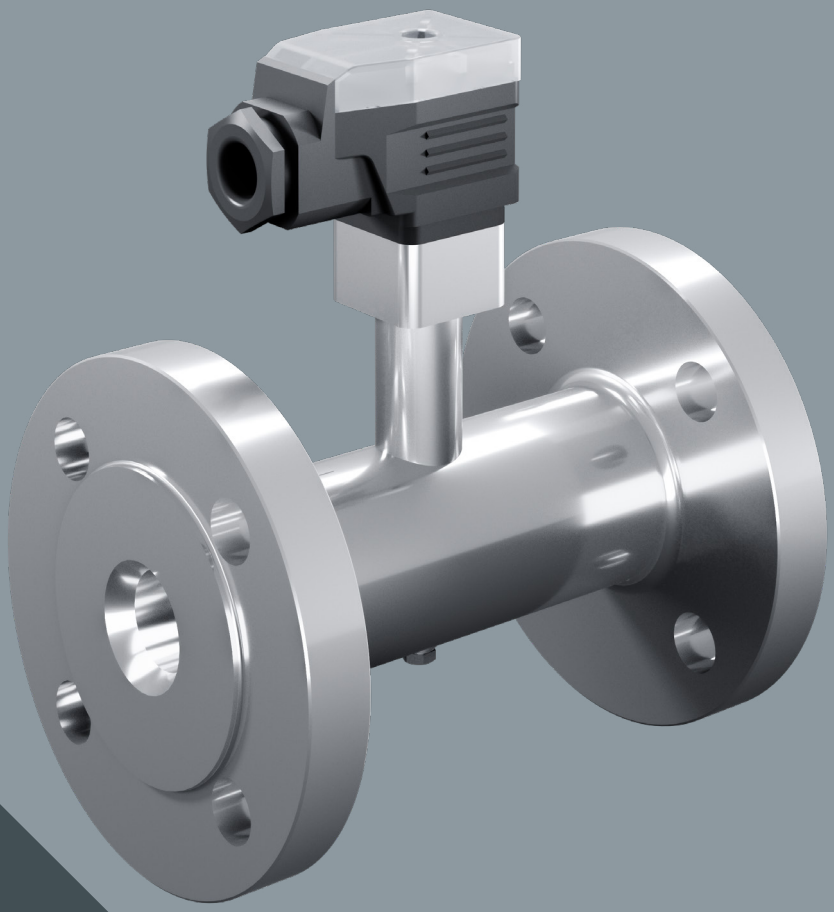
KRACHT®
FLUID TECHNOLOGY AND SYSTEMS

TM
TURBINE FLOW METERS



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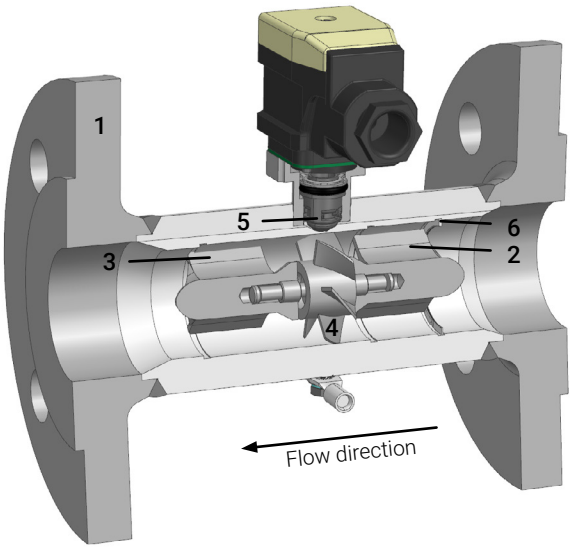
KRACHT®

FLUID TECHNOLOGY AND SYSTEMS

Content

General

Construction



1 Housing
2 Front stator
3 Rear stator
4 Turbine rotor
5 Sensor
6 Clamping ring

General product characteristics

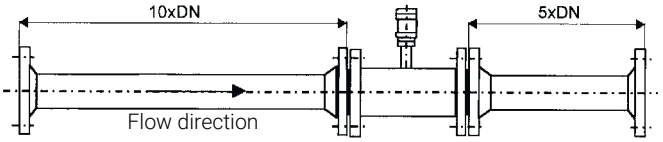
- Large measuring range
- Very low pressure drop
- High working pressure
- Low noise emission
- IO-Link technology available
- Analogue technology available

Description

The TM turbine flow meter is a proven and widely used measuring device in industrial fluid measurement technology. It enables reliable, continuous and accurate measurement of liquids flowing under pressure in closed pipes. Thanks to their stainless steel design and high-quality bearings, these flow meters are suitable for a wide range of media, including aggressive ones.

