TrigasDM

Durchflussmesser-Manufaktur

DM SERIES

TURBINE FLOWMETERS

FOR HIGH ACCURACY MEASUREMENTS

User Manual

DM-Series, EN / 10404

TrigasDM GmbH • Erdinger Str. 2b • 85375 Neufahrn • www.trigasdm.com

Table of contents

1. General

Thank you for selecting a TrigasDM product for your flow measurement application.

Flow meter manufacture

As a specialist in flow measurement technology, TrigasDM supplies high-quality measuring instruments, electronics and calibrators for liquids and gases.

Made in Germany

Our products are exclusively developed and manufactured in Neufahrn, 20 km north of Munich, ensuring world-class technical know-how for our customers.

Contact

We are proud of our high-quality products and friendly customer service and welcome you as a valued customer to our growing family. You can benefit from our long-standing experience and our comprehensive technical support.

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This user manual contains information on the description, operation, commissioning, and maintenance of the TrigasDM turbine flow meter. For special applications, repair or further information on this or other products, please contact TrigasDM directly.

This document can be changed by the manufacturer without prior notice. In case of doubt, please contact the manufacturer before use or ask for the latest revision of this and other relevant manuals. Warranty claims may become void if outdated documents are used.

2. Safety guidelines

2.1 Marking of important information

Important information is specially highlighted in this user manual.

CAUTION
Information related to danger to persons is marked with CAUTION.

ATTENTION
Information related to danger to equipment is marked with ATTENTION.

NOTE
Special information for operation, commissioning and maintenance is marked with NOTE.

2.2 General safety guidelines

Before using the TrigasDM turbine flow meter, this user manual and all safety instructions must be carefully read in their entirety and understood.

Take all necessary precautions to ensure the safety of personnel and equipment. These precautions include, but are NOT limited to, the following examples:

- Mechanical and electrical installations must only be carried out by qualified and authorized personnel.
- It must be ensured that the upper limit of the measuring range of the flow meter is not exceeded.
- Do not install measuring instruments and cables in the vicinity of strong magnetic sources, such as electrical cables, electric motors, transformers, welding equipment, relays or high-voltage cables. These sources can cause electrical noise, resulting in incorrect pulse signals.
- Flow meters which are designed for applications in liquids are not suitable for applications in gas.
- Applicable safety standards (for example the ones in accordance with the German Occupational Safety and Health Act) must be observed for the installation and/or operation of the flow meter. Non-observance can result in DANGER to personnel.
- A flow meter is a precision instrument. Do not use compressed air to clean the flow meter or check its function.

3. Description

3.1 Design and measuring principle

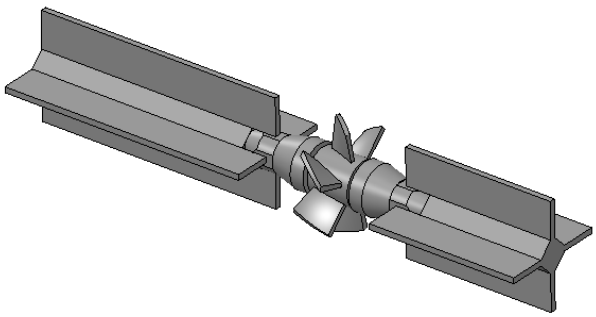
Turbine flow meters are the ideal solution for measurement applications in liquids, where high accuracy, very fast response time, compact design, high reliability in continuous operation and insensitivity to fluctuating flow and temperature are required.

The flow-sensitive element of this volumetric measuring instrument is a turbine rotor concentrically suspended on precision bearings. The flow of the medium imparts a rotational movement on the turbine wheel which is proportional to the velocity of the flowing fluid. The innovative helical design of the rotor blades guarantees improved linearity and reduced pressure loss. Because the flow passage is fixed, the rotation speed is also a real measure of the liquid volume flowing through the flow meter.

The rotation of the turbine rotor generates electrical impulses in the Pickoff. Each of these impulses represents a minute and well-defined volume of liquid.

The turbine flow meter consists of 3 main components:

- Housing
- Pickoff with lock nut and integrated Temperature sensor (optional)
- Helical rotor with asymmetrical flow straightener set



3.2 Technical data

Flow range:	see "Measuring ranges" table
Response time:	<3 ms
Temperature range:	-270° C up to 400° C (Consult factory for pickoff Temperature rating)
Operating pressure:	up to 540 bar depending on connection
	AN: up to 540 bar depending on size according to ISO 8434-2, Part 2: 37 degree flared connectors
	HS: up to 34 bar depending on mating hose and clamp
	Tri-Clamp: up to 100 bar depending on size and mating clamp selection
	NPT: 270 bar or more, according to ASME/ANSI B1.20.1
	BSP: 100 bar or more, according to BS EN 10226-1:2004, BS EN 10226-2:2005, BS EN 10226-3:2005.
Viscosity:	Each turbine is calibrated according to customer specifications and delivered with individual calibration protocols. (Standard viscosity: 1.3 mm^2/s)
Calibration accuracy:	≤±0.03% of reading
Repeatability:	≤±0.05% of reading
Linearity:	≤±0.5% of reading value in the linear flow range ≤±0.1% with linearizing electronics (Lysis, TriLIN)
Material of Construction:	Stainless Steel
	Version 1 (Standard): 1.4305/303, 1.4104/430F, 1.4310/301, Si3N4, 1.4108/440C,1.4016/430
	Version 2 (enhanced Corrosion resistance): 1.4401/316, 1.4460/329, 1.4108/440C, 1.4310/301, Si3N4, 1.4108/440C, 1.4016/430

