MECON
FLOW-CONTROL-SYSTEMS

Rotameter flowrate metering equipment F VA 250

Fig. 1 Rotameter flowrate metering equipment F VA 250

Introduction

This user manual is an aid to correct installation as well as operation and maintenance of the equipment. Read the instructions carefully before you install the equipment and put it into operation. Specially designed or customised models and specialised applications are not included in the manual. All instruments are carefully checked for order-conformity and functional capability prior to despatch. On receiving the equipment please carry out a visual inspection to detect any damage that could have arisen during shipment. Please contact your responsible sales field service if you should discover any defects. In such cases we require the description of the defect, the type and the serial number of the device. Mecon GmbH can assume no guarantee for repair work carried out by the customer without prior notification and consultation. In case of complaint, the rejected parts must be returned to us, if no other provisions have been made.

Application

Due to the all-metal design the rotameter flowrate metering equipment F VA 250 with a standard length of 250 mm (9.84 inch) is suitable for multipurpose measuring of fluids and gases in closed piping systems. The robust design also permits application under harsh conditions. Different flange connections, linings and rotameter materials meet the requirements in the pharmaceutical and chemical industry.

The momentary flowrate is indicated in volume or mass per time unit. The measured value is indicated directly on the scale. The equipment can be supplied with accessory electrical components and touch-sensitive switches for process monitoring and control.

Special features

- Standard model can be supplied at short notice
- Robust all-metal fitting with shock-proof housing
- Can be applied for the measurement of aggressive and combustible materials
- Application at high pressures and temperatures
- Product and percentage scale
- Optionally supplied fitted with heating and cooling jackets
- Contamination-resistant rotameter design

Assembly and mode of operation

The F VA 250 operates according to the principle of flotation, as do other devices within this range: The flowing measuring substance raises the conical rotameter in the measuring ring. In this way the annular gap widens until an equilibrium between the buoyancy of the measuring substance and the weight of the rotameter is achieved. The height achieved by the rotameter is directly proportional to the flowrate. The movement of the rotameter is transmitted via a magnet to a subsequent magnet in the display part outside the measuring pipe.

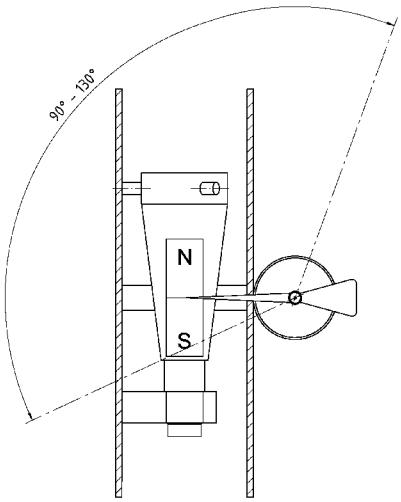


Fig. 2 Measuring cone/scale angle

Operating note

The owner is solely responsible for this measuring equipment with regard to competence, authorised application and the corrosion resistance to the materials employed. In particular, it must be ensured that the material selected for the parts of the measuring equipment coming into contact with the medium to be measured are suitable for the purpose. It must also be ensured that external loads do not have an impact on the measuring equipment. In case of surface temperatures > 70 °C a protection against contact must be provided. The protection against contact must be designed in a manner to prevent the max. admissible ambient temperature at the device from being exceeded. The device may only be employed within the pressure and voltage limits defined on the rating plate. Prior to exchanging the measuring device it must be verified that the device is free from hazardous media and pressure. The devices are designed for predominantly dead load.

Returning the equipment for repair and service work

Indication: According to the relevant waste disposal management legislation, the owner/customer is responsible for the disposal of hazardous and toxic waste. For this reason all devices sent to us for repair work must be free from toxic and hazardous substances. This also applies to cavities and cracks in the equipment. The customer must provide written confirmation that the previously mentioned guideline has been observed in the case of repair work. **See relevant form in the Internet under www.mecon.de/de/service/downloads:**
Contamination Declaration

If, in spite of these requirements, equipment is returned and hazardous and toxic substances are detected on or inside the equipment, Mecon GmbH shall be entitled to dispose of these substances at the cost of the customer without any further inquiries.

Rotameter damping and spring stop

Rotameter damping is recommended

- In general during the measurement of gas
- If air bubbles in the medium cannot be avoided
- If shock pressure predominates in the pipes, arising through a delay in the flow, e.g. due to rapid throttling or shut-off
- If turbulence, pulsations or another type of instability in the rotameter could lead to vibration
- If the flow pressure cannot be built up slowly
- Vibrations in the line cannot be avoided

Partitioning in accordance with the Pressure Equipment Directive 97/23/EC

	Admissible media	Category
DN 15	Gases and fluids of fluid group 1	Art. 3.3
DN 20	Gases and fluids of fluid group 1	Art. 3.3
DN 25	Gases and fluids of fluid group 1	Art. 3.3
DN 32	Gases and fluids of fluid group 1	III
DN 40	Gases and fluids of fluid group 1	III
DN 50	Gases and fluids of fluid group 1	III
DN 65	Gases and fluids of fluid group 1	III
DN 80	Gases and fluids of fluid group 1	III
DN 100	Gases and fluids of fluid group 1	III

Design and dimensions

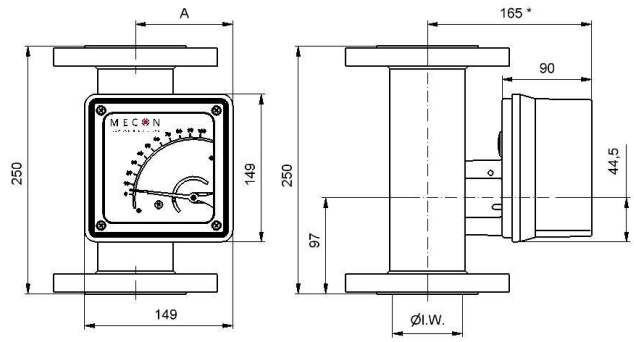


Fig. 3 Housing of display made of aluminium

DN	PN	I. W.	A	B flange	B Ermeto	S	weight
15 (1/2")	40 (150 lbs)	26 (1,02)	74 (2,91)	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
20 (3/4")	40 (150 lbs)	26 (1,02)	74 (2,91)	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
25 (1")	40 (150 lbs)	32 (1,26)	77 (3,03)	110 (4,33)	58,5 (2,3)	150 (5,91)	4,2 (9,3)
32 (1 1/4")	40 (150 lbs)	32 (1,26)	77 (3,03)	110 (4,33)	58,5 (2,3)	150 (5,91)	5,2 (11,5)
40 (1 1/2")	40 (150 lbs)	46 (1,81)	88 (3,46)	130 (5,12)	63 (2,48)	150 (5,91)	6,0 (13,2)
50 (2")	40 (150 lbs)	70 (2,76)	97 (3,82)	140 (5,51)	77,5 (3,05)	150 (5,91)	7,5 (16,5)
65 (2 1/2")	16 (150 lbs)	70 (2,76)	97 (3,82)	140 (5,51)	77,5 (3,05)	150 (5,91)	8,5 (18,7)
80 (3")	16 (150 lbs)	102 (4,02)	113 (4,45)	160 (6,3)	93,5 (3,68)	150 (5,91)	13 (28,7)
100 (4")	16 (150 lbs)	125 (4,92)	126 (4,96)	175 (6,89)	110 (4,33)	120 (4,72)	18 (39,7)

