standard
The contact outputs can be configured as relay or optocoupler outputs.

Contact Outputs
Antic. contact Terminals P1, P1
End contact Terminals P3, P4
Alarm contact Terminals V5, V6
System alarm Terminals V7, V8, V9

Relay Contact
Max. 28 V max. 0.5 A, max 8 W or

Optocoupler
$U_{CE} \leq 25$ V, $I_{CE} \leq 7.5$ mA

Output Signals

Options
Unscaled Pulse Output (0-10 kHz)

Pulse Factor
0 % flowrate = 0 kHz, linear to 100 % flowrate = 10 kHz
! Cannot be scaled !

Specifications: Converter 50ES7000

Pulse Width
0.032 ms

Passive, Optocoupler (Terminals 59/60)
Optocoupler 5 V < U_{CE} < 25 V, 5 mA < I_{CE} < 7.5 mA

Empty Pipe Detector (Terminals V5, V6)
Automatic empty pipe detector with signal on the alarm contact (max. signal cable length 50 m). This option is not available for flowmeter primary designs which incorporate a preamplifier.

Serial Data Link
The serial data links available in RS 485.

RS 485 (ASCII-Protocol)
V_{ss} = 5 V input impedance ≥ 12 kΩ
Max. cable length <1200 m.
Baudrate: 110-9600 Baud, 14400/28800 Baud.
Max. 32 instruments in parallel on a single bus. A shielded data cable with twisted pairs is recommended.
Terminals: V1, V2, V3, V4; Function: T-, T+, R-, R+.

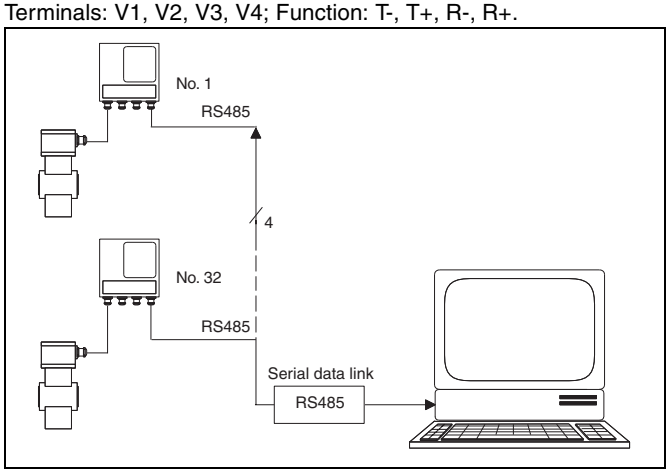


Fig. 19 Communication with RS 485 Data Link

Unscaled Pulse Output, Data Link
In addition to the serial data link RS 485options the following configuration can be selected. The alarm output is then not available.

Unscaled Pulse Output (0-10 kHz)
Pulse width 0.032 ms

Passive, optocoupler (Terminals 59, 60)
Optocoupler U_{CE} ≤ 25 V, I_{CE} ≤ 7.5 mA

Specifications: Converter 50ES7000

Communication and Printer Reports
Six different protocols are available for the data link communication: µDCI-Binary, ASCII, Print1 – Batch Err., Print2 – Batch, Print3 – Service and Print4 – Daily Sum. Detailed information relative to the data link communication can be found under Data Link Protocol and ASCII-Communication.

µDCI-Binary
µDCI-Binary is compatible with the “Micro-DCI” Process Control System from ABB.

ASCII
If a ABB Remote Operator Unit is connected to the converter data link, the parameter “Communication ASCII” is to be selected in the “Data Link” submenu. This should also be done if communication is to be established between a PC and the converter .

Print1 – Batch Err.
This protocol automatically initiates a print out when an under- or overfill occurs.

```
12.03.1993          11:09´09
Overfill
Instr. No..                0
A1      No.                5
Q       30.0083            1
```

Date, Time

A1 = Batch quantity1
No. = Batch cycle number
Q = Actual batch quantity
Qa = Entered batch quantity (“Overfill” set for 0.0005 %)

Print2 – Batch
This protocol automatically initiates a print out after each batch cycle.

```
12.03.1993          11:09´08
Instr. No.                 0
A1      No.                1
Q       29.9990            1
Qg      29.9990            1
12.03.1993          11:06´08
Instr. No.                 0
A1      No.                2
Q       10.8396            1
Qg      40.8386            1
12.03.1993          11:07´08
Instr. No.                 0
A1      No.                3
Q       30.0130            1
Qg      70.8516            1
```

Date, Time

A1 = Batch quantity 1
No. = Batch cycle number
Q = Actual batch quantity
Qg = Totalized batch quantity

Print3 – Service
This protocol automatically initiates a detailed print out after every batch cycle of the important data for the latest batch cycle.

```
12.03.1993          11:14´08
Instr. No.^                0
A1      No.               10
Q       29.9976            1
Qa      30.0000            1
Error   -0.011 %
Qn      0.0416 l
Qnk     -0.043 l
Nz      2000.0 ms
Cal     -1.460 %
Qab     0.0000 l
```