A turbine rotor is mounted concentrically in the stainless steel housing. The bearings are made of either carbide or PTFE. The flow sets the turbine rotor in a rotational motion proportional to the flow rate. After signal processing, the recorded rotational movement is available in several electrical interface variants, including analogue and digital options.

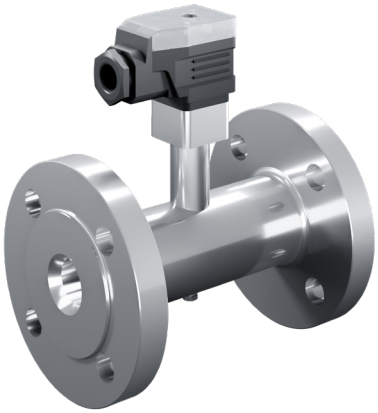
To achieve the specified accuracy, the measurement arrangement with flow-calming sections listed below should be selected. Calibration is also recommended for high-precision applications.



General

Electronic versions

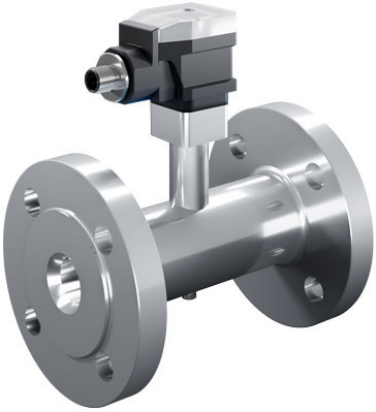
Standard version



The standard versions come with an integrated pre-amplifier which converts the pulses from the magnetic sensors into square-wave signals which are then computed by an electronics into specific measurement values.

Detailed information can be found in the section "Electronics – Standard versions".

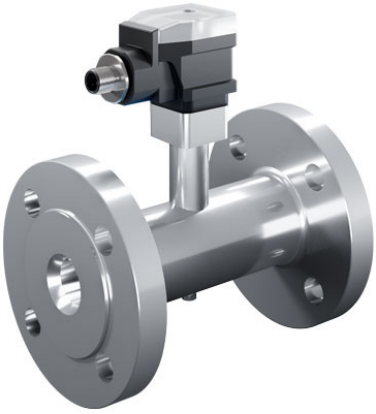
IO-Link version with internal calculation of measured values



TM turbine flow meters with IO-Link technology are based on standard TMs. Unlike the standard version, which only sends square-wave signals to the electronics, IO-Link devices are also capable of calculating specific measured values internally. This means that these flow meters can be used in both classic PLC and IO-Link infrastructures.

Detailed information can be found in the section "Electronics – IO-Link versions".

Analogue version



TM turbine flow meters from the analogue series provide an analogue 4 … 20 mA current signal that can be processed by many control and measuring devices. The analogue signal is used to determine the flow rate.

Detailed information can be found in the section "Electronics – Analogue versions".

Technical data

General characteristics

Design	Turbine flow meter	
Connection types	Flange connection Pipe connection	for nominal sizes 8 … 68 for nominal sizes 0.275 … 16
Mounting position	Horizontal ± 5 °	
Flow direction	Unidirectional (flow direction marked on the housing)	

Hydraulic characteristics

Nominal sizes / Maximum flow rates in m^3/h	0.275 · 0.55 · 1.1 · 2.2 · 4 · 8 · 16 · 34 · 68	
Measuring ranges	0.0552 … 68 m^3/h or 0.92 … 1133.33 l/min	
Typical measuring accuracy	Nominal sizes 0.275 … 1.1 Nominal sizes 2.2 … 68	… ± 1.0 % … ± 0.5 %
Maximum operating pressure	320 bar	
Available pressure stages	040 for operating pressures … 40 bar 320 for operating pressures … 320 bar	
Viscosities	1.0 … 50 mm^2/s	
Permissible medium density	500 … 1500 kg/m^3	
Maximum permissible foreign matter content in the medium	50 g/m^3	
Maximum permissible foreign matter size in the medium	80 % solid particles < 50 µm 20 % solid particles < 500 µm	
Maximum particle hardness	100 HB	

