



Figure 1 TM Tubux variable area meter

Application

The TM Tubux variable area meters are used to measure the volume of transparent liquids and gases passing through closed piping. The variable area meters can also be used for flow monitoring if they are equipped with one or more switching contacts. Standard scales are available for liquids with a density of 1 kg/l (62.43 lbs/cu.ft). The scales must be recalculated for all other media depending on the physical characteristics.

The flow tube is also optionally available with a percentage or 2-mm (0.078 inch) scale.

Design and Operation

The main components of the TM Tubux variable area meters are the glass variable-area flow tube with float, the fitting and the connection parts. The flow is displayed directly on the scale present on the flow tube (e.g. in l/h) and is read at the position of the float's widest diameter.

Special Features

Product scales for liquids and gases

- Rugged versions with various materials
- Can be used for high pressures and temperature
- Short delivery times for standard versions.

Connection and Mode of Operation

For certain variable area meter sizes, the float is packed in a plastic net for transport purposes. Prior to fitting, this must be removed out of the variable area meter from the top.

The locking rod must be pulled upwards out of the variable area meter.

In versions with a float guide rod, the float is usually held in place at the top by a rubber buffer. Push this buffer down to the bottom limit by pressing on the float.

The variable area meter must be fitted vertically and without tension. Control elements or reductions/extensions in the pipe diameter upstream or downstream of the variable area meter have no influence on the accuracy when measuring liquids. However, when measuring gases, the variable area meter should be installed upstream of valves to prevent pulsations resulting from compression. Since variable area meter respond extremely sensitively to changes in flow, control elements should always be adjusted slowly.

The calibration has been carried out for defined media conditions. Deviations in the density, pressure or temperature of gases, or in the density or viscosity of liquids, result in measurement errors. It is essential to observe the calibration conditions. When ordering, it is therefore essential to provide data on the medium, density and viscosity at the operating temperature and pressure. With gases, it is additionally necessary to specify the exact reference point for the pressure (pressure above atmospheric or absolute pressure).

Retrofitting of switching contacts is only possible if variable area meters with magnets are used and if the fitting is made of stainless steel (see Table Versions). When using for the first time, move the float completely past the contact to permit polarization.

Float Guide Rot

(see also tables on page 3 and 4)

The float guide rod prevents the float from making contact with the glass flow tube.

The option is recommended to increase the operational safety and to protect against glass breakages in the case of operating conditions such as solenoid valve control. The option is not possible in conjunction with floats with magnets and weighted PVC/ PVDF floats.

Liquids: Standard: flow tube E 4000 to H 25000
Option: flow tube C 125 and upwards

Gases: Standard: flow tube D 2500 to H 25000
Option: flow tube C 125 and upwards

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 flow meter parts in contact with the medium are suitable for the used process media. The flow meter may only be used within the pressure and voltage limits specified in the operating instructions. Before replacing the measuring tubes, check that the unit is free of hazardous media and pressures. 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 flow meter meets the requirements of the PED 97/23/EG as stated in the table on page 2.

Classification According to PED 97/23/EC

	Order No.	Permissible media	Category
	7ME5810-		
G $\frac{1}{4}$ to G3	xxxax-xxxx; a#2	Gases of fluid group 2 and liquids of fluid group 1	Article 3.3
≤DN25 (G $\frac{1}{4}$ to G1)	xxxax-xxxx; a=2	Gases of fluid group 1 and liquids of fluid group 1	Article 3.3
>DN25 (G $\frac{1}{4}$ to G3)	xxxax-xxxx; a=2	Gases of fluid group 1 and liquids of fluid group 1	I

