



Fig. 1 F VA 250 variable area flow meter

Application

The VA 250 variable area flowmeters with a standard length of 250 mm (9.84 inch) and a completely metal design can be used to measure many different types of liquids and gases passing through closed piping. The robust design means that they can also be used in rough conditions. Different types of flanges, liners and float materials satisfy the requirements of the pharmaceutical and chemical industries.

The measured value is displayed directly on the scale, and output via a switch contact or as a current output.

The main applications for the VA 250 can be found in the following fields:

- Chemical industry
- Water
- Power generation and distribution.

Special features

- Standard design available at short notice
- Robust all-metal fitting with impact-resistant housing cover
- Can also be used for corrosive and flammable media
- Use possible at high pressures and temperatures
- Product and percentage scales
- Can be optionally fitted with heating and cooling sheaths
- Contamination-insensitive guiding of float.

Design and mode of operation

The VA 250 operates like the other units in the VA range according to the variable-area flow tube principle: the flowing medium lifts the conical float in the flow tube. The annular gap is then increased until equilibrium exists between the buoyant force of the medium and the force due to the weight of the float. The height of the float is directly proportional to the flow quantity. The movement of the float is transmitted by a magnet to a slave magnet in the display unit outside the flow tube.

The contacts or the electric remote sensor are controlled by a contact lug or a cam which is mounted on the pointer shaft.

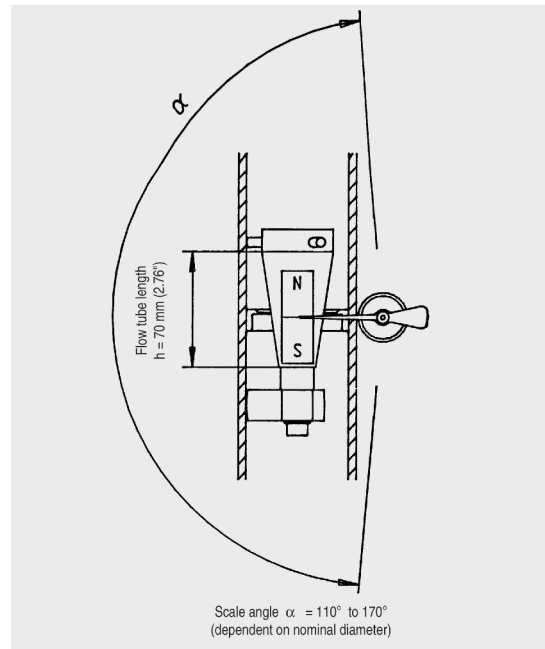


Fig. 2 Flow tube/scale angle

Note of application

The operator of these measuring instruments is responsible for suitability, proper use and corrosion resistance of the used materials with regard to the measuring material. It must be ensured that the materials selected for the flowmeter parts in contact with the medium are suitable for the used process media. No external loads may act on the meter. Provide a touch guard for surface temperatures of > 70°C. This touch guard must be designed in a way that the max. allowable ambient temperature on the unit is not exceeded. The flowmeter may only be used within the pressure and voltage limits specified on the identification plate. Before replacing the measuring tubes, check that the unit is free of hazardous media and pressures. The measuring instruments are primarily designed for static loads.

Classification according to PED 97/23/EG

	Order No. 7ME5820- 7ME5821-	Permissible media	Category
DN 15	xAxxx-xxxx	Gases and liquids of fluid group 1	Art. 3.3
DN 25	xBxxx-xxxx	Gases and liquids of fluid group 1	Art. 3.3
DN 50	xCxxx-xxxx	Gases and liquids of fluid group 1	III
DN 80	xDxxx-xxxx	Gases and liquids of fluid group 1	III
DN 100	xExxx-xxxx	Gases and liquids of fluid group 1	III