Temperatures

Ambient temperature	Standard IO-Link Analogue	-40 … 80 °C -40 … 50 °C -40 … 60 °C -40 … 80 °C	 (higher temperatures on request) for supply voltages > 15 V for supply voltages < 15 V
Media temperature	Standard IO-Link Analogue	-40 … 120 °C -40 … 80 °C -40 … 80 °C	

Materials

Housing	Stainless steel 1.4541 / X6CrNiTi18-10
Flanges	Stainless steel 1.4541 / X6CrNiTi18-10
Turbine rotor	Stainless steel 1.4541 / X6CrNiTi18-10
Bearings	Carbide PTFE

Technical data

Nominal diameters / Available pressure stages

	Nominal sizes								
	0.275	0.55	1.1	2.2	4	8	16	34	68
Nominal pipe connection diameters in mm	6	6	12	15	15	18	25	-	-
Nominal flange connection diameters	-	-	-	-	-	DN20	DN25	DN40	DN50
Pressure stages for pipe connections	320	320	320	320	320	320	320	-	-
Pressure stages for flange connections	-	-	-	-	-	040	040	040	040

Measuring ranges / Typical measuring accuracy

Nominal sizes	Measuring ranges in l/min		Typical measuring accuracy
	Carbide bearing	PTFE bearing	
0.275	0.92 ... 4.58	0.92 ... 4.58	... ± 1.0 %
0.55	1.83 ... 9.17	1.83 ... 9.17	
1.1	3.67 ... 18.33	3.67 ... 18.33	
2.2	7.33 ... 36.67	7.33 ... 36.67	... ± 0.5 %
4	13.3 ... 66.67	13.3 ... 66.67	
8	26.6 ... 133.33	13.3 ... 133.33	
16	53.4 ... 266.67	26.7 ... 266.67	
34	113.0 ... 566.67	56.7 ... 566.67	
68	227.0 ... 1133.33	227.0 ... 1133.33	

* Resolution can be doubled by using both state changes per period duration (see section "Signal behaviour – Standard and IO-Link versions in SIO mode").

Weights

	Nominal sizes								
	0.275	0.55	1.1	2.2	4	8	16	34	68
Pipe connection	0.20 kg	0.20 kg	0.25 kg	0.25 kg	0.25 kg	0.25 kg	0.40 kg	-	-
Flange connection	-	-	-	-	-	2.60 kg	3.70 kg	6.20 kg	8.30 kg

Technical data

Electrical parameters

Standard version

Number of measuring channels	1
Supply voltage	10 … 30 V
Pulse amplitude	≥ 80 % of the supply voltage
Pulse shape for symmetrical output signal	Square
Pulse duty factor	50 % +/- 15 % (50 % corresponds to a duty factor 1:1)
Signal output	PNP / NPN / Push-Pull
Maximum power requirement	0.9 W
Output power per channel	0.3 W short circuit-protected
Protection rating	IP 65

IO-Link version

	IO-Link mode	SIO mode
Number of measuring channels	1	
Supply voltage	10 … 30 V	
Pulse amplitude	Min_{High} ≥ Supply voltage - 2 V Max_{Low} ≤ 2 V	
Pulse shape for symmetrical output signal	–	Square
Pulse duty factor	–	50 % +/- 15 % (50 % corresponds to a duty factor 1:1)
Maximum signal output	Push-Pull / 25 mA	
Maximum power requirement	2 W	
Protection rating	IP 65	

Analogue version

Number of measuring channels	1	
Supply voltage	10 … 30 V DC (Reverse polarity protection up to 30 V DC)	
Maximum load analogue output	793 Ω at 24 V DC	
Maximum current digital output	100 mA (short-circuit protected)	
Maximum power requirement	1.4 W (without analogue and digital output)	
Output signals	Analogue output	0 … 24 mA (Measuring range 4 … 20 mA)
	Digital output	High > Supply voltage – 3 V
		Low < 3 V
Protection rating	IP 65	

Type key

TM	4	T	F	040	S
1	2	3	4	5	6

1 Product	
TM	Turbine flow meter

2 Nominal sizes
0.275 · 0.55 · 1.1 · 2.2 · 4 · 8 · 16 · 34 · 68

3 Bearing materials	
H	Carbide
T	PTFE

4 Connection types	
F	Flange connection
R	Pipe connection

5 Pressure stages	
040	Maximum operating pressure ... 40 bar (only in conjunction with flange connection)
320	Maximum operating pressure ... 320 bar (only in conjunction with pipe connection)