3.2.1 Measuring ranges DM-Series

Model	Linear Range				Extended Flow Range						K-Factor[1]		max. Frequency[1]
	RF[2] and Mag[3]				RF[2]		Mag[3]		RF[2] and Mag[3]				
	min.		max.		min.		min.		max.		[Pulse/l]	[Pulse/gal]	[Hz]
	[l/min]	[GPM]	[l/min]	[GPM]	[l/min]	[GPM]	[l/min]	[GPM]	[l/min]	[GPM]			
DM2-8	0.5[4]	0.13[4]	5.0[4]	1.3[4]	0.05	0.013	0.8	0.21	5.5	1.5	14700	55555	1350
DM4-8	0.95	0.25	12	3.2	0.1	0.03	0.4	0.11	13	3.4	8700	32890	1950
DM6-8	1.9	0.50	20	5.3	0.2	0.05	0.5	0.13	24	6.3	4860	18370	2000
DM8-8	2.8	0.74	33	8.7	0.3	0.08	0.6	0.16	38	10.0	3720	14050	2100
DM-08	3.0	0.79	40	10.6	0.4	0.11	0.8	0.21	48	12.7	2450	9280	1950
DM-10	4.5	1.2	60	16	0.6	0.16	1.1	0.29	70	18.5	1710	6460	2000
DM-12	7.6	2.0	90	23.8	0.9	0.24	1.9	0.50	95	25.1	1260	4760	2000
DM-14	17	4.5	170	44.9	1.7	0.50	2.0	0.52	180	47.6	460	1740	1400
DM-16	19	5.0	220	58.1	2.2	0.58	3.8	1.0	240	63.4	550	2080	2200
DM-20	34	9.0	400	106	3.8	1.0	6.0	1.6	490	130	245	920	2000
DM-24	57	15.1	700	185	6.0	1.6	10	2.6	820	217	110	415	1500
DM-32	83	21.9	1100	291	10	2.6	13	3.4	1300	344	65	245	1400
DM-40	151	39.9	1510	399	17	4.5	19	5.0	1700	450	48	180	1200
DM-48	250	66.0	2500	660	28	7.4	28	7.4	2840	750	15	57	650
DM-64	475	125.4	4750	1254	57	15.1	57	15.1	5700	1505	5.5	21	600

1) The K-factors and frequency data are average values. Each turbine is calibrated according to customer specifications and delivered with individual calibration protocols.
2) RF = Frequency-modulated pickoff
3) Mag = Magnetic pickoff
4) DM2-8 ≤±2% of reading

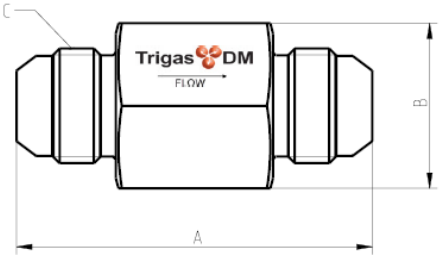
3.2.2 Pressure drop

The pressure drop at different flow rate levels are listed below.

Modell	Pressure drop [bar]						
	% of the maximum flow						
	10%	25%	40%	55%	70%	85%	100%
DM2-8	0.00	0.01	0.03	0.05	0.08	0.11	0.15
DM4-8	0.01	0.03	0.06	0.16	0.19	0.27	0.35
DM6-8	0.01	0.02	0.06	0.11	0.16	0.23	0.32
DM8-8	0.01	0.05	0.11	0.20	0.30	0.46	0.61
DM-08	0.01	0.03	0.08	0.14	0.21	0.29	0.36
DM-10	0.06	0.12	0.23	0.41	0.61	0.92	1.22
DM-12	0.06	0.13	0.24	0.42	0.64	0.93	1.22
DM-14	0.06	0.12	0.20	0.32	0.44	0.62	0.84
DM-16	0.06	0.09	0.16	0.27	0.39	0.57	0.74
DM-20	0.06	0.13	0.24	0.43	0.62	0.96	1.31
DM-24	0.07	0.16	0.32	0.60	0.89	1.32	1.74
DM-32	0.07	0.08	0.14	0.24	0.34	0.51	0.66
DM-40	0.03	0.06	0.13	0.21	0.40	0.45	0.61
DM-48	0.03	0.06	0.13	0.21	0.40	0.45	0.61
DM-64	0.03	0.06	0.13	0.21	0.40	0.45	0.61

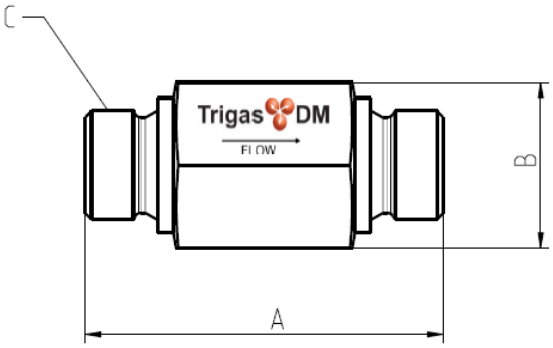
3.2.3 Housing Dimensions

DM-Series AN Housing, Code AN:



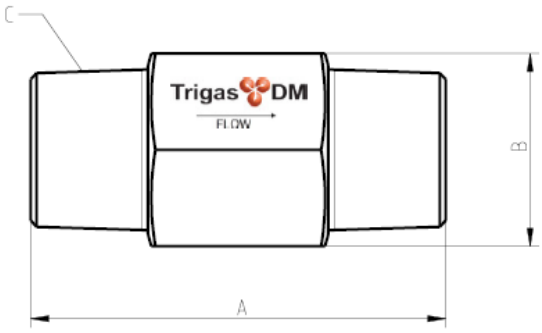
Model	Inner Ø		Housing				Connection	Tube Ø AN-Size	Pickoff Screw-in Depth		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C ["]	["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	62.2	2.45	22 x 22	0.87 x 0.87	¾“ -16UNJF-3A	1/2"	6.2	0.244	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	62.2	2.45	22 x 22	0.87 x 0.87	¾“ -16UNJF-3A	1/2"	6.2	0.244	
DM6-8	9.4	0.37	62.2	2.45	23 x 23	0.91 x 0.91	¾“ -16UNJF-3A	1/2"	6.1	0.240	
DM8-8	10.2	0.40	62.2	2.45	23 x 23	0.91 x 0.91	¾“ -16UNJF-3A	1/2"	5.7	0.224	
DM-08	11.2	0.44	62.2	2.45	25 x 25	0.91 x 0.91	¾“ -16UNJF-3A	1/2"	6.2	0.244	
DM-10	12.8	0.50	69.1	2.72	SW 32	1.26 Hex.	7/8“ -14UNJF-3A	5/8"	8.5	0.335	
DM-12	14.3	0.56	82.6	3.25	SW 32	1.26 Hex.	1-1/16“ -12UNJ-3A	3/4"	7.5	0.295	
DM-16	21.9	0.86	90.4	3.56	SW 36	1.42 Hex.	1-5/16“ -12UNJ-3A	1"	5.7	0.224	
DM-20	25.4	1.00	103.0	4.06	SW 41	1.61 Hex.	1-5/8“ -12UNJ-3A	1 1/4"	6.0	0.236	
DM-24	33.4	1.51	116.6	4.59	SW 50	1.97 Hex.	1-7/8“ -12UNJ-3A	1 1/2"	6.4	0.252	
DM-32	44.5	1.75	154.0	6.06	SW 65	2.56 Hex.	2-1/2“ -12UNJ-3A	2"	7.9	0.311	

DM-Series BSPP, Code BE:



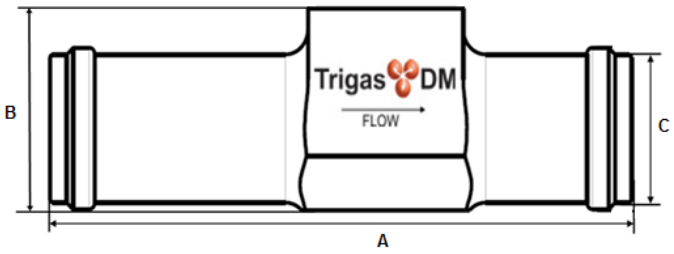
Model	Inner Ø		Housing				Connection	Pickoff Screw-in Depth		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C ["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	62.2	2.45	22 x 22	0.87 x 0.87	G 1/4"	6.2	0.244	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	62.2	2.45	22 x 22	0.87 x 0.87	G 1/4"	6.2	0.244	
DM6-8	9.4	0.37	62.2	2.45	25 x 25	0.98 x 0.98	G 1/2"	7.1	0.279	
DM8-8	10.2	0.40	62.2	2.45	25 x 25	0.98 x 0.98	G 1/2"	6.7	0.263	
DM-08	11.2	0.44	62.2	2.45	25 x 25	0.98 x 0.98	G 1/2"	6.2	0.244	
DM-10	12.8	0.50	69.1	2.72	SW 32	1.26 Hex.	G 1/2"	8.5	0.335	
DM-12	14.3	0.56	82.6	3.25	SW 32	1.26 Hex.	G 1/2"	7.5	0.295	
DM-16	21.9	0.86	90.4	3.56	SW 36	1.42 Hex.	G 1"	5.7	0.224	
DM-20	25.4	1.00	103.0	4.06	SW 50	1.97 Hex.	G 1 1/4"	7.8	0.307	
DM-24	33.4	1.51	116.6	4.59	SW 50	1.97 Hex.	G 1 1/2"	6.4	0.252	
DM-32	44.5	1.75	154.0	6.06	SW 65	2.56 Hex.	G 2"	7.9	0.311	

DM-Series NPT, Code NE:



Model	Inner Ø		Housing				Connection	Pickoff t = screw-in		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C ["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	67.9	2.67	22 x 22	0.87x0.87	1/2" - 14 NPT	6.2	0.244	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	67.9	2.67	22 x 22	0.87x0.87	1/2" - 14 NPT	6.2	0.244	
DM6-8	9.4	0.37	67.9	2.67	23 x 23	0.91x0.91	1/2" - 14 NPT	6.1	0.240	
DM8-8	10.2	0.40	67.9	2.67	23 x 23	0.91x0.91	1/2" - 14 NPT	5.7	0.224	
DM-08	11.2	0.44	67.9	2.67	23 x 23	0.91x0.91	1/2" - 14 NPT	6.2	0.244	
DM-10	12.8	0.50	69.1	2.72	SW 32	1.26 Hex.	3/4" - 14 NPT	8.5	0.335	
DM-12	14.3	0.56	82.6	3.25	SW 32	1.26 Hex.	3/4" - 14 NPT	7.5	0.295	
DM-16	21.9	0.86	90.4	3.56	SW 36	1.42 Hex.	1" - 11 1/2 NPT	5.7	0.224	
DM-20	25.4	1.00	103.0	4.06	SW 46	1.81 Hex.	1 1/4" - 11 1/2 NPT	8.3	0.326	
DM-24	33.4	1.51	116.6	4.59	SW 50	1.97 Hex.	1 1/2" - 11 1/2 NPT	6.4	0.252	
DM-32	44.5	1.75	154.0	6.06	SW 65	2.56 Hex.	2" - 11 1/2 NPT	7.9	0.311	

DM-Series HS Standard:



Model	Inner Ø		Housing				Connection		Pickoff screw-in depth		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C [mm]	C ["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	62.2	2.45	22 x 17	0.87 x 0.87	Ø 9.5	ø 0.37	6.2	0.244	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	62.2	2.45	22 x 17	0.87 x 0.87	Ø 9.5	ø 0.37	6.2	0.244	
DM6-8	9.4	0.37	62.2	2.45	23 x 23	0.91 x 0.91	Ø 12.7	ø 0.5	6.1	0.240	
DM8-8	10.2	0.40	62.2	2.45	23 x 23	0.91 x 0.91	Ø 12.7	ø 0.5	5.7	0.224	
DM-08	11.2	0.44	62.2	2.45	25 x 25	0.91 x 0.91	Ø 12.7	ø 0.5	6.2	0.244	
DM-10	12.8	0.50	69.1	2.72	SW 32	1.26 Hex.	Ø 15.9	ø 0.63	8.5	0.335	
DM-12	14.3	0.56	82.5	3.25	SW 32	1.26 Hex.	Ø 19.1	ø 0.75	7.5	0.295	
DM-16	21.9	0.86	90.4	3.56	SW 36	1.42 Hex.	Ø 25.4	ø 1.00	5.7	0.224	
DM-20	25.4	1.00	103.1	4.06	SW 41	1.61 Hex.	Ø 31.8	ø 1.25	6.0	0.236	
DM-24	33.4	1.51	116.6	4.60	SW50	1.97 Hex.	Ø 38.1	ø 1.5	6.4	0.252	
DM-32	44.5	1.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
DM-40	59.7	2.35	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