Fig. 3 FVA 250, dimensions in mm (inch)
* +100 mm with displaced display

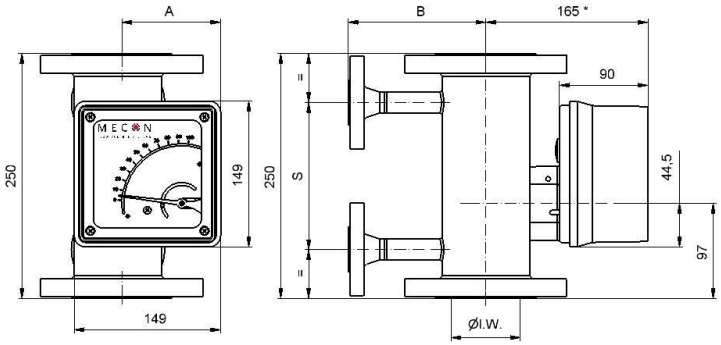


Fig.4 Housing of display made of aluminium and housing of heater connection

DN	B flange	B Ermeto	S	weight
15 (1/2")	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
20 (3/4")	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
25 (1")	110 (4,33)	58,5 (2,3)	150 (5,91)	4,2 (9,3)
32 (1 1/4")	110 (4,33)	58,5 (2,3)	150 (5,91)	5,2 (11,5)
40 (1 1/2")	130 (5,12)	63 (2,48)	150 (5,91)	6,0 (13,2)
50 (2")	140 (5,51)	77,5 (3,05)	150 (5,91)	7,5 (16,5)
65 (2 1/2")	140 (5,51)	77,5 (3,05)	150 (5,91)	8,5 (18,7)
80 (3")	160 (6,3)	93,5 (3,68)	150 (5,91)	13 (28,7)
100 (4")	175 (6,89)	110 (4,33)	120 (4,72)	18 (39,7)

Fig. 4 FVA 250, dimensions in mm (inch)
* + 100mm with displaced display

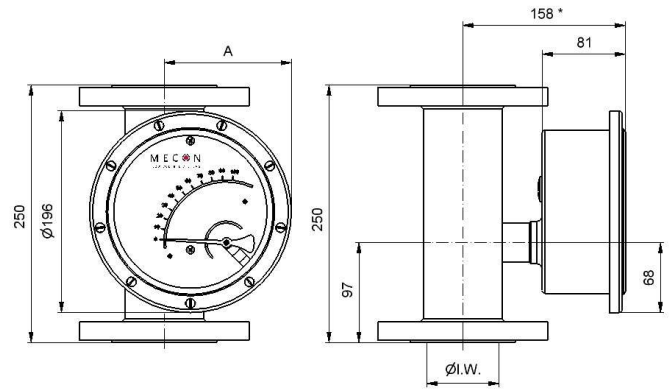


Fig.5 Housing of display made of stainless steel

DN	PN	I. W.	A	B flange	B Ermeto	S	weight
15 (1/2")	40 (150 lbs)	26 (1,02)	74 (2,91)	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
20 (3/4")	40 (150 lbs)	26 (1,02)	74 (2,91)	110 (4,33)	53 (2,09)	150 (5,91)	3,0 (6,6)
25 (1")	40 (150 lbs)	32 (1,26)	77 (3,03)	110 (4,33)	58,5 (2,3)	150 (5,91)	4,2 (9,3)
32 (1 1/4")	40 (150 lbs)	32 (1,26)	77 (3,03)	110 (4,33)	58,5 (2,3)	150 (5,91)	5,2 (11,5)
40 (1 1/2")	40 (150 lbs)	46 (1,81)	88 (3,46)	130 (5,12)	63 (2,48)	150 (5,91)	6,0 (13,2)
50 (2")	40 (150 lbs)	70 (2,76)	97 (3,82)	140 (5,51)	77,5 (3,05)	150 (5,91)	7,5 (16,5)
65 (2 1/2")	16 (150 lbs)	70 (2,76)	97 (3,82)	140 (5,51)	77,5 (3,05)	150 (5,91)	8,5 (18,7)
80 (3")	16 (150 lbs)	102 (4,02)	113 (4,45)	160 (6,3)	93,5 (3,68)	150 (5,91)	13 (28,7)
100 (4")	16 (150 lbs)	125 (4,92)	126 (4,96)	175 (6,89)	110 (4,33)	120 (4,72)	18 (39,7)

Fig. 5 FVA 250, dimensions in mm (inch)
* +100 mm with displaced display

Technical data F VA 250

Range of application	See page 1
Assembly and mode of operation	See page 1
Measuring principle	Rotameter measuring
Input	
Measuring range	See tables on page 5
Pressure stages	PN10 to PN40 according to design (see tables on pages 4 and 5)
Flow	From the bottom to the top
Units of measurement	up to 2,500 l/h in l/h, from 4,000 l/h in m³/h
Conditions of application	
Installation indications	Installation position vertical
Ambient temperature	
- without electrical accessories	- 40 °C to 80 °C
- with limit signal indicator	- 40 °C to 65 °C
- with signal output KINAX:	- 40 °C to 60 °C
- with signal output magnetoelectrical transducer (Hart/Profibus)	- 40 °C to 70 °C
In the case of application in explosive zones, the maximum ambient temperatures in compliance with the temperature class must be taken into account with regard to the respective Type Examination Certificate.	
Storage temperatures	are identical to the ambient temperatures
Climate classification	weatherproof and/or non heated locations, Class C in accordance with DIN IEC 654 Section 1.
Measuring accuracy	
• Fluid	± 1.6% of upper limit of effective range for local display
• Gas	± 2.0% of upper limit of effective range for local display
additional inaccuracy	
- **magnetoelectrical transducer**	± 0.2 % measured value
- KINAX	± 0.5 % measured value
• Reproducibility	± 0.5 % of upper limit of effective range
• Measuring substance temperature	See table on page 4
In the case of deviation of the measuring substance temperature from the temperature allowed for in the calibration process, a proportional display error is inherent due to the corresponding change in density. Alterations in viscosity lead to a non-linear display error	

Viscosity limits

Q_{max} [m³/h]	Viscosity [mPa · s]
≤ 0.1	1.0
> 0.1 to 0.5	1.0 to 3.0
> 0.5 to 3	1.0 to 5.0
> 3 to 10	1.0 to 8.0
> 10 to 25	1.0 to 10
> 25 to 50	1.0 to 15
> 50 to 100	1.0 to 25
	Special inquiries must be made with regard to media possessing a higher viscosity

Constructive assembly	
Flange	EN1029-1, ANSI
Material (see page 3)	
• Armature	Stainless steel (W. No. 14404, 316L)
• Float	Stainless steel, PTFE, Hastelloy
Parts coming into contact with measuring substance	Stainless steel, PTFE, Hastelloy
Protection class (display)	IP 65 Aluminium display IP 66 Stainless steel display
Electromagnetic compatibility	
EN 61000-6-2:1999	Immunity to interference in industrial areas
EN 50 081-1 EN 55011:1998+A1: 1999	Emitted interference in residential areas
NAMUR recommendation	Group 1, Class B NE 21
Immunity to interference/vibration	The equipment should be protected from impact and vibration as this could lead to damage.