6 Electronic versions	
S	Standard
A	Analogue
L	IO-Link
V	Without pre-amplifier

Electronics

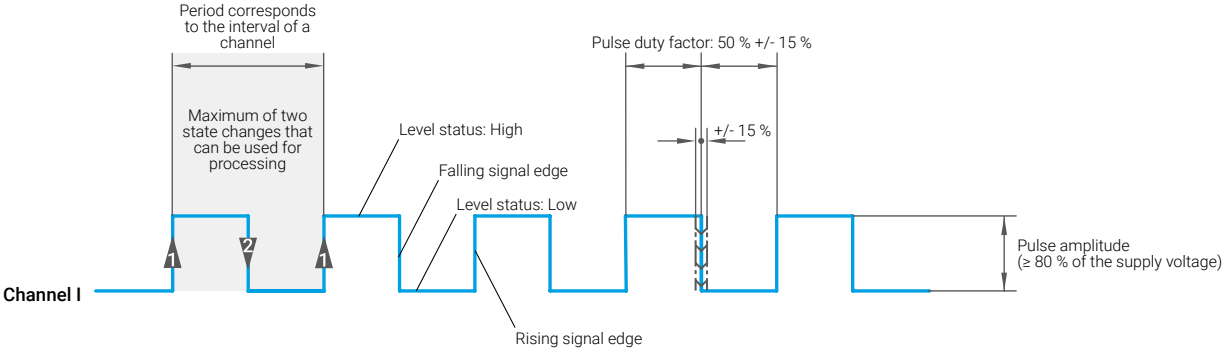
Standard versions

General

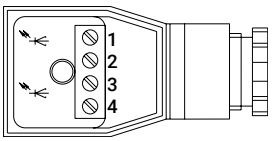
The square wave signal generated by the pre-amplifier enables application-specific resolutions. Standard resolution means that the evaluation electronics process one change of state of the channel/sensor per period duration (rising signal edge corresponds to a change of state from low to high). The 2-fold evaluation, on the other hand, uses the maximum number of state changes per period duration and enables twice the resolution compared to standard evaluation.

The duty cycle, the ratio between pulse and period duration, is theoretically ideal at 50% (1:1 ratio) – but in practice it can deviate by +/- 15 % without affecting the resolution accuracy.

Signal behaviour



Electrical connection



1: Supply voltage (brown)
2: Channel 1 (green)
3: -
4: GND (white)

Electronics

Analogue versions

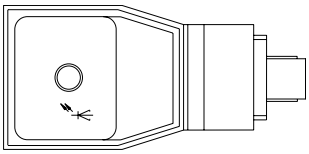
General

The analogue technology, which was developed specifically for common analogue current inputs of control systems or measuring devices, provides an analogue 4 … 20 mA current signal for flow rate determination. The 4 … 20 mA range can be adapted to the application-specific measuring range.

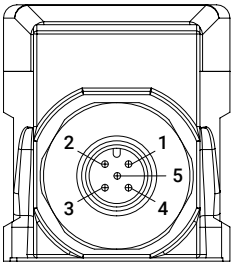
Characteristics:

- Individualisation of the measuring range possible
- Universal application possibilities
- 16 bit resolution
- Cable break detection
- Display of flow rate and direction by proportional LED behaviour on the device

Connection plug



Electrical connection

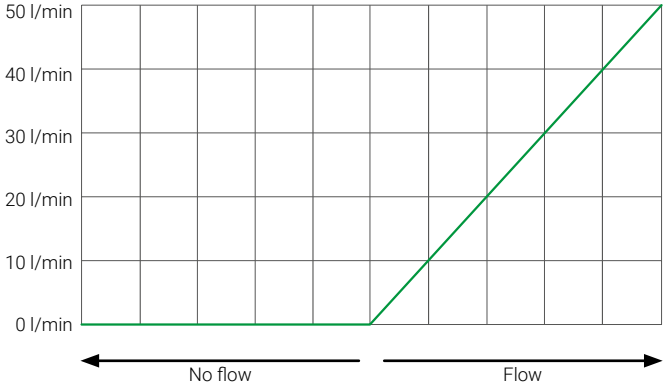


1: Supply voltage (brown)
2: Analogue output (white)
3: GND (blue)
4: Digital output (black)
5: Digital input (grey)