Date, Time

A1 = Batch quantity 1
No. = Batch cycle number
Q = Actual batch quantity
Qa = Entered batch quantity
Error= Percent difference between Q and Qa
Qn = Measured overrun quantity
Qnk = Entered overrun correction quantity
Nz = Entered overrun time
Cal = Entered calibration
Qab = Entered flash off quantity

Print4 – Daily Sum
A daily report can be generated in addition to the other three printer reports. At the end of the production cycle the following parameters can be printed. The print out is initiated for each batch quantity, one after the other from the keypad on the converter. If daily reports from more than one converter are to be printed on a single report printer, then the reports should be initiated one after the other. Each converter required a RS 485 data link.

```
13.03.1993          11:07´08
Instr. No.                 0
A1      Number             5
Qa      30.0000 l
Qg      131.005 l
Underfills                 1
Overfills                  0
```

Date, Time

A1 = Batch quantity 1
Number = Number of batch cycles
Qa = Entered batch quantity
Qg = Total batch quantity
(In this example the registered underfill quantity is 11 Liter)

After standardizing the printer reports, the following printer reports were renamed from previous printer report names and text information added. In addition all reports can now include date and time information if hardware support for this function is available.

Printer 1 = Print1–Batch Err.
Printer 2 = Print2–Batch
Printer 3 = Print3–Service
Daily Report= Print4–Daily Sum

! Note:
For selection of the printer reports Print1–Batch Err., Print2–Batch and Print3–Service each converter needs his own printer.

Interconnection Diagram for Standard-Design, with Preamplifier, Valid for all Converter Designs

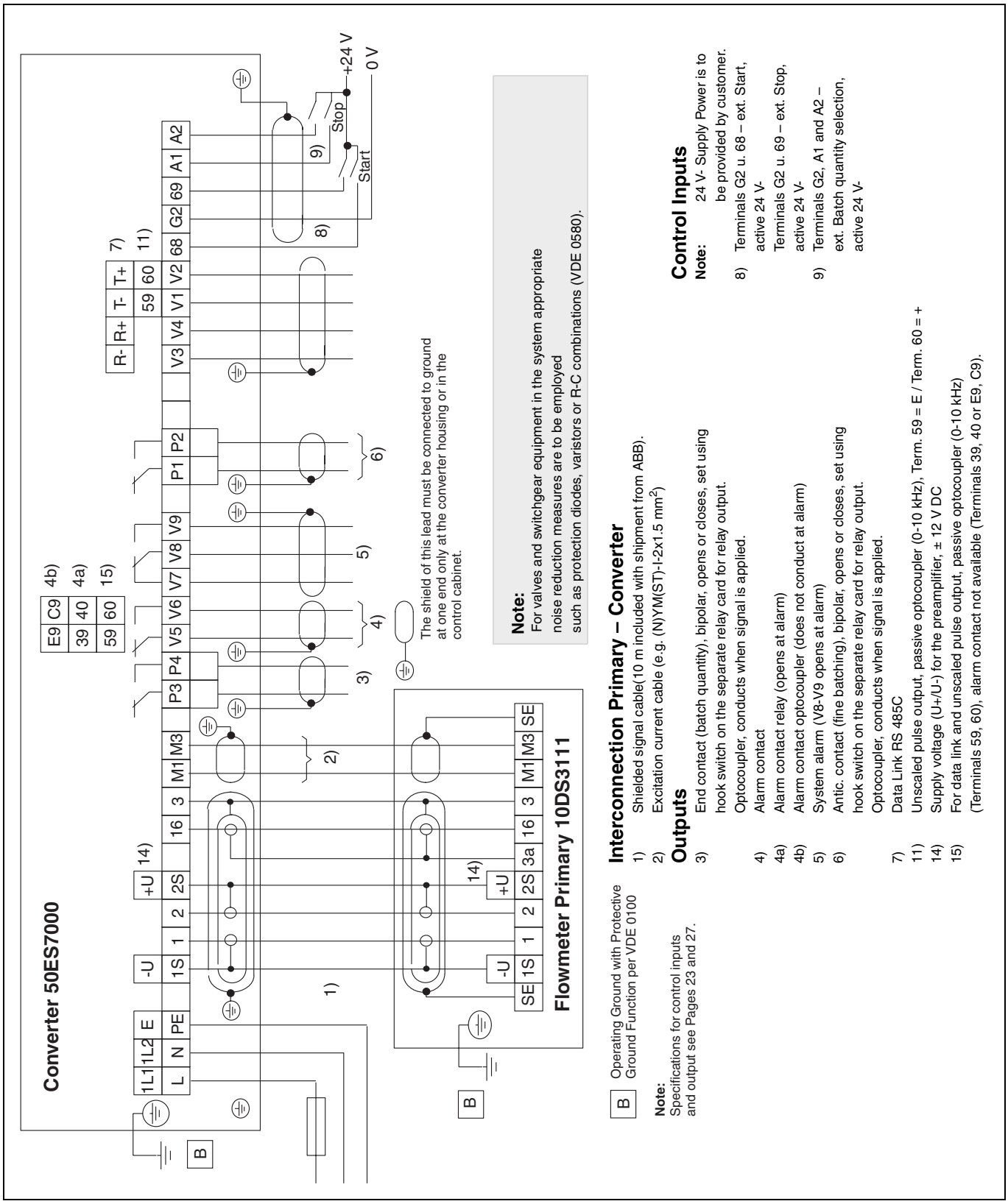
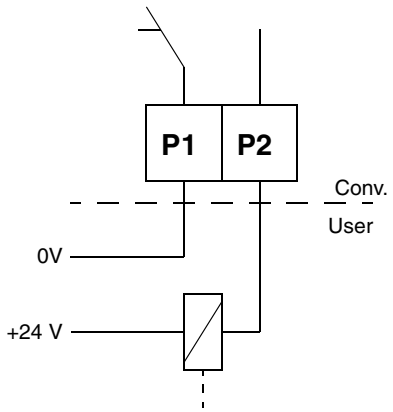