Variable area flowmeter F VA 250

Technical specification

Application	see page 1	
Design and mode of operation	see page 1	
Measuring principle	variable-area flowmeter	
Input		
Measuring range	see tables on page 3	
Pressure rating	PN10 (MWP 145 psi) to PN40 (MWP 580 psi) depending on version (see Tables on page 3 and 4)	
Flow	vertically upwards	
Dimension for measured variables	l/h, from 4.000 l/h (17,6 USgpm) in m ³ /h	
Rated operating conditions		
Mounting	vertical	
Ambient temperature	<80°C (176°F) <70°C (158°F) with contact display	
Medium conditions		
• Accuracy	± 2% of full-scale value (± 1,6% as option, but not for PTFE liner)	
• Temperature of medium	max. 125°C (257°F) (300°C (572°F) as option)	
Viscosity limits		
Q_{max} [m ³ /h]	Q_{max} [USgpm]	Viscosity [mPa.s] (cp)
≤ 0,1	≤ 0,44	1,0
> 0,1 to 0,5	> 0,44 to 2,2	1,0 to 3,0
> 0,5 to 3	> 2,2 to 13	1,0 to 5,0
> 3 to 10	> 13 to 44	1,0 to 8,0
> 10 to 25	> 44 to 110	1,0 to 10
> 25 to 50	> 110 to 220	1,0 to 15
> 50 to 100	> 220 to 440	1,0 to 25
> 100	> 440	1,0 to 50
Design		
Flanges	DIN, ANSI	
Material	Stainless steel 1.4571/ 316Ti	
• Fitting	Stainless steel 1.4571/ 316Ti, Hastelloy, Titanium, Aluminium	
• Float	Stainless steel 1.4571/316Ti, PTFE, C22.8, Hastelloy depending on version	
• Wetted parts materials	IP65	
Degree of protection (display unit)	IP65	

Technical specification

F VA 251 (magnet spring contact)	
Switching principle	Magnet spring contact, twin contact
Connection	Appliance plug to DIN 43650
Max. switching frequency	5/min
Max. rating	AC 250V / 1A / 50VA DC 250V / 1A / 30W Rating data apply to resistive loads; a suppressor circuit is required for inductive loads
Hysteresis	± 3% of full-scale value
Ambient temperature	-20 to +70°C (-4 to 158°F)
F VA 251 (inductive contact)	
Switching principle	Inductive contact, single contact; twin contact as option
Connection	PG 11
Rated voltage	10..28V DC
Self-inductance	500µH
Self-capacitance	80 nF
Ambient temperature	• without EX-protection -20 to +70°C (-4 to 158°F)
F Va 252 (electric remote sensor, current output)	
Principle	Rotation angle transmitter
Connection	2-, 3- or 4-wire system
Power supply	DC 12 to 30V
Self-capacitance	<10 nF
Short-circuit current	max. 160mA
Output	• 2-wire system 4 to 20mA • 3-and 4-wire systems 0 to 20mA
Load	max. 900Ω at 30V
Ambient temperature	• without EX-protection -20 to +70°C (-4 to 158°F)