Technical Data of TM TUBUX

Measuring principle	Float
Input	
Flow	Vertically upwards
Permissible operating pressure	
• Flow tubes A 1 to D 3.000	max. 10 bar / 145 psi
• Flow tubes E 4.000 to F 10.000	max. 8 bar / 116 psi
• Flow tubes G 12.500 to H 25.000	max. 5 bar / 73 psi
Rated operating conditions	
Temperature limits	
• With Float made of Mat. No. 1.4305 / 303 or 1.4571 / 316Ti or aluminum	-10 to +150 °C / 14 to 302 °F
• With float made of PVDF	-10 to +100 °C / 14 to 212 °F
• With float made of PVC	-10 to +50 °C / 14 to 122 °F
• With fitting made of PVC	-10 to +50 °C / 14 to 122 °F
	Etched scale is necessary with medium temperature >90 °C / 194 °F
Medium conditions	
• Accuracy	Class 1.6 (according to VDE/VDI 35 13, sheet 2)
• Measuring range	Dependent on flow tube
- for liquids	0.1 l/h to 25 m ³ /h / 0,00044 to 110 USgpm
- for gases	1.6 l/h to 400 m ³ /h / 0.007 to 1,761 USgpm A special scale must be provided for liquids with a density other than 1 kg/l / 62.43 lbs/cu.ft and all gases
• Dimensions for measured variable	l/h (up to flow tube D 2500) m ³ /h (flow tube D 3000 and above)
Design	
Connections	Screwed gland G ¹ / ₄ to G3
Material	
• Flow tube	Borosilicate glass (length 300 mm (11.8 inch))
• Connection	Cast iron, stainless steel mat. No. 1.4571 / 316Ti, steel/PVC
• Float	Stainless steel, mat. No. 1.4305 / 303, mat. No. 1.4571 / 316Ti, PVC und PVDF, aluminum
• Float guide rod	Stainless steel mat. No. 1.4571 / 316Ti
• Gasket	Buna N up to 90 °C / 194 °F, Viton up to 150 °C / 302 °F, EPDM (for potable water plants) up to 150 °C / 302 °F
• Limit	Springs made of stainless steel for non-guided floats, otherwise rubber buffers for guided floats

Weight

With threaded connection G ¹ / ₂	2.5 kg (5.51 lb)
With threaded connection G1	5.5 kg (12.12 lb)
With threaded connection G2	9 kg (19.8 lb)
With threaded connection G3	24 kg (52.9 lb)

Fittings and Connection PVC DIN 8062

Medium	T [°C (°F)]	Pe [bar (psi)]
Water and not abrasive liquids	20 (68)	10.0 (145)
	40 (104)	10.0 (145)
	50 (122)	2.5 (36)
abrasive liquids	20 (68)	10.0 (145)
	40 (104)	4.0 (58)
	50 (122)	1.0 (15)

P_e = overpressure

Technical Data of Contacts

Switching principle	Magnetic contact unit, bistable
Designation	
• flow tube size C 125 to H 25000	K17 A, K17 B
• flow tube size D 650 to H 25000	K 23
housing/plug	PP/PA 6
contact material	Rhodium
Degree of protection	IP65
Ambient temperature	- 20 to + 80 °C 4 to 176 °F
max. switching frequency	5/min
max. rating	
• K 17	AC 250 V / 0,5 A / 10 VA DC 250 V / 0,5 A / 5 W
• K 23	AC 250 V / 1 A / 150 VA DC 250 V / 1 A / 100 W Rating data apply to resistive loads; a suppressor circuit is required for inductive loads

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Contact Assembly

The bistable contact assembly consists of a contact spring set sealed in a glass tube filled with protective gas.

Three contacts can be selected:

- K 17 A: contact closes when the limit is fallen below
- K 17 B: contact closes when the limit is exceeded
- K 23: changeover contact.

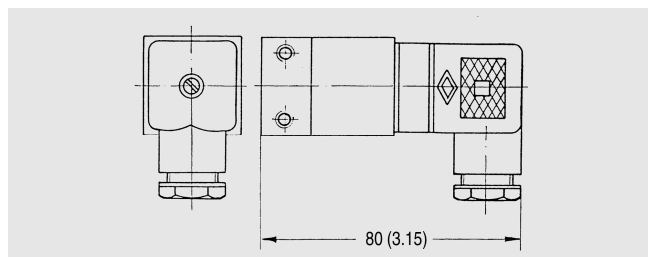


Figure 2: Contact K17, dimensions in mm (inches)

Versions

Eight standard versions are defined in the price list using different combinations of fitting, connection materials and floats (the type number corresponds to the 4th digit of the second block of the order number).