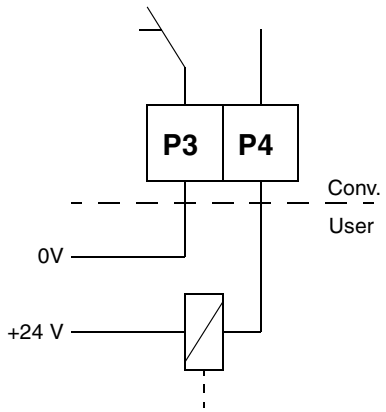
Fig. 20

Interconnection Examples for Peripherals

Antic. Contact Controls Anticipatory Quantity



End Contact Controls Batch Quantity



Contact Settings

logic 0 = open
logic.1 = closed

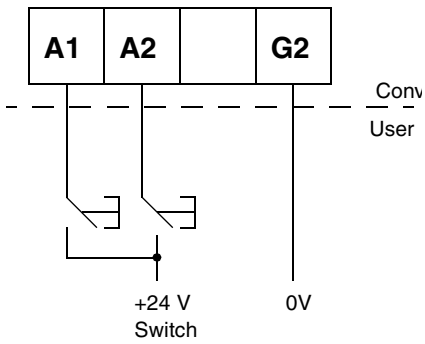
Antic. Contact		End Contact		Operating Mode
P1	P2	P3	P4	Relay Design
0		0		Stop
1		1		Start batch cycle
0		1		Antic. quantity reached
0		0		Batch quantity reached

For valves or switchgear equipment appropriate noise reduction measures are to be employed such as protection diodes, varistors, or RC combinations (VDE 0580).

All leads are to be shielded with their shields connected to the protective ground.

Batch Quantity Selection

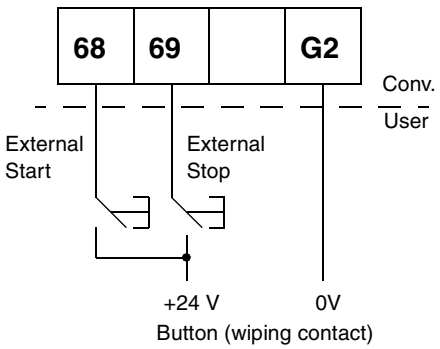
Over external contact



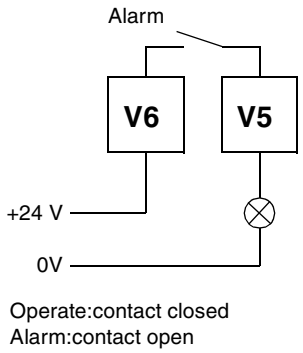
Voltage at		
A1	A2	Batch Quantity
0 V	0 V	4
24 V	0 V	3
0 V	24 V	2
24 V	24 V	1

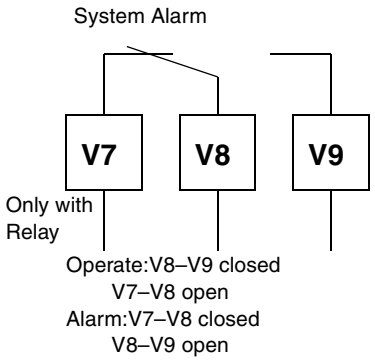
External Batch Cycle Control

Stop interrupts the batch cycle



Signals





Electrical Specifications:

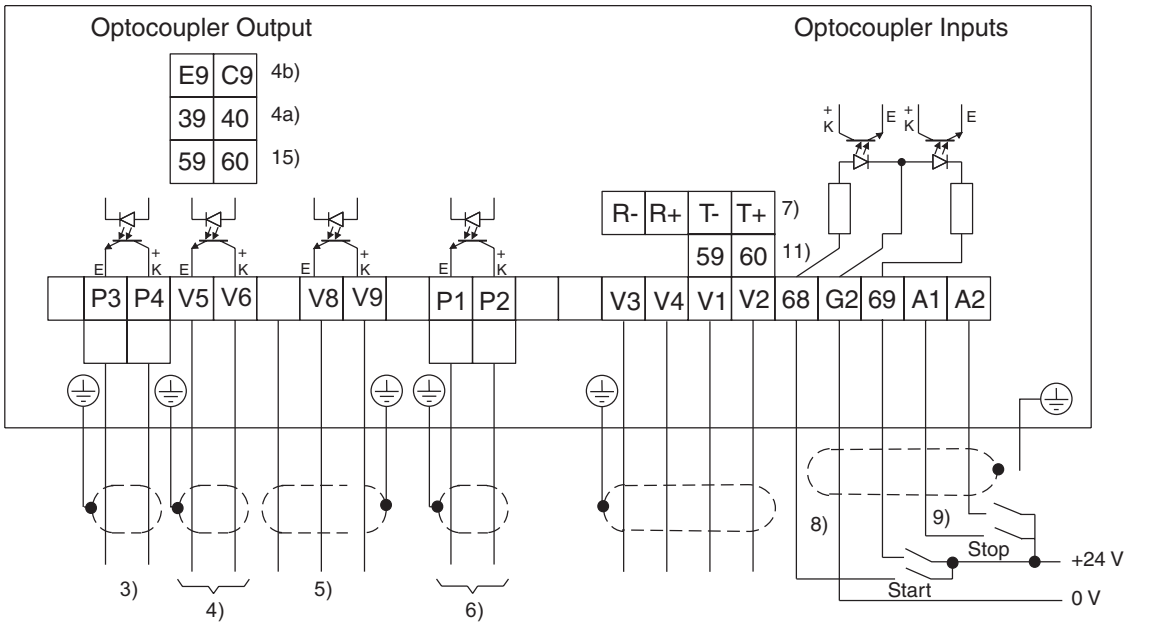
Allowable loads for

a) Relay contact
max. 28 V, 0.5 A, 8 W

b) Optocoupler output
$U_{CE} \leq 25$ V,
$I_{CE} \leq 7.5$ mA

Fig. 21

Interconnection Examples for Peripherals



For valves or switchgear equipment appropriate noise reduction measures are to be employed such as protection diodes, varistors, or RC combinations (VDE 0580).

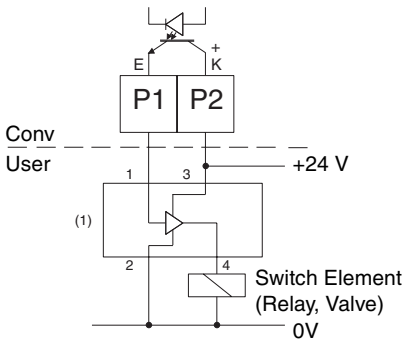
All leads are to be shielded with their shields connected to the protective ground.

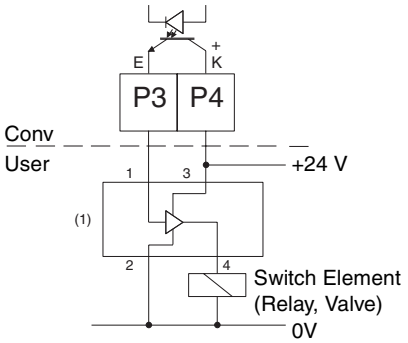
Fig. 22 Diagram for Connecting an Amplifier Module for the Optocoupler Output

Amplifier Module (not included in the ABB-Program)

Current amplifier for weak current SPC signals for subsequent processing in the system
(1) Amplifier Module e.g. Weidmüller DKV -24 V DC ± 10 %, 0.5 A

Antic. Contact Controls Anticipatory Quantity	**End Contact Controls Batch Quantity**	**Contact Settings** logic 0 = open logic 1 = closed





Antic. Contact		End Contact		Operating Mode
P1	P2	P3	P4	Relay Design
0		0		Stop
1		1		Start batch cycle
0		1		Antic. quantity reached
0		0		Batch quantity reached

Fig. 23

Interconnection Examples for Peripherals

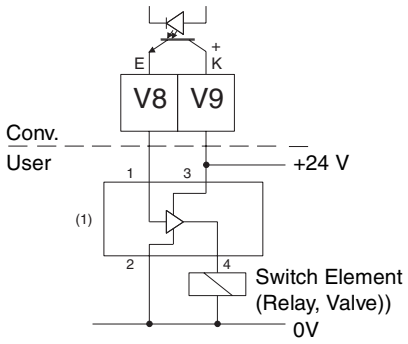
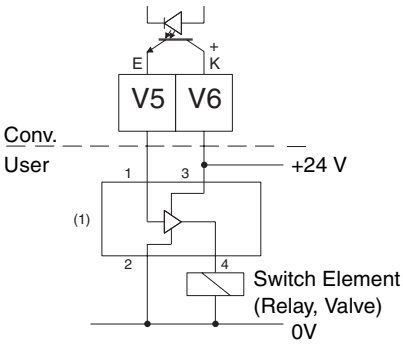
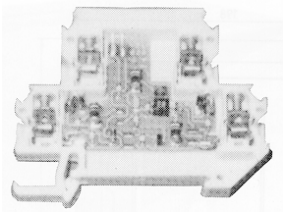
System Alarm Contact	Alarm Contact	Amplifier Module
 Normal: Opto coupler closed Alarm: Opto coupler open	 Normal: Opto coupler closed Alarm: Opto coupler open	 **Ordering Information Fa. Weidmüller:** Type:DKV-24 DC/32 (for 32 mm rails) comp. Weidmüller Part No. 801578 Type:DKV-24 DC/35 (for 35 mm rails) comp. Weidmüller Part No. 801579