DM-Series HS-L (lightweight - standard length)

Model	Inner Ø		Housing				Connection		Pickoff screw-in depth		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C [mm]	C ["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	62.2	2.45	15.7	0.618	Ø 9.5	ø 0.37	6.1	0.240	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	62.2	2.45	15.7	0.618	Ø 9.5	ø 0.37	6.1	0.240	
DM6-8	9.4	0.37	62.2	2.45	19.0	0.748	Ø 12.7	ø 0.50	6.1	0.240	
DM8-8	10.2	0.40	62.2	2.45	19.5	0.767	Ø 12.7	ø 0.50	6.2	0.244	
DM-08	11.2	0.44	62.2	2.45	20.0	0.787	Ø 12.7	ø 0.50	6.2	0.244	
DM-10	12.8	0.50	69.1	2.72	22.5	0.885	Ø 15.9	ø 0.63	6.0	0.236	
DM-12	14.3	0.56	82.5	3.25	25.0	0.984	Ø 19.1	ø 0.75	6.1	0.240	
DM-16	21.9	0.86	90.4	3.56	33.0	1.299	Ø 25.4	ø 1.00	6.1	0.240	
DM-20	25.4	1.00	103.0	4.06	38.0	1.496	Ø 31.8	ø 1.25	6.0	0.236	
DM-24	33.4	1.51	116.6	4.60	45.7	1.799	Ø 38.1	ø 1.50	6.1	0.240	
DM-32	44.5	1.75	154.0	6.06	58.7	2.311	Ø 50.8	ø 2.00	6.1	0.240	
DM-40	59.7	2.35	154.5	6.08	ø 85	ø 3.35	Ø 64.0	ø 2.52	6.1	0.240	

DM-Series HS-K (short version - reduced length and weight)

Model	Inner Ø		Housing				Connection		Pickoff screw-in depth		
	[mm]	["]	A [mm]	A ["]	B [mm]	B ["]	C [mm]	C ["]	t [mm]	t ["]	Thread Type
DM2-8	7.6	0.29	56.0	2.35	15.7	0.618	Ø 9.5	ø 0.37	6.2	0.244	DM-Serie 5/8“ - 18UNF-2B
DM4-8	7.6	0.29	56.0	2.35	15.7	0.618	Ø 9.5	ø 0.37	6.2	0.244	
DM6-8	9.4	0.37	56.2	2.21	19.0	0.748	Ø 12.7	ø 0.5	6.1	0.240	
DM8-8	10.2	0.40	56.2	2.21	19.5	0.767	Ø 12.7	ø 0.5	5.7	0.244	
DM-08	11.2	0.44	56.2	2.21	20.0	0.787	Ø 12.7	ø 0.5	6.2	0.244	
DM-10	12.8	0.50	61.1	2.41	22.5	0.885	Ø 15.9	ø 0.63	8.5	0.335	
DM-12	14.3	0.56	69.8	2.75	25.0	0.984	Ø 19.1	ø 0.75	7.5	0.295	
DM-16	21.9	0.86	77.4	3.05	33.0	1.299	Ø 25.4	ø 1.00	5.7	0.224	
DM-20	25.4	1.00	85.1	3.35	38.0	1.496	Ø 31.8	ø 1.25	6.0	0.236	
DM-24	33.4	1.51	97.6	3.84	ø 56	ø 2.20	Ø 38.1	ø 1.50	6.0	0.236	
DM-32	44.5	1.75	124.0	4.88	ø 70	ø 7.76	Ø 50.8	ø 2.00	6.1	0.240	
DM-40	59.7	2.35	128.0	6.08	ø 85	ø 3.35	Ø 64.0	ø 2.52	6.1	0.276	

3.2.4 Weight

Model	Weight [g]					
	AN	HS	L	K	TC	FL
DM2-8	161	119	41	37	100	CF
DM4-8	161	119	70	37	100	CF
DM6-8	154	110	60	50	110	CF
DM8-8	150	105	56	51	93	CF
DM-08	148	96	48	46	160	CF
DM-10	282	254	104	90	240	CF
DM-12	383	287	133	110	320	CF
DM-16	550	301	193	168	962	CF
DM-20	957	550	390	350	NA	CF
DM-24	1208	NA	520	490	NA	CF
DM-32	2614	NA	944	900	NA	CF
DM-40	NA	NA	1289	1210	NA	CF
DM-48	NA	NA	NA	NA	NA	CF
DM-64	NA	NA	NA	NA	NA	CF

NA Not Available currently

CF Consult Factory (depending on flange type and size)