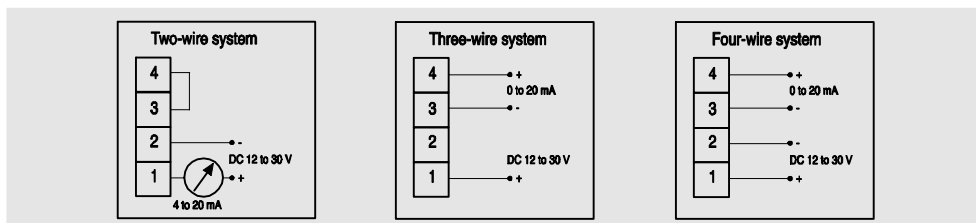


Fig. 3 F VA 252 rotation angle transmitter, connection diagrams

Measuring ranges for liquids

		Version	AF-S	CF-S	CF-K	EF-H	FF-P ¹⁾	
		Wetted parts mat.	C22.8 mat.No. 1.4571/316Ti	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	PTFE/Hastelloy C	PTFE	
		Fitting	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No. 1.4571/316Ti	mat.No.1.4571/316Ti	
		Flange	C22.8	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No. 1.4571/316Ti with PTFE liner	mat.No.1.4571/316Ti with PTFE liner	
		Float/flow tube	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	Hastelloy	PTFE	
		Max. temperature of medium	125°C (257°F) optional 300°C (572°F)	125°C (257°F) optional 300°C (572°F)	125°C (257°F) optional 160°C (320°F)	80°C (176°F)	50°C (122°F)	
		Nominal pressure	DN15 to DN80/ (1/2 to 3 inch): PN40 (580 psi) DN100 (4 inch): PN16 (232 psi)	DN15 to DN80/ (1/2 to 3 inch): PN40 (580 psi) DN100 (4 inch): PN16 (232 psi)	DN15 to DN25 (1/2 to 1 inch): PN40 (580 psi)	PN16 (232 psi)	PN16 (232 psi)	
Connection DIN2501	DN 15 DN 25 DN 50 DN 80 DN 100	Full-scale value		Flow tube				
		l/h	(USgpm)					Nominal diameter
		16	(0,07)	A				
		25	(0,11)	B		x		
		40	(0,18)	C		x		
		63	(0,28)	D		x		
		100	(0,44)	E		x		
		160	(0,7)	F	x	x		
		250	(1,1)	G	x	x	x	DN15-25 (1/2-1 inch) 250 (1,1)
		400	(1,76)	H	x	x	x	DN15-25 (1/2-1 inch) 400 (1,76)
		630	(2,77)	J	x	x	x	DN15-25 (1/2-1 inch) 630 (2,77)
		1.000	(4,4)	K	x	x	x	DN25 (1 inch) 1.000 (4,4)
		1.600	(7,0)	L	x	x	x	DN25 (1 inch) 1.600 (7,0)
		2.500	(11,0)	M	x	x	x	DN25 (1 inch) 2.500 (11,0)
		4.000	(17,6)	N	x	x	x	DN50 (2 inch) 4.000 (17,6)
		6.300	(27,7)	P	x	x	x	DN50 (2 inch) 6.300 (27,7)
		10.000	(44)	Q	x	x	x	DN50 (2 inch) 10.000 (44)
		16.000	(70)	R	x	x	x	
		20.000	(88)	S	x	x	x	
		25.000	(110)	T	x	x	x	DN80-100 (3-4 inch) 25.000 (110)
		40.000	(176)	U	x	x	x	
		50.000	(220)	V	x	x	x	
		63.000	(277)	W	x	x	x	
		100.000	(440)	X	x	x		

¹⁾For the FF-P version, only the measuring ranges of the listed nominal diameters are possible

Nominal diameter	Pressure loss mbar (psi)
DN 15 (1/2 inch)	60 (0,87)
DN 25 (1 inch)	60 (0,87)
DN 50 (2 inch)	90 (1,3)
DN 80 (3 inch)	160 (2,3)
DN 100 (4 inch)	240 (3,5)

Measuring ranges and pressure losses for liquids (density $\rho = 1 \text{ kg/l}$ (62,43 lb/cu.ft) and viscosity 1 mPa.s(cP)) with standard scales. The dynamic range is always 1:10.