Fig. 24

Specifications

Operating Input Voltage
24 V DC ± 10 %

Control Current at U_N
5 mA

Max. Input Power
550 mW

Threshold
13 ... 17 V DC

Operating Output Voltage
24 V DC ± 10 %

Max. Load Current
500 mA

Max. Voltage Drop at Max. Output
≤ 450 mV

Quiescent Current at 24 V
≤ 20 µA

Turn-On Delay
ca. 5 ms

Turn-Off Delay
ca. 25 ms

Max. Switching Frequency 1:1
3 kHz

Dielectric Strength E/A-TS
4 kV_{eff}

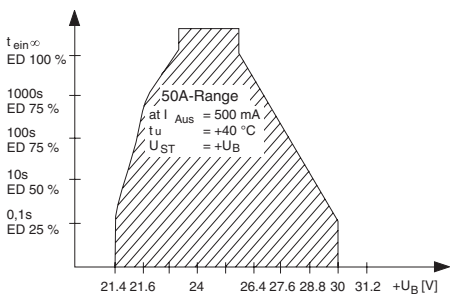
Operating Temperature
-25 to +60 °C

Storage Temperature
-40 to +60 °C

Leads
AWG 22 ... 12

Cross Sectional Lead Area
0.5 ... 4 mm^2

Operating Output Voltage
$+U_B$



Operating Input Voltage
U_{ST}

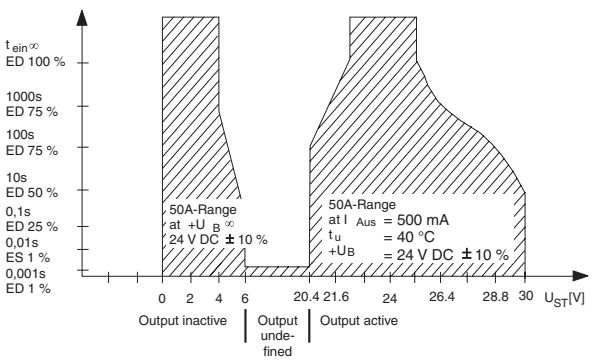


Fig. 25

Dimensions Converter

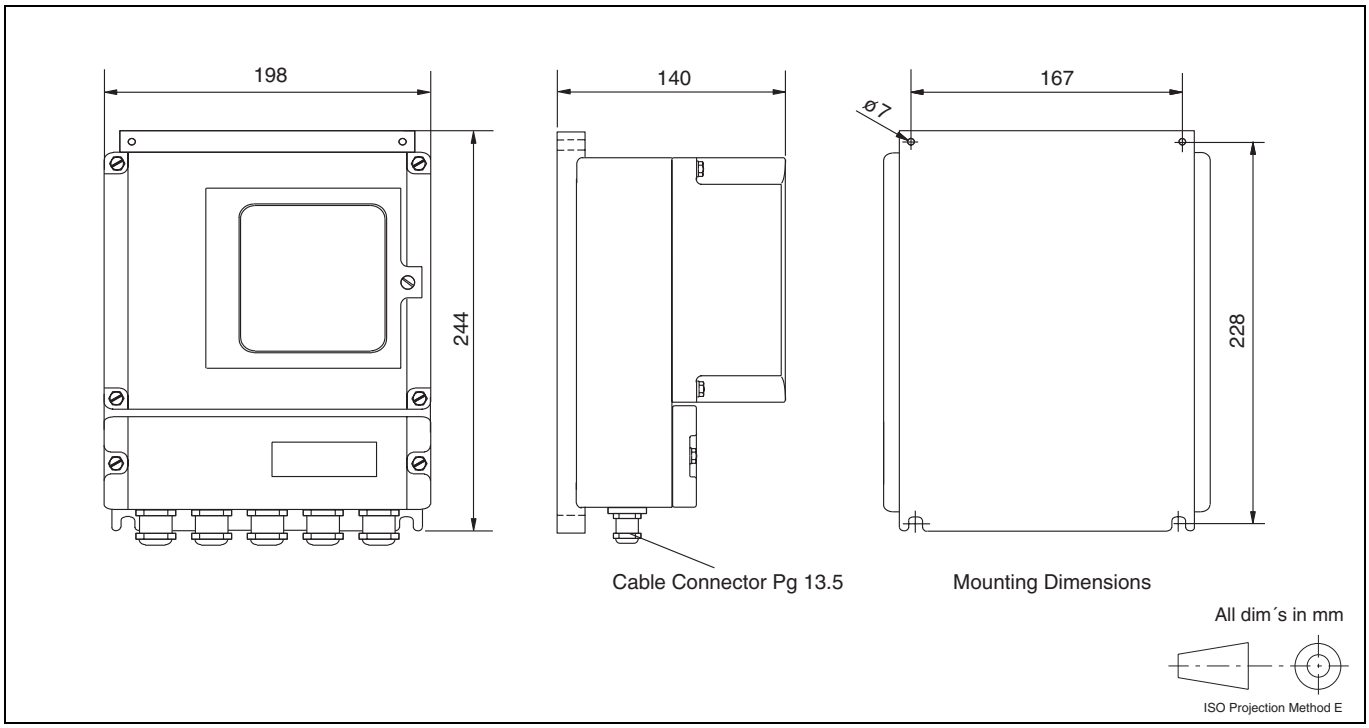


Fig. 26 Dimensions Converter Field Mount Enclosure with Window

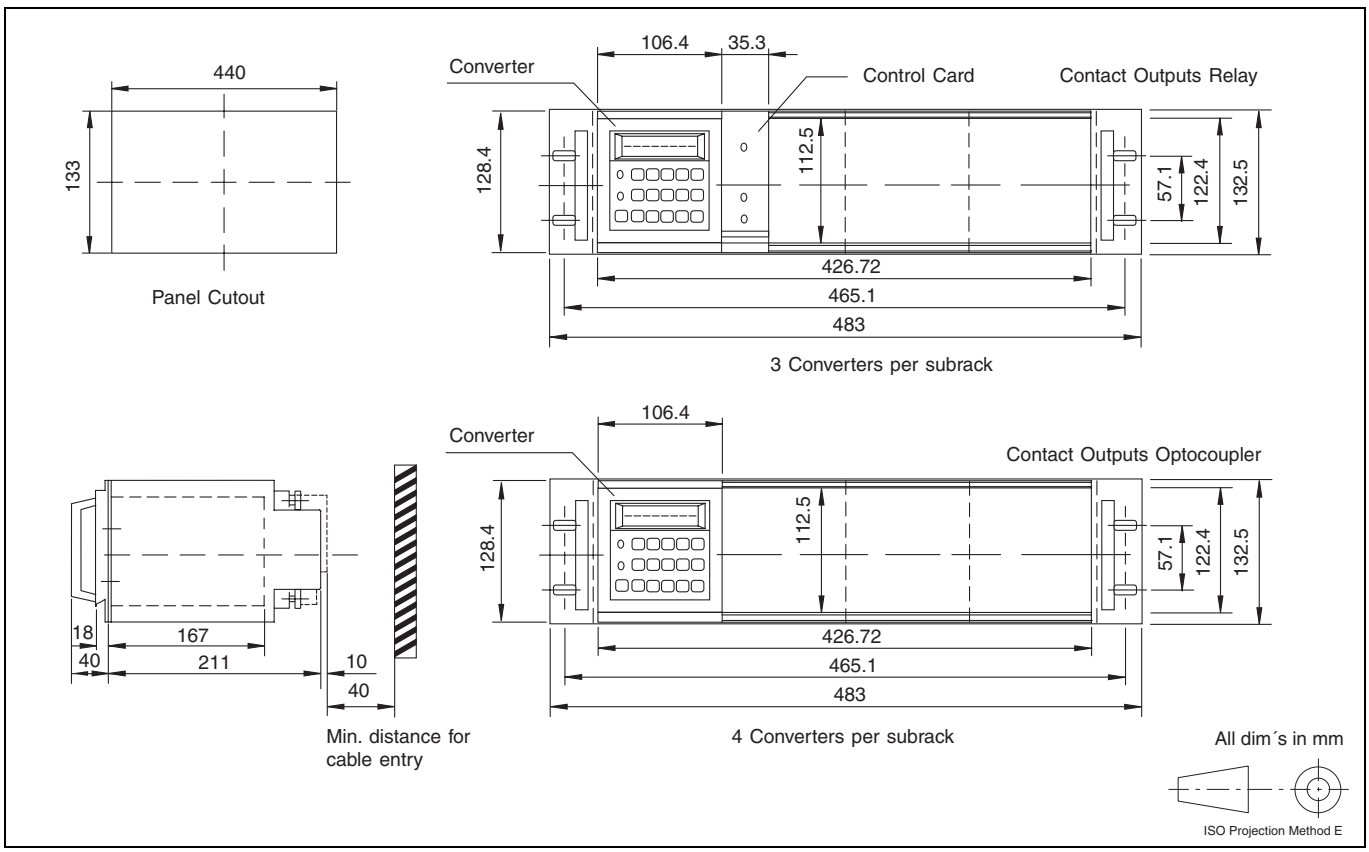
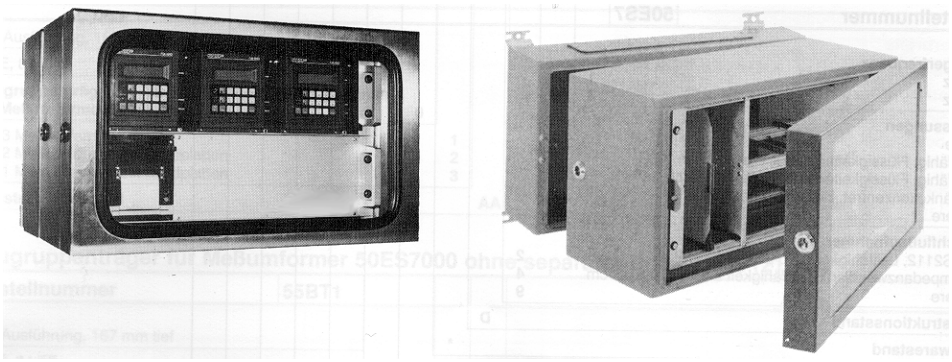
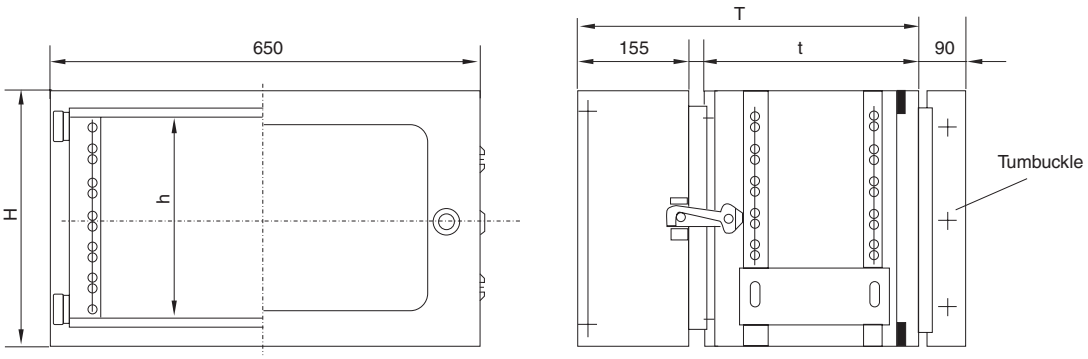