3.3 Model numbering key

3.3.1 Model numbering key DM-Series

Type code:	#1	#2	#3	#4	#5	#6
Example:	DM	-12	AN	-BC	-1	-S

1	Code	Not all combinations are possible. Consult Factory for available Configurations.
Type	DM	
2	Code	Size/ Measuring range liquids
Sensor	2-8	½" - iØ 7.6 mm; up to 5.5 l/min
	4-8	½" - iØ 7.6 mm; up to 13 l/min
	6-8	½" - iØ 9.4 mm; up to 24 l/min
	8-8	½" - iØ 10.2 mm; up to 38 l/min
	-08	½" - iØ 11.2 mm; up to 48 l/min
	-10	5/8“ - iØ 12.8 mm; up to 70 l/min
	-12	¾“ - iØ 14.3 mm; up to 95 l/min
	-16	1“ - iØ 21.9 mm; up to 240 l/min
	-20	1¼“ - iØ 25.4 mm; up to 490 l/min
	-24	1½“ - iØ 33.4 mm; up to 820 l/min
	-32	2“ - iØ 44.5 mm; up to 1300 l/min
	-40	2½“ - iØ 59.7 mm; up to 1700 l/min
	-48	3” - iØ 73 mm; up to 2840 l/min
	-64	4” - iØ 98 mm; up to 5700 l/min
3	Code	Process connection
Process connection	AN	AN Male thread (up to DN-32); pressure rating according to Specification in Technical Data Section
	HS	Hose connection, 34 bar max. (depending on mating hose and clamp)
	NE	NPT male thread, pressure rating according to Specification in Technical Data Section
	BE	BSP male thread, pressure rating according to Specification in Technical Data Section
	C1	ANSI Flange 150#
	C3	ANSI Flange 600#
	D2	DIN Flange PN40
	D5	DIN Flange PN160
	T1	Tri-Clamp ½” – ¾”, plate Ø 2,5 mm (up to DM-12 or smaller), 100 bar max. (depending on mating clamp)
	T2	Tri-Clamp 1” – 1½”, plate Ø 50,5 mm, (DM16 or larger) 69 bar max. (depending on mating clamp)
	T3	Tri-Clamp 2”, plate Ø 64,0 mm, 69 bar max. (depending on mating clamp)
	T4	Tri-Clamp 2 ½”, plate Ø 77,5 mm, 69 bar max. (depending on mating clamp)
4	Code	Bearings
Bearings	-BC	Ball bearings, ceramic
	-BA	Ball bearings, stainless steel
5	Code	Material, housing and internals
Material	-1	Stainless steel (1.4305/303, 1.4104/430F, 1.4310/301, Si3N4, 1.4108/440C, 1.4016/430)
	-2	Stainless steel (1.4401/316, 1.4460/329, 1.4108/440C, 1.4310/301, Si3N4, 1.4108/440C, 1.4016/430)
6	Code	Housing
Housing Type	-S	Standard
	-L	Light weight version (HS Process Connection only)
	-K	Light weight / short version (HS Process Connection only)

3.3.2 Model numbering key Pickoff

List of available Pickoffs
Consult factory for compatibility and special applications

Type	Part Number	Description
RF Pickoffs	101466	Low Profile, Pivot, with PT100, 6-lead, 5m cable with ODU 7-pin half-shell connector, -55 to +180°C
	101128	High Profile, 2-pin MS connector, -74 to + 204°C
	101130	High Profile with PT100, 4-pin MS Bayonet connector, -55 to + 125°C
	101463	High Profile with PT100, 4-pin MS Bayonet connector, extended Temperature Range : -200 to + 230°C
	101104	High Profile, NPT ½" thread and 20 cm flying leads, -74 to + 204°C
	101103	High Profile with PT100, NPT ½" thread and 20 cm flying leads, -55 to + 177°C
Amplified RF Pickoffs	101462	High profile, 3-pin MS connector, -40 to +125°C
	101461	High profile, 5m 3-lead shielded cable with flying leads, -40 to +85°C
	CF	High profile with PT100, -40 to +125°C
Special Purpose RF Pickoffs	101464	Lysis Smart Pickoff, Low Profile, Pivot design, with T sensor, 5-lead, 5 m cable with ODU 5-pin half-shell connector, -40 to +125°C (For Lysis LSA-ST-05 & LSA-ST-08)
	101465	Lysis Smart Pickoff, Low Profile, Pivot design, with T sensor, 5-lead, 5 m cable with ODU 5-pin Nut/Nose connector, -40 to +125°C (For Lysis LSA-ST-07)

4 Installation / commissioning

4.1 Flow meter

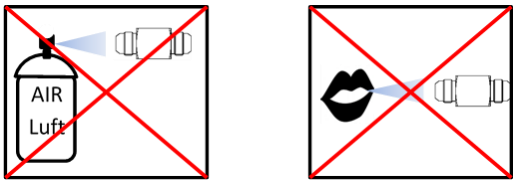
4.1.1 Safety guidelines

- Mechanical and electrical installations must only be carried out by qualified and authorized personnel.
- The maximum measuring range of the flow meter must not be exceeded.
- The flow meter operates under pressure. Only carry out work on the flow meter when it is depressurized.
- If toxic, explosive or other dangerous liquids are used, they must be drained off into a safe area. The system must be completely drained and decontaminated before commencing work.
- The metals utilized in construction are slightly porous at a microscopic level, and traces of liquids that are used during calibration may be retained.
- The mixture of two relatively safe fluids can potentially lead to an unstable and unpredictable reaction, even in case of trace residues, which may remain in the pores.
- Establish the system pressure slowly during commissioning, to avoid possible damage to the rotor from over-speeding.
- Flow meters which are designed for applications in liquids are not suitable for applications in gas.
- Flow meters must be used with suitable filters (see filter guidelines below)
- Shocks and vibrations can cause damage the bearings of the flow meter.

4.1.2 Incoming Inspection

- Carefully unpack the flow meter and check for cleanliness (e.g. packaging residues).
- Check the condition of the flow meter and look for visible damage.
- Check the rotor for ease of movement.

ATTENTION
A flow meter is a precision instrument. Do not use compressed air to clean the flow meter or b low through it to check its function. The resulting over-speed may cause damage and compromise the ability of the instrument to measure accurately.



4.1.3 Operating pressure, tightening torque

To determine maximum safe operating pressure after installation, please refer to applicable ISO standards of the selected process connection or consult factory.