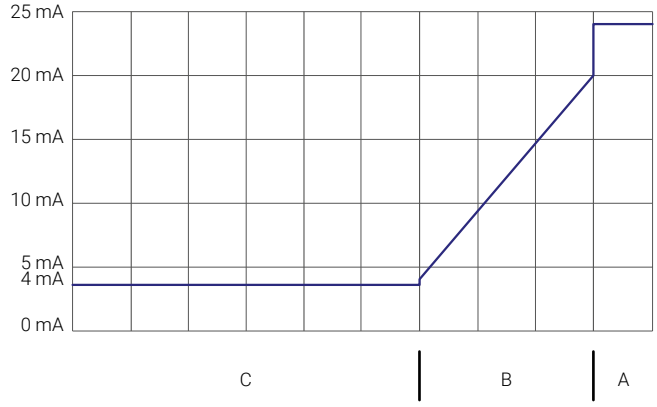
Connection plug arrangement (M12x1 metal / 5-pole round connector)

Signal behaviour

Actual flow rate



Analogue signal
based on a defined measuring range of 8 to 40 l/min



A Maximum flow exceeded
B Measurable flow range
C Minimum flow not reached

LED behaviour

	LED behaviour proportionally dependent on flow rate	
Green	Continuous	No measurable flow
Green / Red	Flashing	Flow within the measuring range
Red	Continuous	Maximum flow exceeded

Electronics

IO-Link versions

General

Thanks to its international standardisation (IEC 61131-9), IO-Link technology offers a point-to-point connection with continuous monitoring between any control level and the TM-IO-Link module. Its handling and commissioning is greatly simplified by the associated IODD file (IO Device Description).

The TM IO-Link module provides all measured values directly with units. In the preset SIO mode (standard input output), square wave signals are output by the flow meter if the IO-Link mode has not been actively switched on by an IO-Link master. This ensures backward compatibility of the TM IO-Link module with the standard square wave signal.

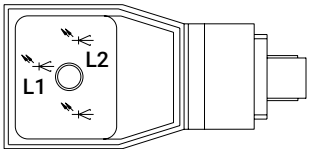
The square wave signal generated by the IO-Link module in SIO mode enables application-specific resolutions. Standard resolution means that the evaluation electronics process one change of state of the channel/sensor per period duration (rising signal edge corresponds to a change of state from low to high). The 2-fold evaluation, on the other hand, uses the maximum number of status changes per period and enables twice the resolution compared to the standard evaluation.

The duty factor, the ratio between pulse and period duration, is theoretically ideal at 50 % (1:1 ratio) – but in practice it can deviate by +/- 15 % without affecting the resolution accuracy.

Communication of the assembly

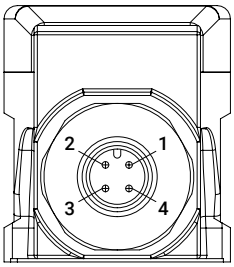
SIO mode	Same output of the two square-wave signals as in standard pre-amplifier
IO-Link mode	Signal output as described in IODD according to the following units: number of pulses litres, …

Connection plug



	IO-Link mode	SIO mode
L1 green	Flashing at 1/s	Continuous light, ready for operation
L2 red	Channel 1 Gear detected = LED on Gear not detected = LED off	

Electrical connection



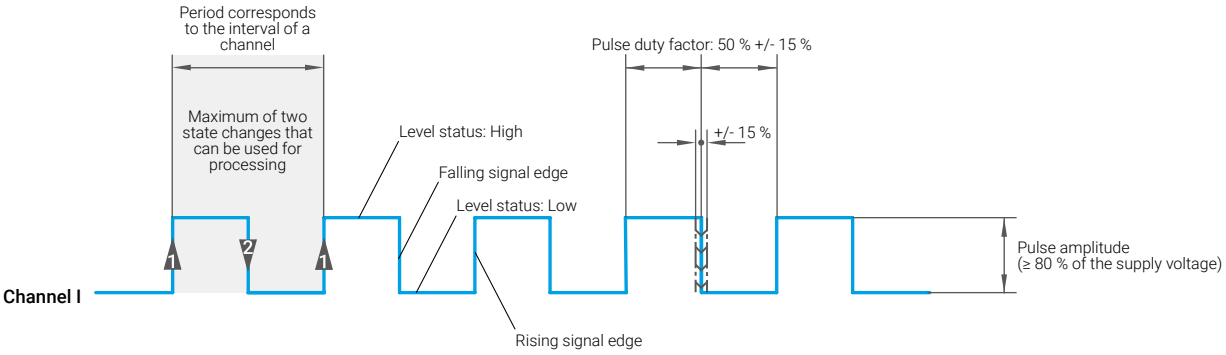
	IO-Link mode	SIO mode
1: brown	Supply voltage	
2: white	I/Q	Channel 1
3: blue	GND	
4: black	C/Q	-