Fig. 27 Dimensions 19”-plug-in unit and 19”-subrack

Dimensions Stainless Steel Enclosure

19”-Stainless Steel Enclosure





Size	Dimensions			
HE	H	h	T	t
3	210	133	400	240
6	340	267	400	240
9	472.5	400	400	240
12	605	534	400	240

Wall brackets welded on the sides

19”-Panel Mount Enclosure

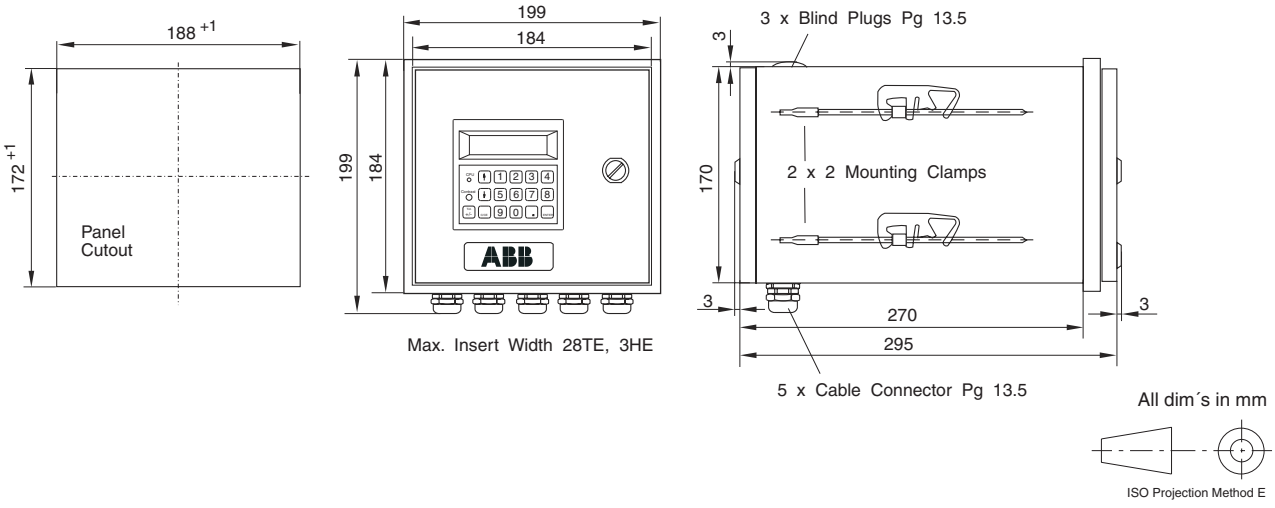


Fig. 28

Ordering Information Converter 50ES7000

In addition to the Ordering Number please provide the following information:
Flow range, batch quantities anticipatory contact quantities, batch cycle times