Measuring ranges for air

		Version	CL-A	CL-T	CL-K	EL-T	FL-R
		Wetted parts mat.	mat.No. 1.4571/316Ti Aluminium	mat.No.1.4571/316Ti, Titan	mat.No.1.4571/316Ti	PTFE/ Hastelloy C, Titanium	PTFE
		Fitting	mat.No.1.4571/316Ti	mat.No..1.4571/316Ti	mat.No.1.4571/316Ti	mat.No. 1.4571/316Ti	mat.No.1.4571/316Ti
		Flange	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	mat.No.1.4571/316Ti with PTFE liner	mat.No.1.4571/316Ti with PTFE liner
		Float/flow tube	Aluminium/ mat.No.1.4571/316Ti	Titanium mat.No.1.4571/316Ti	mat.No.1.4571/316Ti	Titanium/ Hastelloy	PTFE
		Max. temperature of medium	125°C (257°F) optional 300°C (572°F)	125°C (257°F) optional 300°C (572°F)	125°C (257°F) optional 160°C (320°F)	80°C (176°F)	50°C (122°F)
		Nominal pressure	DN15 to DN80/ (1/2 to 3 inch): PN40 (580 psi) DN100 (4 inch): PN16 (232 psi)	DN15 to DN80/ (1/2 to 3 inch): PN40 (580 psi) DN100 (4 inch): PN16 (232 psi)	DN15 to DN25/ (1/2 to 1 inch) PN40 (580 psi)	PN16 (232 psi)	PN16 (232 psi)
Connection DIN2501							
DN 15 DN 25 DN 50 DN 80 DN 100	Full-scale value		Flow tube				
	m³/h	(USgpm)					
	0,5	(0.294)					
	1,0	(0.589)				X	
	1,6	(0.942)				X	
	2,5	(1.47)				X	
	4,0	(2.35)				X	
	12,0	(7.06)					
	16,0	(9.42)	X	X		X	X
	25,0	(14.71)	X	X		X	X
	25,0	(14.71)					X
	40,0	(23.54)	X	X		X	X
	63,0	(37.08)	X	X		X	X
	100,0	(58.86)	X	X		X	X
	100,0	(58.86)					X
	160,0	(94.17)	X	X		X	X
	250,0	(147.1)	X	X		X	X
	400,0	(235.4)	X	X		X	X
	400,0	(235.4)					X
	630,0	(370.8)	X	X		X	X

Nominal diameter	Pressure loss mbar (psi)	Minimum inlet pressure mbar (psi)
DN 15 (1/2 inch)	40 (0,58)	500 (7,25)
DN 25 (1 inch)	40 (0,58)	100 (1,45)
DN 50 (2 inch)	65 (0,94)	100 (1,45)
DN 80 (3 inch)	80 (1,16)	100 (1,45)
DN 100 (4 inch)	80 (1,16)	100 (1,45)

Measuring ranges and pressure losses for air ($p_{abs} = 1,013 \text{ bar}$ (14,69 psi) at $T = 20^\circ\text{C}$ (68°F)). The dynamic range is 1:10 for each flow tube.

Installation and operating instructions

The main information for installation and startup is listed below. Further information can be obtained from VDI/VDE 3513, sheet 3, installation recommendations for variable area meters.

Installation instructions

The variable area meter is delivered protected in a PVC sleeve, and is ready for operation. It has been checked for correct functioning prior to delivery. Before installing, check that the float moves freely: the float must slide smoothly in the flow tube without sticking or tilting. The pointer must smoothly follow the movement of the float. In the rest position (zero flow), the pointer must point to the marked reference point (first scale line). In the end position of the float, the pointer must be positioned above the full-scale value.

The variable area meter must be fitted into the piping vertically and without tension. Magnetic fields from other equipment may influence the result. If several variable area meters are installed next to one another, the following minimum distances must be observed between the main axes of the variable area meters:

- DN 15 to 50 (½ to 2 inch): 250 mm (9.84 inch)
- DN 80 to 100 (3 to 4 inch): 400 mm (15.74 inch).

The flange screws of the PTFE-lined fittings must only be tightened with the following maximum torques:

- DN 15 to 25 (½ to 2 inch): 14 Nm
- DN 50 (2 inch): 25 Nm
- DN 80 (3 inch): 35 Nm
- DN 100 (4 inch): 42 Nm

Interference-free inlet and outlet pipe sections are not usually required. However, additional measures (inlet pipe sections, flow stabilizers) may be meaningful to retain the measuring accuracy in the case of highly asymmetric flow profiles.

To prevent pulsations resulting from compression when measuring gases, a throttle should be positioned directly downstream of the variable area meter. To avoid faulty measurements, the arrangement should be selected such that the pressure in the variable area meter corresponds to the reference pressure for the calibration.