Technical data output

Limiting value transmitter (inductive contact)

Switching principle	**Inductive contact, single contact/double contact**
Terminal connection	M20 x 1.5
Auxiliary energy	DC 8 V
Inherent inductivity	500 µH
Inherent capacitance	80 nF
Ambient temperature	
• when not used in explosive zones	-40 to +65 °C
• when used in explosive zones	See page 4
EC Type Examination Certificate in accordance with the directive 94/9/EC	PTB 99 ATEX 2219 X

Electrical remote sensor with power output

Switching principle	**Rotation angle measuring transducer**
Terminal connection	2-, 3- or 4-conductor connection
Auxiliary energy	DC 12 to 30 V
Inherent capacitance	< 10 nF
Short-circuit current	max. 160 mA
Output	
• 2-conductor connection	4 to 20 mA
• 3- and 4-conductor connection	0 to 20 mA
Load	max. 900 Ω at 24 V
Ambient temperature	
• if not used in explosive zones	-40 to +60 °C
• if used in explosive zones	See page 4

Electrical remote sensor signal output (HART)

Switching principle	**Magnetoelectrical measuring transducer**
Terminal connection	2-conductor connection
Auxiliary energy	DC 14 to 30 V
Output	4 to 20 mA
Load	min. 250 Ω
Ambient temperature	
• if not used in explosive areas	-40 to +70 °C
• if used in explosive zones	See page 4
EC Type Examination Certificate in accordance with the directive 94/9/EC	BVS 07 ATEX E 033 II2G EEx ia IIC T6

See user manual magnetoelectrical measuring transducer

electrical remote sensor Profibus PA

Switching principle	**Magnetoelectrical measuring transducer**
Auxiliary energy	DC 10 to 25 V
Ground current	< 16.5 mA
Fault current	< 18 mA
Transmission rate	31.25 kBaud
• if not used in explosive zones	-40 to +70 °C
• if used in explosive zones	See page 4
EC-Type Examination Certificate in accordance with the directive 94/9/EC	BVS 07 ATEX E 033 II2G EEx ia IIC T6

See user manual for magnetoelectrical measuring transducer

Application in explosive zones

Without electrical accessories
In its basic design, the flow metering device is a *non-electrical piece of equipment* without its own ignition sources and complies with the requirements of DIN EN 13463-1; it may be used in explosive zones which demand equipment complying with Category 2.

Designation: II 2GD c
BVS 06 ATEX H/B 146

The maximum surface temperature of the measuring substance is decisive as the equipment does not exhibit its own energy sources that could lead to a rise in temperature.
Regular cleaning is essential when the equipment is employed in dust-explosive zones in order to prevent sedimentation exceeding the thickness of 5 mm.

With installed electrical signal transducers
The equipment is evaluated as an electrical assembly when electrical signal transducers are installed and is designated in accordance with DIN EN 50014 with regard to the entire equipment including the installed electrical signal transducers.

The electrical and thermal data and the special directives of the EC Type Examination Certificate with regard to the installed signal transducers must be observed and adhered to. The impact of the temperature of the measuring substances on the installed signal transducers must be taken into account.
For this purpose the temperature rise of the maximum measuring substance temperature in relation to the maximum ambient temperature and the appropriate factor defined in the following table must be taken into consideration.

Nominal width	Factor in case of standard model	Factor in case of advanced display
DN15 and DN25	0.2	0.07
DN40 and DN50	0.25	0.085
DN80 and DN100	0.3	0.1

Example for installed limiting value transmitter at widths DN 15 and DN 25:

Max. ambient temperature	T_{amb} = 40°C
Max. measuring substance temperature	T_m = 120°C
Factor for heat input	F = 0.2
Temperature class	T4

$T_ü$ = excess temperature
T_a = ambient temperature
limiting value transmitter

$$Tü = Tm - Tamb = 120°C - 40°C = 80°C$$
$$Ta = Tü * F + Tamb = 80°C * 0{,}2 + 40°C = 56°C$$

In accordance with the tables contained in the EC Type Examination Certificate PTB 99 ATEX 2219 X, the inductive sensor SJ 3.5-… N… must be operated within the temperature class T5 with an intrinsically safe circuit that does not exceed the maximum values of a Type 3 circuit.

Furthermore, the respective national installation directives must be adhered to.

Example for the calculation of the max. measuring substance temperature in relation to the max. ambient temperature for the installed sensor type at widths DN 15/25.

T_a = 70 °C
T_{amb} = 60 °C
F = 0.2

$$Tm = \left(\frac{Ta - Tamb}{F}\right) + Tamb = \left(\frac{70°C - 60°C}{0{,}2}\right) + 60°C = 110°C$$

Designation in case of installed limiting value transmitter SJ 3,5… N…
PTB 99 ATEX 2219 X
II 2G EEx ia IIC T6-T4

Designation in case of installed magnetoelectrical measuring transducers Hart and Profibus
BVS 07 ATEX E 033
II 2G EEx ia IIC T6

Designation in case of installed rotation angle measuring transducer KINAX 2W2
ZELM 03 ATEX 0123
II 2G EEx ia IIC T6

Designation in case of installed rotation angle measuring transducer KINAX 3W2
PTB 97 ATEX 2271
II 2G EEx ia IIC T6

EC Type Examination Certificates

Magnetoelectrical measuring transducer

Translation

DEKRA

- Directive 94/9/EC -
Equipment and protective systems for use in potentially explosive areas

Acknowledgement

BVS 06 ATEX H/B 146

in accordance with article 8 (1) b) ii)
of having received the documentation in compliance with annex VIII number 3

Manufacturer: Mecon GmbH
Address: Zieglerstrasse 10-16
52078 Aachen

The certification body of EXAM BBG Prüf- und Zertifizier GmbH, notified body No. 0158 in accordance with article 9 of directive 94/9/EC of the European Parliament and of the Council of the European Communities of March 23, 1994, acknowledges to have received the documentation mentioned below on 17 October 2006:

Documentation on measuring device FVA 250

The documentation is neither examined on sufficiency nor is it verified. It will be archived for a period of 10 years. If the manufacturer desires to have the duration of archival storage extended, he is to duly communicate this in writing.

EXAM BBG Prüf- und Zertifizier GmbH
Bochum, 17 October 2006

Signed: Dr Jockers — Certification body
Signed: Dr Wörsdörfer — Special service unit

MECON
FLOW-CONTROL-SYSTEMS

Rotameter flowrate metering equipment F VA 250

Versions and Measuring ranges

Version	CF-S	FF-P	EF-H
Wetted parts material	stainless steel	PTFE	Hastelloy
Fitting	stainless steel	stainless steel with PTFE liner	<= DN 25: Hastelloy > DN 25: Hastelloy stainless
Flange	stainless steel	stainless steel	<= DN 25: Hastelloy > DN 25: Hastelloy stainless
Float / Flow tube	stainless steel	PTFE	Hastelloy
Max. temperature of medium	-40 °C - +200 °C optional -80 °C - 350 °C	-20 °C - +125 °C	-40 °C - +200 °C optional -80 °C - 350 °C
Nominal pressure	DN 15 - DN 80: PN 40 DN 100: PN 16 (1/2 - 3 inch): (580 psi) (4 inch): (232 psi) optional up to 400 bar	DN 15 - DN 100: PN 16 (1/2 - 4 inch): (232 psi)	DN 15 - DN 80: PN 40 DN 100: PN 16 (1/2 - 3 inch): (580 psi) (4 inch): (232 psi) optional up to 400 bar
Display	housing made of aluminium with safety glass scale pane optional housing made of stainless steel		
Measuring ranges for	**Liquids in l/h with density: 1,0 kg/l, temperature: 20°C, viscosity: 1mPa.s** **Gas in m³/h with density: 1,293 kg/m³, temperature: 20°C, viscosity: 0,0181mPa.s, pe 0 bar**		

DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	pressure loss (mbar) *3)	CF-S Liquid l/h	CF-S Gas m³/h	FF-P Liquid l/h	FF-P Gas m³/h	EF-H Liquid l/h	EF-H Gas m³/h
									40	0,5 - 5	0,015 - 0,15	--	--	--	--
									40	1 ,0- 10	0,030 - 0,30	--	--	--	--
									40	1,6 - 16	0,048 - 0,48	--	--	--	--
									40	2,5 - 25	0,075 - 0,75	--	--	--	--
									40	4 - 40	0,13 - 1,3	--	--	--	--
X *4)		X							40	5 - 50	0,15 - 1,5	10 - 50 *2)	0,3 - 1,5 *2)	5 - 50	0,15 - 1,5
X *4)		X							40	7 - 70	0,21 - 2,1	14 - 70 *2)	0,4 - 2,1 *2)	7 - 70	0,21 - 2,1
X *4)		X							60	10 - 100	0,3 - 3	20 - 100 *2)	0,6 - 3 *2)	10 - 100	0,3 - 3
X *4)		X							60	16 - 160	0,46 - 4,6	16 - 160	0,46 - 4,6	16 - 160	0,46 - 4,6
X *4)		X							60	25 - 250	0,7 - 7	25 - 250	0,7 - 7	25 - 250	0,7 - 7
X *4)		X							70	40 - 400	1,1 - 11	40 - 400	1,1 - 11	40 - 400	1,1 - 11
X *4)		X							80	60 - 600	1,7 - 17	60 - 600	1,7 - 17	60 - 600	1,7 - 17
		X							60	100 - 1000 *1)	3 - 30 *1)	100 - 1000 *1)	3 - 30 *1)	100 - 1000 *1)	3 - 30 *1)
		X							70	160 - 1600 *1)	4,6 - 46 *1)	160 - 1600 *1)	4,6 - 46 *1)	160 - 1600 *1)	4,6 - 46 *1)
		X							100	250 - 2500 *1)	7 - 70 *1)	250 - 2500 *1)	7 - 70 *1)	250 - 2500 *1)	7 - 70 *1)
					X				DN <40: 100;DN >32: 50	400 - 4000	11 - 110	400 - 4000	11 - 110	400 - 4000	11 - 110
					X				DN 40: 180; DN >40:80	600 - 6000	17 - 170	600 - 6000	17 - 170	600 - 6000	17 - 170
					X				110	1000 - 10000	29 - 290	1000 - 10000	29 - 290	1000 - 10000	29 - 290
					X		X		DN <80: 230; DN >65:70	1600 - 16000	46 - 460	1600 - 16000	46 - 460	1600 - 16000	46 - 460
									DN <80: 230; DN >65:70	2000 - 20000	55 - 550	--	--	2000 - 20000	55 - 550
							X		DN <80: 500; DN >65:100	2500 - 25000	70 - 700	2500 - 25000	70 - 700	2500 - 25000	70 - 700
								X	DN 80: 350; DN 100: 120	4000 - 40000	110 - 1100	4000 - 40000	110 - 1100	4000 - 40000	110 - 1100
								X	DN 80: 350; DN 100: 120	5000 - 50000	135 - 1350	5000 - 50000	135 - 1350	5000 - 50000	135 - 1350
									360	6000 - 60000	170 - 1700	--	--	6000 - 60000	170 - 1700
									600	8000 - 80000	240 - 2400	--	--	8000 - 80000	240 - 2400
									600	10000 - 100000	300 - 3000	--	--	10000 - 100000	300 - 3000

Possible flange connections EN 1092-1
gray = Type CF-S and Type EF-H
X = Type FF-P

*1) reduced scale raised face DN 15/20
*2) dynamic range 1:5

*3) in relation to full-scale value
*4) ANSI ½" not available; available Size ANSI ¾"

Installation and operating instructions

The following section contains the significant specifications concerning installation and setting into operation; moreover, reference is made to the Installation Recommendations for Rotameter Flow Metering Equipment VDI/VDE 3513 Sheet 3.

Installation indications

When unpacking the equipment, proceed with caution in order to prevent damage. With reference to the delivery note enclosed in the packaging, verify that all technically relevant data complies with your requirements.

The equipment was checked for flawless functioning prior to despatch. According to the size of the instrument, the rotameter is protected against transport damage. Remove this transport protection from the fitting. The free mobility of the rotameter should be verified prior to installation: the rotameter must slide smoothly in the pipe without canting or deadlocking. The pointer must smoothly follow the movement of the body. In the idle state (no flow) the pointer must be at the marked reference point (first line on the scale). At the end position of the rotameter the pointer must be above the final value of the scale.

The instruments must be stored in a clean and dry location prior to installation so that contamination, especially of the inside areas of the fittings, is prevented. The limits with regard to the ambient temperature must be adhered to. When the instruments must be transported to a distant assembly site, we recommend you use the same packaging as was provided by the manufacturer including the transport protection.

The limits in relation to temperature and air humidity must be observed at the installation site. A corrosive atmosphere must be avoided, aeration is necessary if this cannot be achieved. The instrument must be installed vertically and free from stress in the piping system. Please ensure that there is sufficient clearance to magnet-influencing parts, such as, for example solenoid valves and ferromagnetic components, e.g. steel brackets/structures. We recommend observing at least 300 mm as the lateral clearance between 2 adjacently mounted instruments, the instruments can be mounted staggered by the length of one instrument at reduced clearance. The lateral clearance to influencing steel parts must constitute at least 200 mm. In case of doubt the influence can be tested by moving the instrument up and down ca. 200 mm at a selected clearance and verifying whether the position of the pointer in the display changes. The installation site should be selected to allow a reliable reading of the values displayed on the scale. Please ensure that there is adequate space for a potential upgrading of the instrument.

Inlet and outlet pluggings in front of and behind the instrument are usually unnecessary in the case of linear flow profile of the medium; the installation of unilaterally constricting fittings in front of the instrument should be avoided. As a rule, interference-free inlet and outlet tracks are not required. In the case of highly asymmetric flow profiles, however, additional measures (e.g. inlet tracks, flow rectifiers) could be expedient for the attainment of measuring accuracy. If this is absolutely necessary, at least the length of the instrument = 250 mm should be designed as the inlet track. The nominal width of the pipe to be connected must correspond to the nominal width of the measuring instrument. The installation of unilaterally constrictive fittings directly in front of the instrument must be avoided. For gases, valves must be installed at the rear of the measuring device, as a rule. The nominal width of the instrument and the pipes must be identical. The flanges must be compliant both in their pressure stage and in their dimensions. The surface roughness of the flange sealing areas must be appropriate for the designed seals.

Please verify that accessories such as spring stop, gas/fluid damping are still correctly seated in the flange. Check that the installation clearance between the flanges of the pipe correspond to the fitting dimension of the instrument and additionally 2 gaskets.