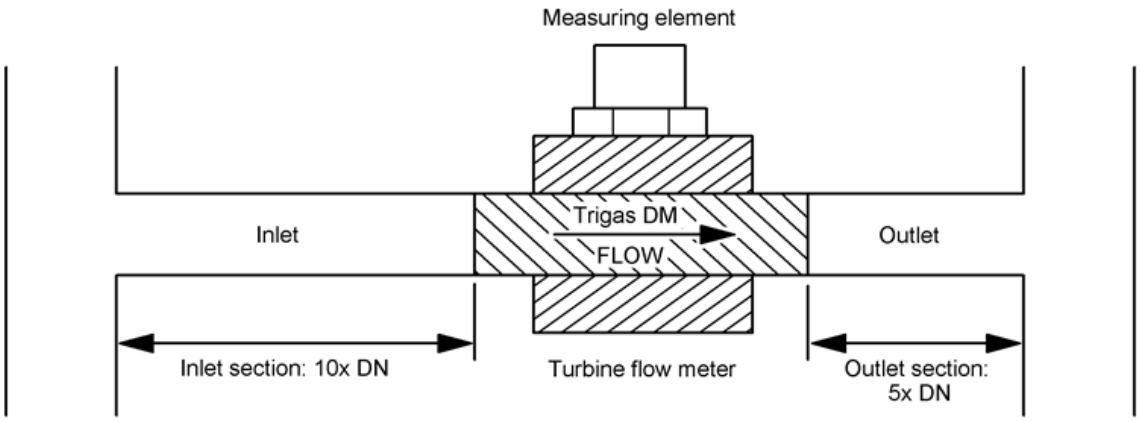
To determine appropriate tightening torque of threaded fittings, please refer to applicable ISO standards of the selected process connection or consult factory.

4.1.4 Installation

- The flow meter must be installed according to the marking that indicates the direction of flow (on the housing).
- Turbine flow meters function correctly in any installation position. To optimize the accuracy of flow measurement at low flow rates, the flow meter should be installed in the same position in which it was calibrated. The default installation configuration for the flowmeter during calibration is horizontal with the pickoff in vertical position, pointing up.

4.1.5 Piping Configuration

Turbine flow meters can be affected by the velocity profile of the fluid being measured. Installation with proper pipe runs will reduce or completely eliminate flow profile induced measurement errors during calibration and operation.



Inlet section and outlet section, schematic diagram

A straight run of pipe of at least 10 times the pipe diameter for the upstream side, and 5 times the pipe diameter for the downstream side are recommended (see figure and table). The upstream section should be fitted with a flow straightening vane.

Appropriate flow straightening sets (up- and downstream) are available from TrigasDM on request

Model	Minimum lenght for Up- & Downstream ["]				
	Inner ø	Upstream Standard	Downstream Standard	Upstream Flowstraightener TrigasDM	Downstream Flowstraightener TrigasDM
DM2-8	0.29	3.00	1.50	5.00	3.74
DM4-8	0.29	3.00	1.50	5.00	3.74
DM6-8	0.37	3.70	1.85	5.00	3.74
DM8-8	0.40	4.00	2.00	5.00	3.74
DM-08	0.44	4.41	2.20	5.00	3.74
DM-10	0.50	5.04	2.52	6.30	3.74
DM-12	0.56	5.63	2.82	7.48	3.74
DM-14	0.70	7.00	3.50	9.24	4.62
DM-16	0.86	8.62	4.31	10.04	5.00
DM-20	1.00	10.00	5.00	12.51	7.48
DM-24	1.51	13.15	6.58	15.00	6.30
DM-32	1.75	17.52	8.76	20.00	10.04
DM-40	2.35	23.5	11.75	NA	NA
DM-48	73.00	750	375.0	NA	NA
DM-64	98.00	1000	500.0	NA	NA

- Longer straight sections may be required if devices that cause flow disturbances are present upstream of the installation location of the flow meter. Pumps, valves, elbows, etc. may cause strong velocity profile distortions or swirl in the pipe making the installation of flow straighteners necessary.

- Connection of mating pipes and fittings to the housing of the flow meter should be realized with appropriate supports, to avoid undue strain on the flow meter.

- The flow meter should not be exposed to excessive vibrations, as they have a negative impact on the precision of the measurements and may cause damage to the bearings.

- The inner diameters of the pipe connections and the turbine must be matched as closely as possible. If they cannot be identical, it is preferable that the inner diameter of the pipe connection is slightly smaller than the inner diameter of the turbine rather than the other way around.

- Flow metering sections must be designed in such a way as to prevent exposure of the flowmeter to pressure surges and over-speeding. Either of these events can cause damage to the Rotor and Bearings. If exposure cannot be avoided, care must be exercised to ensure pressure surges do not exceed 10% and over-speeding is present for only short periods of time and does exceed 150% of the rated speed of the flowmeter.

- Control valves, whenever possible, should be installed downstream of the flow meter. Opening a valve upstream of the flowmeter when the meter section is drained can result in a hard impact of the liquid striking the rotor (Water Hammer), possibly resulting in damage to the rotor.

- Installing a bypass section parallel to the flow meter makes it possible to clean the pipe when a measuring instrument is installed, or to repair or replace the flow meter without interrupting system operation.

- Liquid flow meters should be installed so that liquid does not drain away from the flow meter when flow in the system is interrupted.

4.1.6 Contamination / Filtering

- All pipe sections and components in the metering line must be cleaned prior to the installation of the flow meter. Pipe Sealants, metal shavings and slag can damage the flow meter.

- If the cleanliness of the fluid cannot be guaranteed, a filter should be installed upstream of the flow meter, subject to the diameter of the flow meter.

Modell	Inner Ø [mm]	Filter mesh width
DM2-8	7.6	10 micrometer
DM4-8	7.6	10 micrometer
DM6-8	9.4	10 micrometer
DM8-8	10.2	10 micrometer
DM-08	11.2	10 micrometer
DM-10	12.8	10 micrometer
DM-12	14.3	10 micrometer
DM-16	21.9	20 micrometer
DM-20	25.4	20 micrometer
DM-24	34.4	50 micrometer
DM-32	44.5	50 micrometer
DM-40	59.8	50 micrometer
DM-48	73.0	50 micrometer
DM-64	98.0	50 micrometer

4.1.7 Commissioning

ATTENTION
Increase the pressure slowly during commissioning, to avoid possible damage to the rotor from over-speeding.