Version	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Can be used for	liquids					gases		
Fitting	steel	Mat. No. 1.4571/316 Ti	steel	PVC	Mat. No. 1.4571/316Ti/steel	steel	steel	Mat. No. 1.4571/316Ti/steel
Connection	steel (cast iron)	Mat. No. 1.4571/316 Ti	Mat. No. 1.4571/316Ti	PVC	steel	steel (cast iron)	Mat. No. 1.4571/316Ti	steel (cast iron)
Float	Mat. No. 1.4571/316Ti, 1.4305/303	Mat. No. 1.4571/316Ti	Mat. No. 1.4571/316Ti	PVC weighted	Mat. No. 1.4571/316Ti	Aluminum (PVC and PVDF as special version)		Aluminum (PVC as special version)
Magnet	-	-	-	-	X	-	-	X
Flow tube, size	A and B	X	X	X	X	-	X	-
	C to F	X	X	X	X	X	X	X
	G and H	X	-	X	-	X	X	X

Standard types of variable area flow meter

Select of Float

There are three versions of floats:

- Non-guided float
- Guided float
- Viscosity-compensated float.

Use of the viscosity-compensated float is necessary above the following viscosities:

Flow tube	Pressure (mPa·s)
C 125 to C 500	≥3
D 650 to D 3000	≥5
E 4000 to F 10000	≥8
G 12500 to H 25000	≥10

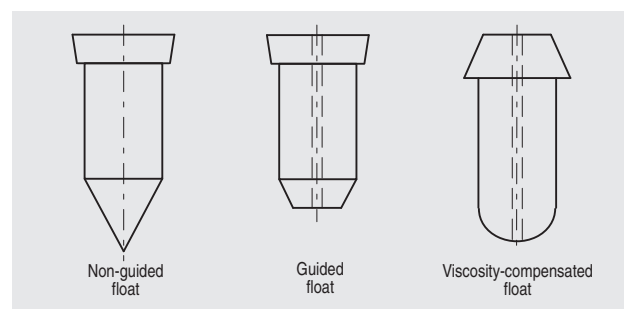


Figure 3 Float versions

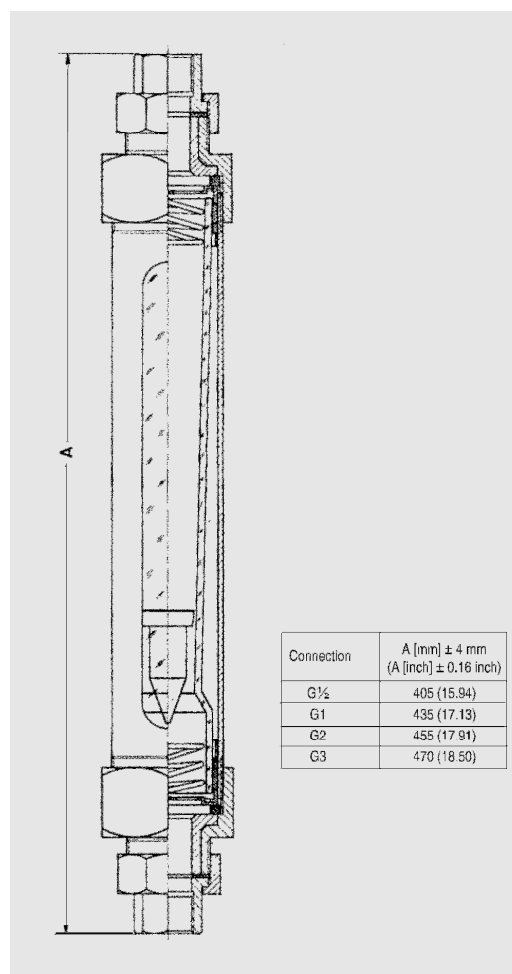


Figure 4 TM Tubux, dimensions in mm (inches)