To achieve an installation free from strain the flanges for the pipe must be positioned parallel and aligned to each other. Mounting screws and gaskets of the prescribed dimensions must be employed. The gaskets must be appropriate for the operating pressure, the temperature and the measuring substance.

For PTFE-cladded instruments, use gaskets that conform in the inner and outer dimensions with the raised face of the instrument. Tighten the screws crosswise so that the process connections are sealed. The tightening torque for the screws must be adhered to especially in the case of PTFE-cladded devices. Please ensure that the pipe has been mounted securely enough to exclude any vibration or oscillation in the instruments. **Do not use steel mounting brackets on the instrument!** Pay particular attention to the positioning of the valve when gas is to be measured. If the instrument is absolutely calibrated for a pressure exceeding 1.013 bar the valve is usually installed at the rear of the flowmeter, at 1.013 bar absolute (free emanation) in front of the instrument.

The flange screws for PTFE-cladded fittings may only be tightened with the following maximum torques (VDI/VDE Guideline 3513):

- DN 15 to 25/½ to 1 inch: 14 Nm
- DN 50/2 inch: 25 Nm
- DN 80/3 inch: 35 Nm
- DN 100/4 inch: 42 Nm.

For the prevention of compression oscillation during gas measurements, a throttle must be arranged immediately behind the measuring instrument. For the avoidance of erroneous measurements the arrangement must be selected to ensure that the pressure prevailing in the measuring instrument corresponds to the reference pressure of the calibration.

The instrument may only be operated in compliance with the pressure and voltage limits defined on the rating plate.

Setting into operation

1. During the setting into operation of new systems, residual materials are conveyed in the medium and could adhere to the rotameter. In this case we recommend cleaning the instrument after a relatively short period of operation. In particular ferromagnetic substances such as weld beads could lead to the shut-down of the equipment. A magnet filter (accessory) should be mounted in front of the instrument if such fragments cannot be avoided in routine operation.
2. The rotameter must not be exposed to knocks or impacts. Hence it is recommended to start up in countercurrent with a closed valve that is then slowly adjusted to the operating pressure. Fluids must be aerated slowly in order to prevent shock pressure due to gas bubbles. Especially with gas the primary pressure must be increased slowly in order to prevent high shock pressure. As a rule, avoid activation via solenoid valves to eliminate the skyrocketing of the rotameter. Allow the operating pressure to rise slowly when gases are being dealt with.
3. The instrument will indicate in all scale ranges in accordance with its accuracy class. During each starting-up process it must be ensured that the rotameter is able to level off and that for measurement in the lowest measuring range a higher flowrate is initially set for a brief period.

Maintenance and repair work

The instrument requires no maintenance in routine and appropriate operation. Depending on the measuring substances, contamination, abrasion or chemical reactions could affect the measuring orifice and the rotameter and hence have an impact on the measuring accuracy. In this case the instrument should be dismounted and cleaned with suitable agents including the rotameter. The measuring orifice and the rotameter may not be damaged mechanically or by aggressive cleaning agents. If attacks are detected on the measuring orifice or the rotameter, they must be recalibrated or replaced. Please observe the following points:

- Please observe that in instruments with installed electrical equipment, the removal of the display hood will lead to constraint in the EMC protection.
- Before you dismount an instrument, please ensure that the pipeline is free from products and pressure and has cooled down.
- Fittings that are coated on the inside can be cleaned carefully following disassembly using a brush and appropriate cleaning agents. The rotameter should be carefully cleaned to remove possible coating. Warning, do not treat the measuring ring/cone and the rotameter with hard objects.
- The switching points of the limiting value transmitters are adjustable. Remove the display hood, loosen the contact point pointers on the scale and re-set. Tighten the screws of the contact point pointers after adjustment. Replace the display hood and fix tightly.
- The calibration of the signal output with KINAX is permanently set and is not adjustable. Do not adjust the potentiometers of the measuring transducer.
- The parameterising of the ES is possible and is carried out using HART®. See the separate user manual for ES.
- The cylinders of the gas and fluid dampers can be checked for freedom from contamination (see Dismounting/Installation of dampers).

On conclusion of the maintenance and cleaning work the instruments must be subjected to a function control before being operated once again.

Installation and dismounting of the cone/rotameter/damper/spring stop
The instrument must be dismounted from the pipe before the rotameter (cone/ rotameter) can be removed. After dismounting, clamp the instrument in a horizontal position, ensuring that the fitting is not damaged in the process.
Model with measuring ring: Secure the rotameter against distortion from above in the fitting using a suitable tool at the guide bracket, remove the screw which is visible from below in the fitting from the guide bracket ant then remove the guide bracket. After this the rotameter may be removed from above.
Model with cone: Unscrew the cone together with the rotameter using a suitable tool via the bottom cone screw thread, remove the rotameter after detaching the top cone lock.
Warning! Avoid damaging the rotameter/measuring ring and cone.
From a measured variable of 5–50 l/h water, the rotameter can be exchanged for alteration of the measuring range. The cylinders of the gas and fluid dampers and the spring stop for the rotameter can be pulled out from the top after they have been dismounted from the instrument. When reinstalling the parts, proceed in reverse sequence.

Settings

Limit signal transducer (inductive contact)
The measuring equipment is delivered ready for operation in compliance with your order. Limit signal transducers are preset at the required values. If you have not requested customised setting, the basic setting for

- **1 contact unit is**:
  min. contact switching point at 10% declining flowrate. (damped closed current principle)
- **2 contact units is**:
  min. contact switching point at 10% declining flowrate and max. contact switching point at 90% rising flowrate

Resetting limit signal transducer
The contacts are adjusted and reset via the contact position indicators located on the scale. For this purpose, dismount the display hood, loosen the contact position indicators, set at the required value and remount.

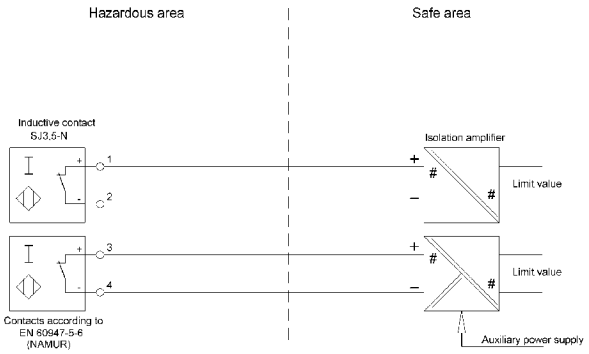
Analogue output with magnetoelectrical measuring transducer
The magnetoelectrical measuring transducer has already been calibrated with regard to the scale values by the manufacturer when it is delivered to the customer.

The HART® version can only be supplied with a 2-conductor 4–20 mA connection signal output. The signal output and the limits can be configured using a HART® modem with the configuration program "PDM" from Siemens.

The Profibus PA is designed with an interface to provide a digital communication electric circuit in compliance with the FISCO model. The configuration of the signal output is "PDM" from Siemens.

Analogue output with rotation angle measuring transducer KINAX 3W2
The signal output of the rotation angle measuring transducer has been permanently calibrated by the manufacturer. The signal output is equivalent to 4–20 mA in the 2-conductor connection, alternatively 0–20 mA in the 4- or 3-conductor connection. Signal output 4 mA is equivalent to the flow on the scale of 0 (at 0–20 mA 0 mA).