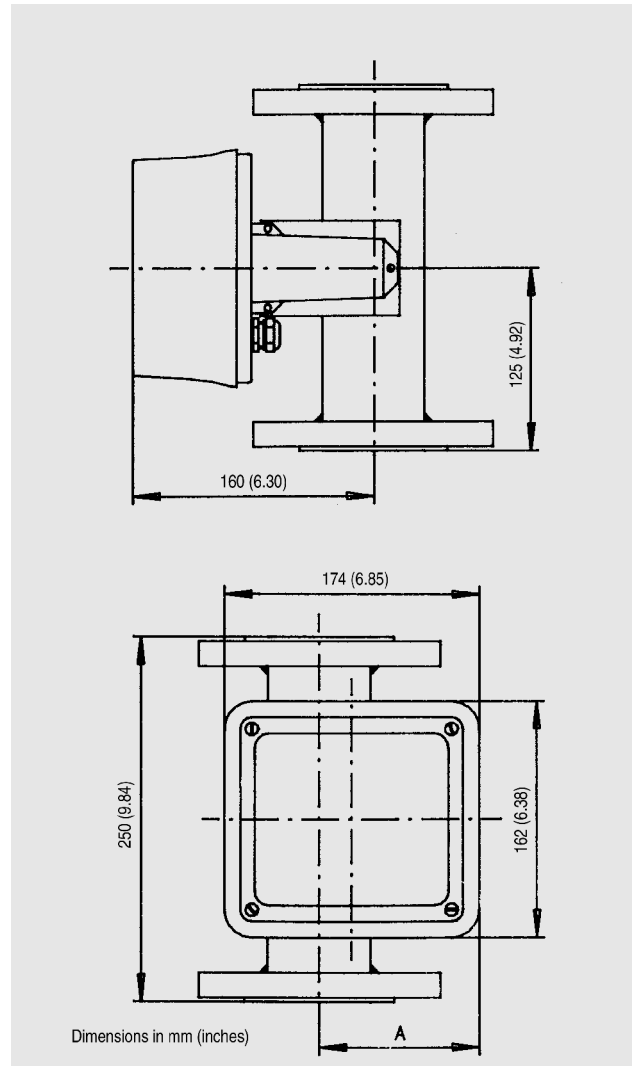
The flowmeter may only be used within the pressure and voltage limits specified on the identification plate.

Startup

1. When starting up new plants, material residues (e.g. welding spatter) are carried over in the medium and could be deposited on the variable area meter. In such cases it is recommendable to clean the variable area meter after a short period of operation.
2. The float must not be exposed to sudden pressures. It is therefore recommendable to start with a closed valve which is then slowly regulated to the operating pressure. Liquids should be vented carefully to prevent pressure surges resulting from gas bubbles.
3. The variable area meter outputs values in all scale ranges according to its accuracy class. Each time a flow is started, permit the variable area meter to settle. When measuring in the lowest range, initially set a higher flow for a short time.

Maintenance and repair

Depending on the medium, contamination, abrasion or chemical reactions may attack the orifice and the float, thus influencing the accuracy of the measurement. In such cases it is recommendable to dismount the variable area meter and to clean it, including the float, with appropriate agents. The orifice and float must not be damaged mechanically or by aggressive cleaning agents. If erosion is noticed on the orifice or float, recalibration or replacement is necessary. Following all maintenance and cleaning operations, carry out a function test of the variable area meter before using it again.



DN-connection	Dimensions „A“ in mm (inch) Versions		Weight kg (lb)
	AF-S, CF-S, CF-K CL-A, CL-T, CL-K	EF-H, FF-P, EL-T, FL-R	
15 (1/2inch)	86 (3,4)	89 (3,5)	4 (8,8)
25 (1 inch)	92 (3,6)	96 (3,8)	5 (11)
50 (2 inch)	92 (3,6)	111 (4,4)	9 (19,8)
80 (3 inch)	125 (4,9)	132 (5,2)	13 (28,7)
100 (4 inch)	138 (5,4)	138 (5,4)	15 (33)

Fig. 4 F VA 250, dimensions in mm (inch)