Connection plug arrangement (M12x1 metal / 4-pole round connector)

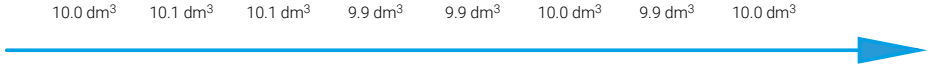
Technical characteristics

Manufacturer ID	0x0524
Device ID	0x000001
Name of manufacturer	Kracht GmbH
IO-Link connection plug	V1.1
Bit rate	COM3 / 230.4 kbit/s
Minimum cycle time	500µs
SIO mode supported	Yes
Use of indexed service data (IS DU)	Yes
Data storage (DS) possible	Yes

Signal behaviour in SIO mode



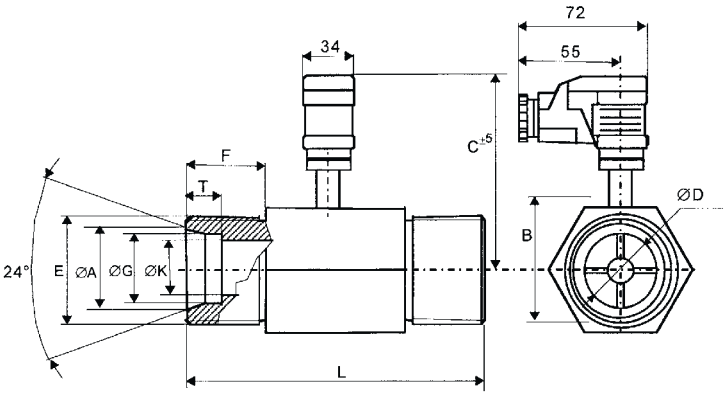
Signal behaviour in IO-Link mode



Technical drawings / Dimensions

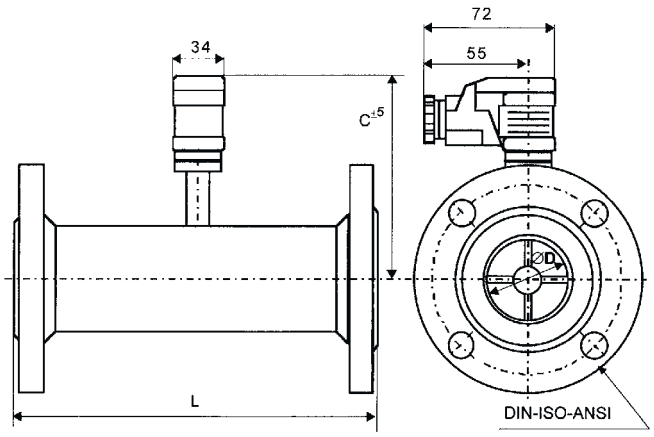
TM with pipe connection

Nominal sizes	Ø D	Ø A	Ø G	Ø K	B	C	L	E	F	T
0.275	6	14.3	12	8	25	82	58	M20x1.5	12	7.5
0.55	6	14.3	12	8	25	82	58	M20x1.5	12	7.5
1.1	12	18.3	16	12	36	86	76	M24x1.5	14	8.5
2.2	15	22.9	20	15	41	87	76	M30x2	16	10.5
4	15	22.9	20	15	41	87	76	M30x2	16	10.5
8	18	27.9	25	19	48	89	130	M36x2	18	12.0
16	25	38.0	35	27	48	92	155	M52x2	16	10.5

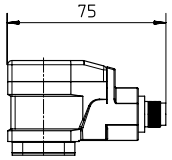


TM with flange connection

Nominal sizes	Ø D	C	L	Connecting flange
8	18	80.0	141.0	DN 20
16	25	83.0	153.5	DN 25
34	37	90.0	179.0	DN 40
68	50	95.0	198.0	DN 50



IO-Link versions (M12x1 / 4-pole)
Analogue versions (M12x1 / 5-pole)



Dimensions in mm

Notes

Notes

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TM/EN/03.2026

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