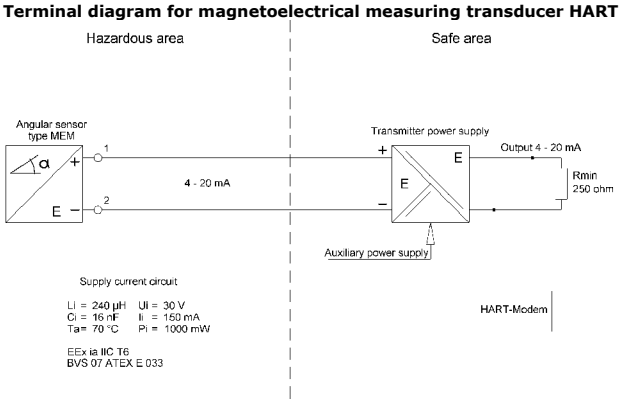
Terminal diagram for inductive limiting value transmitter



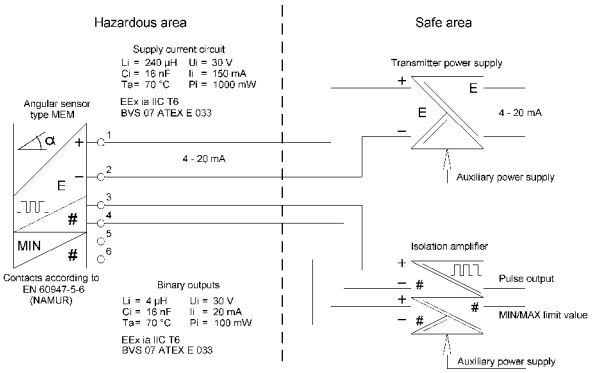
Electrical connection terminals

Wiring: To connect the auxiliary energy, remove the display hood, insert the cable set via the cable glands and fasten at the terminal in accordance with the mounting plan. Tighten the cable glands, replace the display hood and seal tightly.

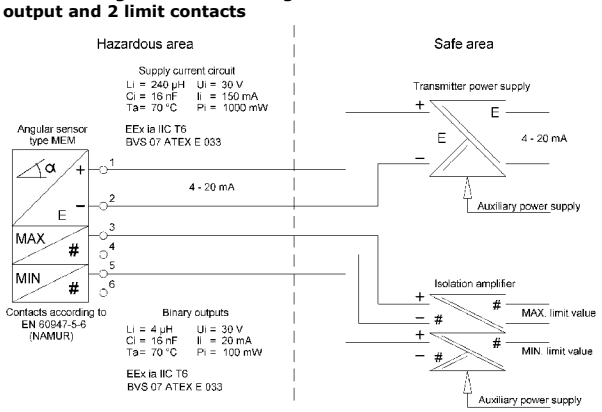
Terminal diagram for magnetoelectrical measuring transducer HART



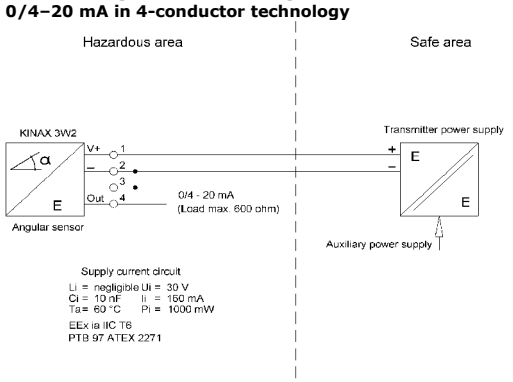
Terminal diagram for measuring transducer HART with 4–20 mA output, pulse output and limit contact



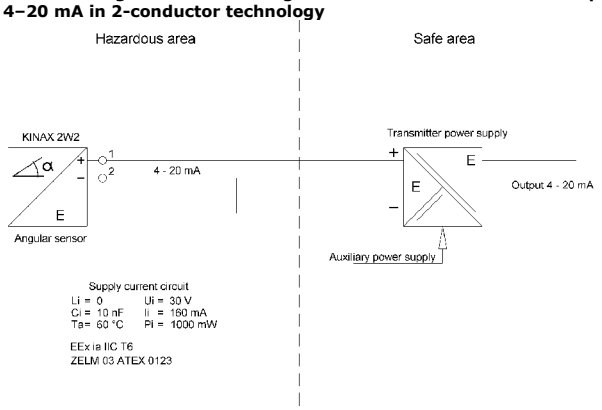
Terminal diagram for measuring transducer HART with 4–20 mA output and 2 limit contacts



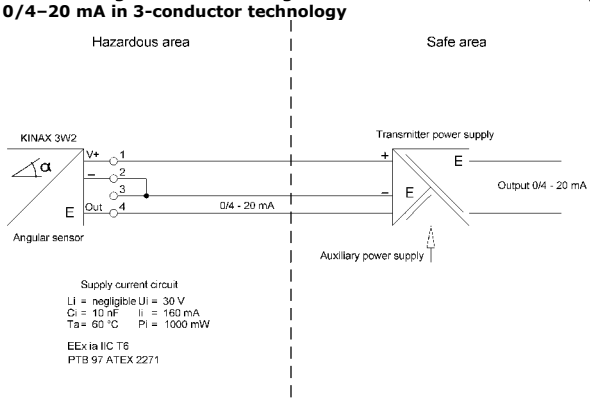
Terminal diagram for measuring transducer KINAX 3W2 with output 0/4–20 mA in 4-conductor technology



Terminal diagram for measuring transducer KINAX 2W2 with output 4–20 mA in 2-conductor technology



Terminal diagram for measuring transducer KINAX 3W2 with output 0/4–20 mA in 3-conductor technology



Ordering data Type FVA 250 all metal for fluid metering

7ME5822- [ ][ ][ ] **0** [ ] - [ ][ ][ ][ ] - **Z**

Version

Type CF-S:	fitting, flange and float in stainless steel	**2**
Type EF-H:	fitting in stainless steel, liner Hastelloy, float in Hastelloy	**4**
Type FF-P:	fitting in stainless steel, liner PTFE, Schwebekörper in PTFE	**5**

Nominal diameters / Flange versions

CF-S	EF-H	FF-P			
			DN 15 flange DIN 2501 PN 40	**A**	
			1/2" ANSI 150 RF B16.5	**K**	
			1/2" ANSI 300 RF B16.5	**Z**	**J2A**
			DN 20 flange DIN 2501 PN 40	**F**	
			3/4" ANSI 150 RF B16.5	**L**	
			3/4" ANSI 300 RF B16.5	**Z**	**J2B**
			DN 25 flange DIN 2501 PN 40	**B**	
			1" ANSI 150 RF B16.5	**M**	
			1" ANSI 300 RF B16.5	**Z**	**J2C**
			DN 32 flange DIN 2501 PN 40	**G**	
			1 1/4" ANSI 150 RF B16.5	**N**	
			1 1/4" ANSI 300 RF B16.5	**Z**	**J2D**
			DN 40 flange DIN 2501 PN 40	**H**	
			1 1/2" ANSI 150 RF B16.5	**P**	
			1 1/2" ANSI 300 RF B16.5	**Z**	**J2E**
			DN 50 flange DIN 2501 PN 40	**C**	
			2" ANSI 150 RF B16.5	**Q**	
			2" ANSI 300 RF B16.5	**Z**	**J2F**
			DN 65 flange DIN 2501 PN 16	**J**	
			2 1/2" ANSI 150 RF B16.5	**R**	
			2 1/2" ANSI 300 RF B16.5	**Z**	**J2G**
			DN 65 flange DIN 2501 PN 40	**Z**	**J1A**
			DN 80 flange DIN 2501 PN 40	**D**	
			3" ANSI 150 RF B16.5	**S**	
			3" ANSI 300 RF B16.5	**Z**	**J2H**
			DN 100 flange DIN 2501 PN 16	**E**	
			4" ANSI 150 RF B16.5	**T**	
			4" ANSI 300 RF B16.5	**Z**	**J2J**
			DN 100 flange DIN 2501 PN 40	**Z**	**J1B**