Variable area flowmeter F VA 250

Selection and ordering data

F VA 250
variable area meter,
made completely of metal
for measurement of liquids

Order No. Order code

7ME5820-
↑↑↑↑↑↑ - ↑↑↑↑↑↑
see right

Version

- Type AF-S (standard)
Fitting: stainless steel 1.4571/316Ti
Flange: steel C22.8
Float: stainless steel 1.4571/316Ti
- Type CF-S (standard)
Fitting: stainless steel 1.4571/316Ti
Flange: stainless steel 1.4571/316Ti
Float: stainless steel 1.4571/316Ti
- Type CF-K
Fitting: stainless steel 1.4571/316Ti
Flange: stainless steel 1.4571/316Ti
Float: stainless steel 1.4571/316Ti
- Type EF-H
Fitting: stainless steel 1.4571/316Ti
Flange: 1.4571/316Ti with PTFE liner
Float: Hastelloy
- Type FF-P
Fitting: stainless steel 1.4571/316Ti
Flange: 1.4571/316Ti with PTFE liner
Float: PTFE

Norm.diam./flange connection

- DN15 (1/2" ANSI)
- DN25 (1" ANSI)
- DN50 (2" ANSI)
- DN80 (3" ANSI)
- DN100 (4" ANSI)

Flow tube

Size	Full-scale value	
	l/h	(Usqpm)
A	16	(0,07)
B	25	(0,11)
C	40	(0,18)
D	63	(0,28)
E	100	(0,44)
F	160	(0,7)
G	250	(1,1)
H	400	(1,76)
J	630	(2,77)
K	1000	(4,4)
L	1600	(7,0)
M	2500	(11)
N	4000	(17,61)
P	6300	(27,7)
Q	10000	(44)
R	16000	(70,4)
S	20000	(88)
T	25000	(110)
U	40000	(176)
V	50000	(220)
W	63000	(277)
X	100000	(440)

Flange connection standard

- EN1092-1 (standard)
- ANSI B 16.5
- Special connections (thread or other pressure stages)

Temperature shield

- Without (standard)
- With temperature shield 125 to 200°C (257 to 392°F)
- With displaced display 200 to 300°C (392 to 572°F)

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3
4
5

A
B
C
D
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A
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F
G
H
J
K
L
M
N
P
Q
R
S
T
U
V
W
X

1
2
9
0
1
2

L1Y

Selection and ordering data

F VA 250
variable area meter
made completely of metal
for measurement of liquids

Order No. Order code

7ME5820-
↑↑↑↑↑↑ - ↑↑↑↑↑↑
see left

Heating/cooling sheath

- Without (standard)
- H/K with flange connection
- H/K without flange connection

Display

- With local display (standard)
- With magnet spring contact F VA 251
- With inductive contact F VA 251
- With electric remote sensor F VA 252 (0 bis 20mA)
- With electric remote sensor F VA 252 (4 bis 20mA)

Contact function

- No contact (standard)
- For magnet spring contact (twin contact):
 - Close on upward or downward violation of limit
 - Open on upward or downward violation of limit
 - Close on downward violation, open on upward violation of limit
 - Open on downward violation, close on upward violation of limit

For inductive contacts:

- Open on downward violation of limit
- Close on downward violation of limit
- Close on upward or downward violation of limit
- Open on upward or downward violation of limit
- Close on downward violation, open on upward violation of limit
- Open on downward violation, close on upward violation of limit

Calibration

- Standard calibration
- Without calibration certificate
- With calibration certificate
- Special calibration (1,6% accuracy)

Further designs

Please add "-Z" to Order No. and specify Order code(s)

	Order code
Acceptance test B to DIN50049, Section. 3.1 and EN10204	C 1 2
Measured medium, specify in plain text (always required): Medium, measuring range, dimension, density, density dimension, viscosity, viscosity dimension, operating temperature, operating pressure	Y 0 1
Silicone-free version	Y 0 4
Water as measured medium	Y 0 5
Viscosity: 1mPas (cp)	
Density: 1 kg/l (62,43 lb/cu.ft)	
Stainless steel tag plate	Y 1 7
Special version: specify in plain text	Y 9 9

Note: See table on page 3 for possible combinations of nominal diameters and flow tube.