Measuring Ranges for Liquids

Conection		Flow tube	Pressure loss		Max. Measuring range for the selected floats									
Female thread G, NPT	PVC-adhesive bushing mm (inch)		mbar (psi)		Up to flow tube B 100 Mat. No.		Viscosity-compensated Mat. No.		With magnet Mat. No.		PVC weighted Mat. No.			
					1.4305, 1.4571	303, 316Ti	1.4571	316Ti	1.4571	316Ti				
					l/h	(USgpm)	l/h	(USgpm)	l/h	(USgpm)	l/h	(USgpm)		
(G¼), (G¾), G½	20 (0.79)	A 1	10	(0.145)	1	(0.0044)	-	-	-	-	-	-		
		A 3			3	(0.013)	-	-	-	-	-	-		
		A 5			5	(0.022)	-	-	-	-	-	-		
		A 10			10	(0.044)	-	-	-	-	-	-		
		A 25			25	(0.110)	-	-	-	-	-	-		
		B 30			30	(0.132)	-	-	-	-	11	(0.048)		
		B 40			40	(0.176)	-	-	-	-	15	(0.066)		
		B 50			50	(0.22)	-	-	-	-	20	(0.088)		
		B 65			65	(0.29)	-	-	-	-	25	(0.110)		
		B 80			80	(0.35)	-	-	-	-	32	(0.140)		
		B 100			100	(0.44)	-	-	-	-	40	(0.176)		
		C 125			20	(0.290)	125	(0.55)	100*	(0.44)*	120	(0.53)	65	(0.29)
		C 160					160	(0.70)	125*	(0.55)*	150	(0.66)	90	(0.40)
		C 200					200	(0.88)	160*	(0.70)*	180	(0.79)	110	(0.48)
C 250	250	(1.10)	200*	(0.88)*			240	(1.06)	140	(0.62)				
(G½), (G¾), G1	32 (1.26)	D 650	19	(0.28)	650	(2.86)	400*	(1.76)*	600	(2.64)	500	(2.20)		
		D 800			800	(3.52)	500*	(2.20)*	750	(3.30)	600	(2.64)		
		D 1000			1000	(4.4)	600*	(2.64)*	950	(4.18)	750	(3.30)		
		D 1250			1250	(5.5)	750*	(3.30)*	1200	(5.3)	1000	(4.40)		
		D 1600	24	(0.35)	1600	(7.0)	1000*	(4.40)*	1500	(6.6)	1250	(5.50)		
		D 2000			2000	(8.8)	1200*	(5.30)*	1800	(7.9)	1600	(7.0)		
(G1¼), (G1½), G2	63 (2.48)	E 4000	25	(0.36)	4000*	(17.6)*	2500*	(11.0)*	3800*	(16.7)*	3200	(14.0)		
		E 5000			5000*	(22.0)*	3000*	(13.0)*	4800*	(21.1)*	3800	(16.7)		
		E 6500			6500*	(28.6)*	4000*	(17.6)*	6400*	(28.0)*	5000	(22.0)		
		F 8000			8000*	(35.0)*	4500*	(19.8)*	7500*	(33.0)*	6400	(28.0)		
		F 10000			10000*	(44.0)*	5500*	(24.0)*	9500*	(42.0)*	7500	(33.0)		
		G 12500			34	(0.49)	12500*	(55.0)*	7000*	(31.0)*	12000*	(53.0)*	-	-
G 16000	16000*	(70.0)*	9000*	(40.0)*			16000*	(70.0)*	-	-				
(G2), (G2½), G3	-	H 20000	38	(0.55)	20000*	(88.0)*	11000*	(48.0)*	18000*	(79.0)*	-	-		
		H 25000			25000*	(110.0)*	14000*	(62.0)*	24000*	(106.0)*	-	-		

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Standard measuring range for liquid ($\rho = 1 \text{ kg/l}$ (62.43) lbs/cu.ft, viscosity 1 mPa·s (1cp)) (dynamic range 1:10)

* Guided float

Non-standard sizes for the thread are listed in brackets.

Standard versions are bold printed.