Measuring ranges

Indicated measuring ranges refer to:

density: 1Kg/l; viscosity: 1 mPa.s; temperature 20°C

Nom. Diameter	CF-S	EF-H	FF-P		
DN 15 - DN 25	0,5 - 5 l/h	----	----	**Z**	**K1A**
DN 15 - DN 25	1,0 - 10 l/h	----	----	**Z**	**K1B**
DN 15 - DN 25	1,6 - 16 l/h	----	----	**A**	
DN 15 - DN 25	2,5 - 25 l/h	----	----	**B**	
DN 15 - DN 25	4 - 40 l/h	----	----	**C**	
DN 15 - DN 25	5 - 50 l/h	5 - 50 l/h	10 - 50 l/h	**Z**	**K1C**
DN 15 - DN 25	7 - 70 l/h	7 - 70 l/h	14 - 70 l/h	**D**	
DN 15 - DN 25	10 - 100 l/h	10 - 100 l/h	20 - 100 l/h	**E**	
DN 15 - DN 25	16 - 160 l/h	16 - 160 l/h	16 - 160 l/h	**F**	
DN 15 - DN 25	25 - 250 l/h	25 - 250 l/h	25 - 250 l/h	**G**	
DN 15 - DN 25	40 - 400 l/h	40 - 400 l/h	40 - 400 l/h	**H**	
DN 15 - DN 40	60 - 600 l/h	60 - 600 l/h	60 - 600 l/h	**J**	
DN 15 - DN 40	100 - 1000 l/h	100 - 1000 l/h	100 - 1000 l/h	**K**	
DN 15 - DN 40	160 - 1600 l/h	160 - 1600 l/h	160 - 1600 l/h	**L**	
DN 15 - DN 40	250 - 2500 l/h	250 - 2500 l/h	250 - 2500 l/h	**M**	
DN 25 - DN 65	0,4 - 4 m³/h	0,4 - 4 m³/h	0,4 - 4 m³/h	**N**	
DN 40 - DN 65	0,6 - 6 m³/h	0,6 - 6 m³/h	0,6 - 6 m³/h	**P**	
DN 50 - DN 65	1,0 - 10 m³/h	1,0 - 10 m³/h	1,0 - 10 m³/h	**Q**	
DN 50 - DN 80	1,6 - 16 m³/h	1,6 - 16 m³/h	1,6 - 16 m³/h	**R**	
DN 50 - DN 80	2,0 - 20 m³/h	2,0 - 20 m³/h	----	**S**	
DN 50 - DN 80	2,5 - 25 m³/h	2,5 - 25 m³/h	2,5 - 25 m³/h	**T**	
DN 80 - DN 100	4,0 - 40 m³/h	4,0 - 40 m³/h	4,0 - 40 m³/h	**U**	
DN 100	5,0 - 50 m³/h	5,0 - 50 m³/h	5,0 - 50 m³/h	**V**	
DN 100	6,0 - 60 m³/h	6,0 - 60 m³/h	----	**W**	
DN 100	8,0 - 80 m³/h	8,0 - 80 m³/h	----	**Z**	**K1D**
DN 100	10 - 100 m³/h	10 - 100 m³/h	----	**X**	

Display/ Process temperature

Standard up to 150 °C for electric output/ 200 °C for local display	**0**
standard with displaced display	**2**
stainless steel IP66 for process temperature 150 °C	**5**
stainless steel IP66 displaced	**6**

Heating/ cooling sheath

without	**0**
with flange connenction DN 15 DIN 2501 PN 40 in stainless steel	**2**
with flange connection 1/2" ANSI B16.5 150 RF in stainless steel	**3**

Display

with local display	**A A**
with local display and an inductive contact SJ 3,5 N	**C J**
with local display and two inductive contacts SJ 3,5 N	**C L**
with local display and electric remote sensor FVA 252 (0-20 mA)	**D A**
with local display and electric remote sensor FVA 252 (0-20 mA) with one inductive contact SJ 3,5 N	**D J**
with local display and electric remote sensor FVA 252 (4-20 mA)	**E A**
with local display and electric remote sensor FVA 252 (4-20 mA) with one inductive contact SJ 3,5 N	**E J**
with HART- protocol, 4 - 20 mA, Eex ia	**F A**
with HART- protocol, 4 - 20 mA, Eex ia with two inductive contacts SJ 3,5 N	**G L**
with HART- protocol, 4 - 20 mA, Eex ia with one inductive contact and a pulse output	**H J**
electric transmitter with Profibus PA. Eex ia	**P A**

Calibration certificate

without	**0**
with calibration certificate	**1**

Further designs

Measured medium:	**Y01**
Silicone-free version	**Y04**
TAG plate made of stainless steel	**Y17**
Test report 2.2	**C11**
Acceptance test B to DIN 50049, Section 3.1 and EN 10204	**C12**
Rating plate in English	**B11**
Special measuring range for DN 15 to DN 25: Qv 0,5 - 5 l/h	**K1A**
Special measuring range for DN 15 to DN 25: Qv 1,0 - 10 l/h	**K1B**
Special measuring range for DN 15 to DN 25: Qv 5,0 - 50 l/h	**K1C**
Special measuring range for DN 100: Qv 8 - 80 m³/h	**K1D**

	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100
Process connection									
DIN 2501 PN 40	--	--	--	--	--	--	J1A	--	J1B
ANSI 300 RF B16.5	J2A	J2B	J2C	J2D	J2E	J2F	J2G	J2H	J2J
with liquid damping									
for CF-S	D01	D02	D03	D04	D05	D06	D07	D08	D09
for EF-H	E01	E02	E03	E04	E05	E06	E07	E08	E09
for FF-P *1)	P01	--	P03	--	--	P06	--	P08	P09

*1) built in length + 5mm

Ordering data Type FVA 250 all metal for gas metering

7ME5823- ☐☐☐☐ **0** ☐ - ☐☐☐☐ - **Z**

Version

Type CF-S:	fitting, flange and float in stainless steel	**2**
Type EF-H:	fitting in stainless steel, liner Hastelloy, float in Hastelloy	**4**
Type FF-P:	fitting in stainless steel, liner PTFE, float in PTFE	**5**