Transmitters and contacts cannot be ordered simultaneously.

0
2
3

A
B
C
D
E

A
D
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G
H

J
K
L
M
N
P

0
1
9 R 1 Y

Selection and ordering data

F VA 250
variable area meter,
made completely of metal,
for measurement of gases

Version

- Type CL-A
Fitting: stainless steel 1.4571/316Ti
Flange: stainless steel
Float: aluminium
- Type CL-T
Fitting: stainless steel 1.4571/316Ti
Flange: stainless steel 1.4571/316Ti
Float: titanium
- Type CL-K
Fitting: stainless steel 1.4571/316Ti
Flange: stainless steel 1.4571/316Ti
Float: stainless steel 1.4571/316Ti
- Type EL-T
Fitting: stainless steel 1.4571/316Ti
Flange: 1.4571/316Ti with PTFE liner
Float: titanium
- Type FL-R
Fitting: stainless steel 1.4571/316Ti
Flange: 1.4571/316Ti mit PTFE liner
Float: PTFE

Nom.diam./flange connection

- DN15 (1/2" ANSI)
- DN25 (1" ANSI)
- DN50 (2" ANSI)
- DN80 (3" ANSI)
- DN100 (4" ANSI)

Flow tube

Size	Full-scale value	
	m ³ /h	(Usgpm)
A	0,5	(2,2)
B	1,0	(4,4)
C	1,6	(7,04)
D	2,5	(11,0)
E	4,0	(17,6)
F	12,0	(53)
G	16,0	(70)
H	25,0	(110)
J	40,0	(176)
K	63,0	(277)
L	100	(440)
M	160	(704)
N	250	(1100)
P	400	(1761)
Q	630	(2774)

Flange connection standard

EN 1092-1 (standard)
ANSI B 16.5
Special connections (thread or other pressure stages)

Temperature shield

Without (standard)
With temperature shield
125 to 200°C (257 to 392°F)
With displaced display
200 to 300°C (392 to 572°F)

Order No.

7ME5821-



Order code



L1Y

Selection and ordering data

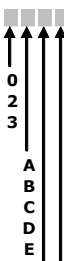
F VA 250
variable area meter
made completely of metal
for measurement of gases

Order No.

7ME5821-



Order code



Heating/cooling sheath

Without (standard)
H/C with flange connection
H/C without flange connection

Display

With local display (standard)
With magnetic spring contact F VA 251
With inductive contact F VA 251
With electric remote sensor F VA 252 (0 to 20mA)
With electric remote sensor F VA 252 (4 to 20mA)

Contact function

No contact (standard)
For magnet spring contacts:
• Close on upward or downward violation of limit
• Open on upward or downward violation of limit
• Close on downward violation, open on upward violation of limit
• Open on downward violation, close on upward violation of limit

For inductive contacts:

- Open on downward violation of limit
- Close on downward violation of limit
- Close on upward or downward violation of limit
- Open on upward or downward violation of limit
- Close on downward violation, open on upward violation of
- Open on downward violation, close on upward violation of limit

Calibration

Standard calibration
• Without calibration certificate
• With calibration certificate
• Special calibration (1,6% accuracy)

Further designs

Please add "-Z" to Order No. and specify Order code(s)

Further designs	Order code
Acceptance test B to DIN50049, Section 3.1 and EN10204	C 1 2
Measured medium, specify in plain text (always required)	Y 0 1
Medium, measuring range, dimension, density, density dimension, viscosity, viscosity dimension, operating temperature, operating pressure	Y 0 4
Silicone-free version	Y 1 7
Stainless steel tag plate	Y 9 9
Special version:	Y 9 9

specify in plain text

Note: See table on page 4 for possible combinations of nominal diameters and flow tube.

Telet transmitter and contacts cannot be ordered simultaneously.