Ordering Number	**50ES7**													
Excitation Frequency														
50 Hz		**1**												
60 Hz		**3**												
Approvals														
None			**0**											
Certifiable, Liquids Other than Water, Beer/KEG[1)]			**1**											
Certifiable, Liquids Other than Water, Milk, Beverage Concentrates, Beer, Wort, Brine[2)] chemical liquids			**2**											
Not certifiable, Beer/KEG			**9**											
Flowmeter Primary														
≥ DN 10[3/8"] conductivity ≥ 20 µS/cm				**2**										
With preamplifier[3)], conductivity see.Pg. 8 and 13				**4**										
Others				**9**										
Design Level					*****									
Software Level						*****								
Housing														
Field mount housing with window, pivoted							**G**							
19"-plug-in unit, 167 mm with connection board[4)]							**M**							
Contact Outputs														
Passive, optocoupler[5)]								**1**						
Passive, relay[6)]								**2**						
Pulse Output Unscaled[7)]Data Link														
NoneRS 485[1), 2)] Standard									**4**					
Passive, optocoupler[8)]RS 485									**6**					
Others									**9**					
Signals														
Anticipatory and end contact										**AA**				
Others										**ZZ**				
Accessories														
None											**A**			
Automatic empty pipe detector											**E**			
Others											**Z**			
Supply Power														
230 V, 50/60 Hz												**B**		
115/120 V, 50/60 Hz												**C**		
24 V, 50/60 Hz												**F**		
Instrument Tag														
German													**1**	
English													**2**	

1) For the certified KEG-Design the serial data link RS485 options should be ordered.
2) For the certified designs the serial data link RS485 should be ordered.
3) For flowmeter primaries with preamplifiers the automatic empty pipe detector option is not available.
4) For the 19"-converters a flowmeter primary with preamplifier is recommended.
5) For contact output optocoupler; without relay card (21 TE),
6) For contact output relay; with separate relay card (28 TE).
7) 0-10 kHz (not scalable e.g. 1 pulse/liter), pulse factor: 100 % flowrate = 10 kHz.
8) The alarm contact is not available.
9) Certificable, liquids other than water, chemical liquids with a conductivity ≥ 20 µS/cm upon request.

Signal cable: A 10 m long signal cable is shipped with each flowmeter. For longer cable lengths please order Part No. D173D018U02 (EMC).

Ordering Information Accessories

Subrack for Converter 50ES7000 with Separate Relay Card (28 TE) (Relais)

Ordering Number	55BT1					
19”-Design, 167 mm deep						
3 HE, 84 TE		**1**				
Subrack, 21 TE + 7 TE with Guide Rails for Converters 50SM1000, 50ES7000			**0**			
For 3 converters				**1**		
For 2 converters with blind plate				**2**		
For 1 converters with blind plates				**3**		
Design Level					**AA**	

Subrack for Converter 50ES7000 without Separate Relay Card (21 TE) (Optocoupler)

Ordering Number	55BT1					
19”-Design, 167 mm deep						
3 HE, 84 TE		**1**				
Subrack, 21 TE with Guide Rails for Converters 50SM1000, 50ES7000			**0**			
For 4 converters				**1**		
For 3 converters with blind plate				**2**		
For 2 converters with blind plates				**3**		
For 1 converters with blind plates				**4**		
Design Level					**AA**	

19”-Stainless steel hinged enclosure

Housing closure: Lever hasp closure with double catch.

Front door: Stainless steel construction with viewing window (safety glass), lever hasp closure with double catch.

Shipment includes Mounting Plate and Wall Brackets

1 HE with 10 Pg 13.5 and 5 Pg 16
6 HE with 15 Pg 13.5 and 5 Pg 16
9 HE with 20 Pg 13.5 and 7 Pg 16
12 HE with 25 Pg 13.5 and 10 Pg 16

Instrument Design

3 HE max. 3 Converter (21 TE), or 2 Converter (28 TE)
6 HE max. 6 Converter (21 TE), or 5 Converter (28 TE)
9 HE max. 10 Converter (21 TE), or 8 Converter (28 TE)
12 HE max. 14 Converter (21 TE), or 11 Converter (28 TE)

19”-Panel Mount Enclosure

Material

Stainless steel No. 1.4301 [304]

Front Door

Stainless steel construction with viewing window (safety glass)

Installation Dimensions

3 HE, 28 TE 198x270 mm

Ordering Number: D612A103U01

Ordering Information Accessories

Test simulator for FiII-MAG

Ordering Number	**55XC4**						
Setting of the flow signal with a							
3-digit switch, 1000 steps		**1**					
Others		**9**					
Power supply[1]							
Grounding type plug (Schuko) for AC voltage 110 - 234 V, 50/60 Hz			**1**				
Banana plug (4 mm) 24 V - 48 V AC/DC			**2**				
USA plug for 110 V - 240 V 60 Hz			**3**				
Others			**9**				
Additional feature							
None				**0**			
Design level (specified by ABB)					*****		
Nameplate							
German						**1**	
English						**2**	
Others						**9**	

1) Power supply is used to supply the converter

Software

Software for measuring point documentation on a PC
upon request.
EMF selection program for PC free of charge.
Diskette format is 3 1/2”.

ABB Automation Products GmbH
Dransfelder Str. 2, D-37079 Göttingen, Germany
Tel. 0551/90 5 - 0
Fax 0551/90 57 77
http://www.abb.com

D184S033U02 Rev. 01