ATTENTION
Avoid dry running!
Liquid flow meters should be installed so that liquid does not drain away from the flow meter when flow in the system is interrupted. Failure to do so may lead to corrosion and damage to the bearings.

- The type of measuring fluid, the bearing type used in the flow meter and the period during which the metering section is decommissioned and therefore dry, can reduce the service life and negatively affect the operation of the flow meter.

- If it is economically viable and possible in the specific operating conditions, the flow meter should be always removed from the line, cleaned and stored, if there is any doubt about the level of the liquid in the pipe during the decommissioning period.

4.2 Pickoff and amplifier

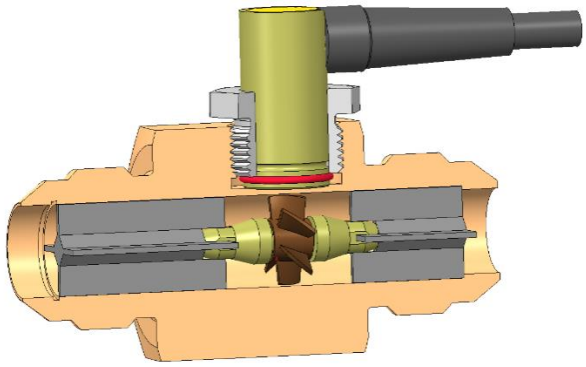
CAUTION
Mechanical and electrical installations must only be carried out by qualified and authorized personnel.

NOTE
A wide variety of pickoffs are available, with different connectors or cables. Please contact TrigasDM for a detailed consultation.

4.2.1 Installation / Removal

4.2.1.1 Standard Low-Profile Pivoting Pickoff

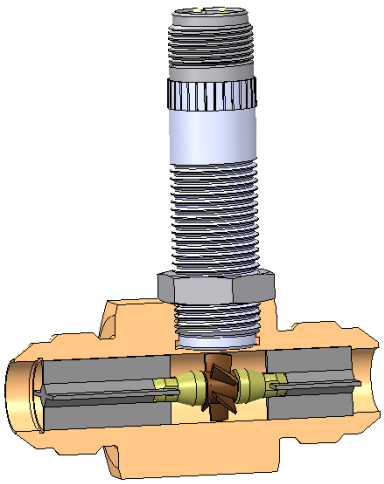
1. Screw the pickoff swivel nut into the housing by hand until it reaches the end of its travel and then back off slightly (1/4th turn).
2. Swivel the cable exit to the desired direction.
3. Tighten the pickoff nut to 12 Nm (9 ft.lb).
4. The Pickoff can be removed from the housing by loosening the lock nut and unscrewing it.



ATTENTION
Do not overtighten. Excessive torque may damage the pickoff and/or the flowmeter housing.

4.2.1.2 Conventional High Profile Pickoff

1. Hand-tighten the Pickoff – Do not use tools.
2. Tighten the lock nut securely against the flowmeter housing.
3. The Pickoff can be removed from the housing by loosening the lock nut.



ATTENTION
Tighten the pickoff by hand. Tools should only be used to secure the lock nut. Excessive torque may damage the pickoff and/or the flowmeter housing.

4.2.2 Connection of pickoff, amplifier, electronics

All commonly used flowmeter pickoffs inherently produce low amplitude output signals. As a result, appropriate electronics are required to amplify the raw signal so that it can be read by electronic instruments such as Flow Computers, Controllers, etc.
TrigasDM offers a complete range of electronic devices for flow meters. Always observe the installation guidelines listed below.

- Do not install measuring instruments and cables in the vicinity of strong magnetic sources, such as electrical cables, electric motors, transformers, welding equipment, relays, or high-voltage cables. These sources can cause electrical noise, influencing the flowmeter output and causing erroneous readings of flow.
- A shielded cable (preferably with braided shielding) must be used for the connections between pickoff, amplifier, electronics, and display instrument.
- The amplifier should be installed as close as possible to the flowmeter pickoff.
- Pickoff cables should not be installed together with other cables (no shared cable shielding).
- A ground cable with a cross-section of 2.5 mm² (#14 AWG or larger) between the amplifier ground and Pickoff housing or the cable shield can reduce electrical noise.
- A ground connection with the amplifier ground can also reduce electrical noise.

  ATTENTION
  The cable shield may only be grounded in accordance with the operating manual of the electronics used.

4.2.3 Explosion protection (ATEX)

All TrigasDM flowmeters can be configured for installation in hazardous locations, as severe as Zone 0. With appropriate pickoffs and Safety Barriers **ATEX: II 1G Ex ia IIC (Zone 0, 1, 2)** is possible.
Please consult the factory for details.

4.3 Troubleshooting

The following Steps for error detection or error correction can be taken if the turbine emits no signal or a faulty signal:

- Check the power supply of the electronics
- Turbine check for proper operation and true running. If necessary, clean the turbine.
- Check Pickoff Function (High Profile RF version)
  Measure the resistance between pin A and pin B:
  - Target value for modulated carrier (RF) Pickoff: 10 Ohm +/-15%
  - Target value for magnetic Pickoff: 2200 Ω +/-10%
  - Resistance between each pin and housing: >1 MΩ at 500 V.

  If one of these values is outside the specified limits, the pickoff is defective and must be replaced.
  More details and values for other Pickoffs are available on request.
- Check wiring. Check cable shield.

If the above measures do not solve the problem, it could be that the flowmeter has suffered mechanical damage. As there are no user serviceable components in the DM series flowmeters, it should be returned to the factory for evaluation, repair and recalibration.

5. Maintenance

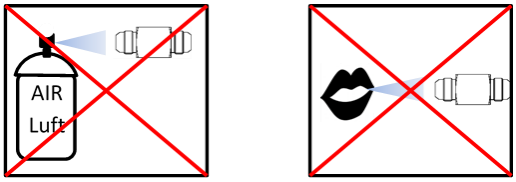
The TrigasDM turbine flow meters do not require any user performed maintenance.