Measuring Ranges for Air

Connection		Flow tube	Pressure loss		Max. measuring range for the selected floats											
Female thread G, NPT	PVC-adhesive bushing mm (inch)		mbar	(psi)	Aluminum, Mat. No. 3.1645		Aluminum, Mat. No. 3.1645		PVC		PVDF		PVC with magnet			
					(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)		
(G¼), (G½), G½	20 (0.79)	A 1	4	(0.058)	16	(0.07)	-	-	10	(0.044)	10	(0.044)	-	-		
		A 3			50	(0.22)	-	-	25	(0.11)	25	(0.11)	-	-		
		A 5			80	(0.35)	-	-	50	(0.22)	50	(0.22)	-	-		
		A 10			160	(0.70)	-	-	80	(0.35)	80	(0.35)	-	-		
		A 25			400	(1.76)	-	-	250	(1.10)	250	(1.10)	-	-		
		B 30			500	(2.20)	-	-	320	(1.40)	360	(1.59)	-	-		
		B 40			650	(2.86)	-	-	450	(1.98)	500	(2.20)	-	-		
		B 50			800	(3.52)	-	-	550	(2.42)	650	(2.86)	-	-		
		B 65			1100	(4.84)	-	-	750	(3.30)	800	(3.52)	-	-		
		B 80			1400	(6.2)	-	-	900	(3.96)	1000	(4.4)	-	-		
		B 100			1600	(7.0)	-	-	1100	(4.84)	1250	(5.5)	-	-		
		C 125			6,5	(0.094)	2000	(8.8)	2500	(11.0)	1400	(6.2)	1500	(6.6)	2200	(9.7)
		C 160					3000	(13.0)	3200	(14.0)	1800	(7.9)	2000	(8.8)	3000	(13)
		C 200					3600	(16.0)	4000	(17.6)	2200	(9.7)	2500	(11)	3600	(16)
C 250	4000	(17.6)	5000	(22.0)			2800	(12.3)	3000	(13)	4500	(19.8)				
C 315	15	(0.218)	5000	(22)	6400	(28.0)	3400	(15.0)	3600	(16)	6000	(26)				
C 400			6400	(28)	8000	(35.0)	4000	(17.6)	5000	(22)	7000	(31)				
C 500			8000*	(35)*	-	-	5000*	(22.0)*	5500*	(24)*	-	-				
(G½), (G¾), G1	32 (1.26)	D 650	7	(0.102)	10000	(44)	12000	(53)	7000	(31.0)	8000	(35)	10000	(44)		
		D 800			13000	(57)	15000	(66)	9000	(39.6)	9000	(40)	12000	(53)		
		D 1000			16000	(70)	20000	(88)	11000	(48)	12000	(53)	16000	(70)		
		D 1250			20000	(88)	24000	(106)	14000	(62)	15000	(66)	20000	(88)		
		D 1600			9	(0,131)	28000	(123)	32000	(141)	18000	(79)	20000	(88)	25000	(110)
		D 2000					36000	(159)	40000	(176)	22000	(97)	25000	(110)	32000	(141)
		D 2500			12	(0,174)	40000*	(176)*	-	-	28000*	(123)*	30000	(132)*	-	-
		D 3000					50000*	(220)*	-	-	32000*	(141)*	36000	(159)*	-	-
(G1¼), (G1½), G2	63 (2.48)	E 4000	10	(0,145)	64000*	(282)*	75000*	(330)*	45000	(198)	50000	(220)	60000	(264)		
		E 5000			80000*	(352)*	100000*	(440)*	55000	(242)	65000	(282)	80000	(352)		
		E 6500			100000*	(440)*	125000*	(550)*	75000	(330)	80000	(352)	100000	(440)		
		F 8000			140000*	(616)*	150000*	(660)*	90000	(396)	100000	(440)	125000	(550)		
		F 10000			160000*	(704)*	180000*	(793)*	120000	(528)	125000	(550)	160000	(704)		
(G2), (G2½), G3	-	G 12500	13	(0,189)	200000*	(881)*	220000*	(969)*	130000*	(572)*	150000*	(660)*	175000*	(771)*		
		G 16000			280000*	(1233)*	300000*	(1321)*	180000*	(793)*	200000*	(881)*	240000*	(1057)*		
		H 20000	14	(0,203)	320000*	(1409)*	36000*	(1585)*	220000*	(969)*	250000*	(1100)*	300000*	(1320)*		
		H 25000			400000*	(1761)*	450000*	(1981)*	280000*	(1233)*	300000*	(1320)*	360000*	(1585)*		

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Standard measuring range for air (pabs = 1.023 bar (14.69 psi) at T = 0 °C (32 °F)) (dynamic range 1:10)

*Guided float.

Non-standard sizes for the thread are listed in brackets.

Standard versions are bold printed.