Nominal diameters / Flange versions

CF-S	EF-H	FF-P			
			DN 15 flange DIN 2501 PN 40	**A**	
			1/2" ANSI 150 RF B16.5	**K**	
			1/2" ANSI 300 RF B16.5	**Z**	**J2A**
			DN 20 flange DIN 2501 PN 40	**F**	
			3/4" ANSI 150 RF B16.5	**L**	
			3/4" ANSI 300 RF B16.5	**Z**	**J2B**
			DN 25 flange DIN 2501 PN 40	**B**	
			1" ANSI 150 RF B16.5	**M**	
			1" ANSI 300 RF B16.5	**Z**	**J2C**
			DN 32 flange DIN 2501 PN 40	**G**	
			1 1/4" ANSI 150 RF B16.5	**N**	
			1 1/4" ANSI 300 RF B16.5	**Z**	**J2D**
			DN 40 flange DIN 2501 PN 40	**H**	
			1 1/2" ANSI 150 RF B16.5	**P**	
			1 1/2" ANSI 300 RF B16.5	**Z**	**J2E**
			DN 50 flange DIN 2501 PN 40	**C**	
			2" ANSI 150 RF B16.5	**Q**	
			2" ANSI 300 RF B16.5	**Z**	**J2F**
			DN 65 flange DIN 2501 PN 16	**J**	
			2 1/2" ANSI 150 RF B16.5	**R**	
			2 1/2" ANSI 300 RF B16.5	**Z**	**J2G**
			DN 65 flange DIN 2501 PN 40	**Z**	**J1A**
			DN 80 flange DIN 2501 PN 40	**D**	
			3" ANSI 150 RF B16.5	**S**	
			3" ANSI 300 RF B16.5	**Z**	**J2H**
			DN 100 flange DIN 2501 PN 16	**E**	
			4" ANSI 150 RF B16.5	**T**	
			4" ANSI 300 RF B16.5	**Z**	**J2J**
			DN 100 flange DIN 2501 PN 40	**Z**	**J1B**

Measuring ranges

Indicated measuring ranges refer to: density 1,293 kg/m³
viscosity: 0,0181 mPa.s; temperature 20°C; pressure 1,013 bar absolut

Nom. Diameter	CF-S	EF-H	FF-P		
DN 15 - DN 25	0,015 - 0,15 m³/h	----	----	**Z**	**K1A**
DN 15 - DN 25	0,03 - 0,30 m³/h	----	----	**Z**	**K1B**
DN 15 - DN 25	0,045 - 0,48 m³/h	----	----	**A**	
DN 15 - DN 25	0,075 - 0,75 m³/h	----	----	**B**	
DN 15 - DN 25	0,13 - 1,3 m³/h	----	----	**C**	
DN 15 - DN 25	0,15 - 1,5 m³/h	0,15 - 1,5 m³/h	0,3 - 1,5 m³/h	**Z**	**K1C**
DN 15 - DN 25	0,2 - 2,1 m³/h	0,2 - 2,1 m³/h	0,4 - 2,1 m³/h	**D**	
DN 15 - DN 25	0,3 - 3,0 m³/h	0,3 - 3,0 m³/h	0,6 - 3,0 m³/h	**E**	
DN 15 - DN 25	0,5 - 4,6 m³/h	0,5 - 4,6 m³/h	0,5 - 4,6 m³/h	**F**	
DN 15 - DN 25	0,7 - 7,0 m³/h	0,7 - 7,0 m³/h	0,7 - 7,0 m³/h	**G**	
DN 15 - DN 25	1,0 - 11 m³/h	1,0 - 11 m³/h	1,0 - 11 m³/h	**H**	
DN 15 - DN 40	1,7 - 17 m³/h	1,7 - 17 m³/h	1,7 - 17 m³/h	**J**	
DN 15 - DN 40	3 - 30 m³/h	3 - 30 m³/h	3 - 30 m³/h	**K**	
DN 15 - DN 40	4 - 46 m³/h	4 - 46 m³/h	4 - 46 m³/h	**L**	
DN 15 - DN 40	7 - 70 m³/h	7 - 70 m³/h	7 - 70 m³/h	**M**	
DN 25 - DN 65	11 - 110 m³/h	11 - 110 m³/h	11 - 110 m³/h	**N**	
DN 40 - DN 65	17 - 170 m³/h	17 - 170 m³/h	17 - 170 m³/h	**P**	
DN 50 - DN 65	29 - 290 m³/h	29 - 290 m³/h	29 - 290 m³/h	**Q**	
DN 50 - DN 80	46 - 460 m³/h	46 - 460 m³/h	46 - 460 m³/h	**R**	
DN 50 - DN 80	55 - 550 m³/h	55 - 550 m³/h	----	**S**	
DN 50 - DN 80	70 - 700 m³/h	70 - 700 m³/h	70 - 700 m³/h	**T**	
DN 80 - DN 100	110 - 1100 m³/h	110 - 1100 m³/h	110 - 1100 m³/h	**U**	
DN 100	135 - 1350 m³/h	135 - 1350 m³/h	135 - 1350 m³/h	**V**	
DN 100	170 - 1700 m³/h	170 - 1700 m³/h	----	**W**	
DN 100	240 - 2400 m³/h	240 - 2400 m³/h	----	**Z**	**K1D**
DN 100	300 - 3000 m³/h	300 - 3000 m³/h	----	**X**	

Display/ Process temperature

standard up to 150 °C for electric output/ 200 °C for local display	**0**
standard with displaced display	**2**
stainless steel IP66 for process temprature 150 °C	**5**
stainless steel IP66 displaced	**6**

Heating/ cooling sheath

without	**0**
with flange connenction DN 15 DIN 2501 PN 40 in stainless steel	**2**
with flange connenction 1/2" ANSI B16.5 150 RF in stainless steel	**3**

Display

with local display	**A A**
with local display and an inductive contact SJ 3,5 N	**C J**
with local display and two inductive contacts SJ 3,5 N	**C L**
with local display and electric remote sensor FVA 252 (0-20 mA)	**D A**
with local display and electric remote sensor FVA 252 (0-20 mA) with one inductive contact SJ 3,5 N	**D J**
with local display and electric remote sensor FVA 252 (4-20 mA)	**E A**
with local display and electric remote sensor FVA 252 (4-20 mA) with one inductive contact SJ 3,5 N	**E J**
with HART- protocol, 4 - 20 mA, Eex ia	**F A**
with HART- protocol, 4 - 20 mA, Eex ia with two inductive contacts SJ 3,5 N	**G L**
WITH HART- protocol, 4 - 20 mA, Eex ia with an inductive contact and a pulse output	**H J**
electric transmitter with Profibus PA. Eex ia	**P A**

Calibration certificate

without	**0**
with calibration certificate	**1**

Further designs

Measured medium:	**Y01**
Silicone-free version	**Y04**
TAG plate made of stainless steel	**Y17**
Test report 2.2	**C11**
Acceptance test B to DIN 50049, Section 3.1 and EN 10204	**C12**
Rating plate in English	**B11**
Special measuring range for DN 15 to DN 25: Qn 0,015 - 1,5 m³/h	**K1A**
Special measuring range for DN 15 to DN 25: Qn 0,03 - 0,30 m³/h	**K1B**
Special measuring range for DN 15 to DN 25: Qn 0,15 - 1,5 m³/h	**K1C**
Special measuring range for DN 100: Qn 240 - 2400 m³/h	**K1D**

	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100
Process connection									
DIN 2501 PN 40	--	--	--	--	--	--	J1A	--	J1B
ANSI 300 RF B16.5	J2A	J2B	J2C	J2D	J2E	J2F	J2G	J2H	J2J
with gas damping									
for CF-S	D11	D12	D13	D14	D15	D16	D17	D18	D19
for EF-H	E11	E12	E13	E14	E15	E16	E17	E18	E19
for FF-P *1)	P11	--	P13	--	--	P16	--	P18	P19

*1) built in length + 5mm