Depending on Type, System design, Environmental or operating conditions, Fluid being measured and Age, these flow meters need to be periodically recalibrated and if damaged, repaired or replaced.

NOTE
Independent consulting and calibration as well as repair services are available through the accredited calibration laboratory at TrigasFI (www.trigasfi.com). TrigasFI is certified to the highest ISO levels and maintains traceability to German and other international standards.

Calibration history is maintained for all flowmeters calibrated regularly at TrigasFI. In addition to being a reliable indicator of drift over time for the flowmeter under test, it also forms the basis for the determination of a suitable recalibration interval. Consult the calibration lab for details.

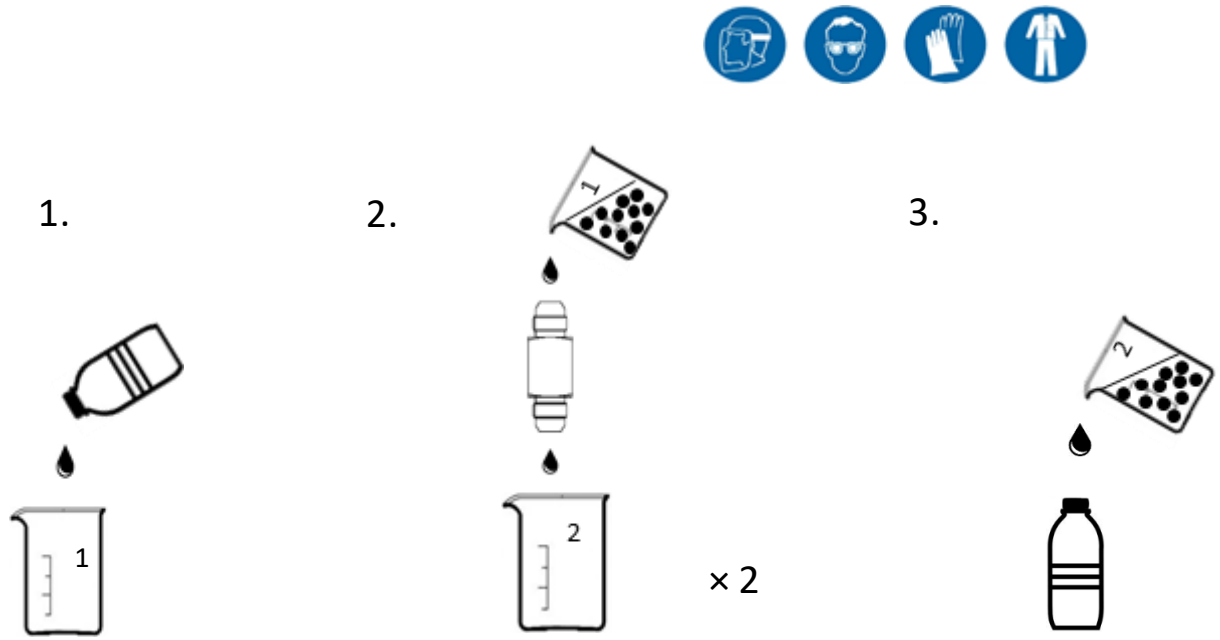
ATTENTION
A flow meter is a precision instrument. Do not use compressed air to clean the flow meter or b low through it to check its function. The resulting over-speed may cause damage and compromise the ability of the instrument to measure accurately.



6. Cleaning and Storage

To ensure long term reliable service, a Turbine flowmeter must be properly cleaned after each use.

Cleaning consists of pouring appropriate fluids through the flowmeter and then allowing it to soak in these fluids as shown below:



The choice of fluids depends on whether the flowmeter will be placed in storage or will be repurposed for another measurement application.

A cleaning kit with appropriate fluids is available through TrigasFI. The sequence should be performed as described in the table below:

from \ to	Oil based	Water based
Oil based	Cleaning fluid Type A	1. Cleaning fluid Type A 2. Cleaning fluid Type B
Water based	1. Cleaning fluid Type B 2. Cleaning fluid Type A	Cleaning fluid Type B

If a cleaning kit is not available, the following substitutes can be used:

Type A MIL-PRF-7024 or other appropriate light solvent

Type B Ethanol or other non hazardous Alcohol cleaner

ATTENTION

An ultrasonic bath can be used to enhance the effectiveness of the cleaning process. Extreme caution is however required since lengthy exposure could cause damage to the bearings.

If there is concern that the cleaning process described above did not produce the required level of cleanliness, it is recommended that the flowmeter is returned to the factory for cleaning and if required, reconditioning and calibration.

7. Declaration of conformity

TrigasDM flow meters are not subject to the WEEE directive for Waste Electrical and Electronic Equipment and comply with the RoHS directive for Restriction of Hazardous Substances.

TrigasDM flow meters comply with applicable EU directives (EU Declaration of Conformity).

8. Warranty

TrigasDM GmbH guarantees that all the equipment supplied hereunder is flawless with regard to materials and workmanship, provided that the equipment was selected in accordance with its intended purpose, installed properly and not operated incorrectly.

Only the current "General Terms and Conditions" of *TrigasDM* apply. You can either request a copy of the terms and conditions by calling +49 8165 9999-300, or visit our website at www.trigasdm.com for information.

9. Customer service

If you should require customer service for your *TrigasDM* products, please contact our customer service department. All requests for information concerning a specific flowmeter must include the model and serial number of the measuring instrument.

We will provide you with all possible assistance over the phone. If your equipment has to be examined or repaired at our plant, whether within the warranty period or after its expiration, our customer service department will issue an authorization number, which is used to initiate our quick and efficient customer service processing. On receipt at our plant, your equipment will be repaired or replaced without delay, calibrated, and returned to you within the shortest period possible.

Please do not return any products without an authorization number.

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