FLOWSIC600
Ultrasonic Gas Flow Meter

For Custody Transfer and Process Applications

Many years of experience and continuous improvement of the measuring technique have led to a new generation of ultrasonic gas flow meters – the FLOWSIC600. This compact design utilizes a patented concealed transducer cabling system which provides additional meter integrity and low maintenance even in the harshest industrial conditions.

The FLOWSIC600 can be equipped with 1, 2, 4, 5 or 8 non-reflective, chordal measuring paths. This makes it ideal for applications ranging from high accuracy custody transfer to those with less precise requirements such as flare and underground storage.

The compact 3D overall length inch and larger) provides lower cost station designs, especially important for smaller line sizes.

The FLOWSIC600 has provisions for analog, frequency and digital outputs plus two Modbus serial ports. This permits easy interface with all brands of flow computers. An integrated LCD display provides local access to all live data and alerts the user of any past or present alarms without necessitating the use of a computer. Extremely low power consumption (less than 1 watt) permits operation with solar power for remote applications.

SICK | MAIHAK
Analyzers and Process Instrumentation

FLOWSIC600 – Key Benefits at a Glance

- Bi-directional measurement with no pressure drop
- Compact 3D design with direct path layout
- Virtually insensitive to regulator noise
- Integrated realtime health monitoring with user programmable limits on all diagnostics
- 3 logbooks (Alarms, Warnings and Parameter changes)
- 3 data logs (Hourly, Daily and Weekly historical data)
- Very small, high frequency sealed titanium transducers
- Meter sizes from 2"... 48", and ANSI 150...2500
- Same 4-path chordal design for 3-inch and larger meters
- Transducers extractable: 6"...48" ANSI 150...900
- All sizes operate at atmospheric pressure
- Rangeability greater than 100-1 (independent of pressure)
- High accuracy (±0.1% of reading after flow calibration)
- No damage from over-ranging or liquid slugging
- Low power usage <1 watt (12/24 VDC, intrinsically safe

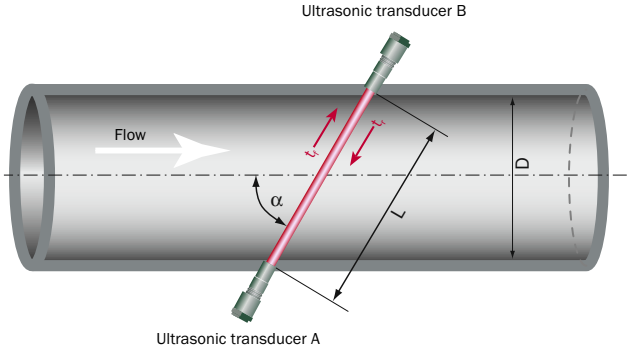
FLOWSIC600 – Applications at a Glance

- Custody transfer (fiscal metering)
- Low pressure custody and non-custody (atmospheric)
- Landfill (low pressure and high CO2)
- Check metering (onshore and offshore)
- Allocation metering
- Underground gas storage (bi-directional)
- Power plants and other large industrial users
- Chemical and Refinery Industry
- Cryogenic gas applications down to -317 °F (-194 °C)
- Process gases like N2, O2, H2, CO2, Cl2, Ethylene, etc.
- Gases with high H2S content (>25%) like sour gas or biogas

The FLOWSIC600 meets or exceeds the requirements of OIML R6, OIML D11, OIML R32 Annex A, AGA 9, API 21.1 and Measurement Canada.

Operating Principle

Two ultrasonic transducers, which are installed at an angle to the gas flow, operate alternately as a transmitter and receiver. The signals transmitted through the gas accelerate in the direction of flow and decelerate against the direction of flow. The resulting difference in propagation (transit) times is used to determine the mean gas velocity. The cross-sectional area is then used to compute the volumetric flow rate. To increase measurement accuracy, gas velocity is measured with multiple chordal paths. The uncorrected measurement is not affected by the pressure, temperature or gas composition.



$$v = \frac{L}{2 \cdot \cos \alpha} \cdot \left(\frac{1}{t_f} - \frac{1}{t_r}\right)$$

$$Q = v \cdot \frac{D^2 \cdot \pi}{4}$$

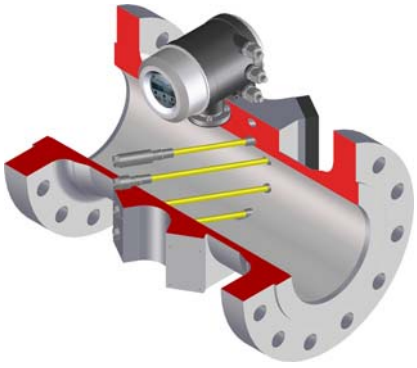
v ... Speed of gas
L ... Path length
α ... Mounting angle
Q ... Flow rate
D ... Diameter
t_f ... Transit time in direction of flow
t_r ... Transit time against direction of flow

Meter Designs

Direct Chordal Path Layout – No Reflection

The FLOWSIC600 is designed as a direct chordal path ultrasonic meter (no bouncing signals). Since the signals are not reflected inside the meter body, contamination or changes in wall roughness do not affect transit times which can significantly impact meter accuracy. In addition, the layout of the measuring paths improves the signal-to-noise ratio (SNR) when used near regulators. One reason the FLOWSIC600 performs well in control valve applications is due to non-reflective direct path which results in improved signal strength.

With the shorter path length of the chordal meter, control valve noise immunity is further enhanced by the very strong transmit signal level of the fully sealed titanium transducers. This high signal strength reduces the amount of amplification, and thus also improves the signal-to-noise ratio. This, combined with a higher frequency transducer than traditional ultrasonic meters employ, provides substantially better immunity to control valve noise regardless if a noise abatement trim or a conventional valve regulator is used. All FLOWSIC600 meters are capable of operating at atmospheric pressure. This is possible due to the high transmit sound pressure level of the standard 210 KHz transducers.



Standard (4 path)

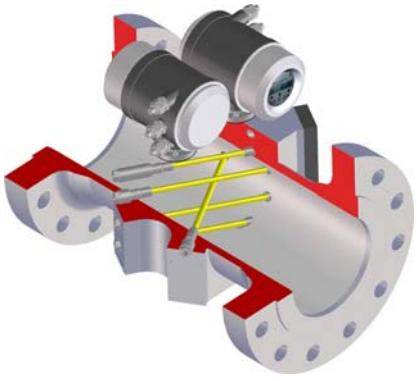
Redundancy

The FLOWSIC600 can be specified with a redundant design. This is achieved by adding a second electronics and associated transducers. As a result, the main and the additional electronics form a redundant system which is integrated into one meter body. The second electronics can be equipped with 1 or 4 pairs of transducers depending upon application needs.

FLOWSIC600 2Plex (4+1 CBM Design)

The 2Plex 4+1 CBM (Condition Based Maintenance) design provides for continuous hourly or daily verification of the fiscal 4-path meter. Testing has shown that a single-path, center-line meter is much more sensitive to flow profile changes than the 4-path chordal meter. The flow profile is affected when blockage in front of the flow conditioner occurs, or there is contamination in the pipeline. The difference in sensitivity of these two path designs permits detecting profile changes that may indicate increased measurement uncertainty in the fiscal 4-path meter.

The 2Plex 4+1 CBM design uses separate electronics for full redundancy. Both electronics operate independently, and there is no interaction between them. Transducer performance is not affected even though both electronics use the same transducer frequency. Since the single-path layout is also direct in design, there is no compromise in performance when installed near control valves.

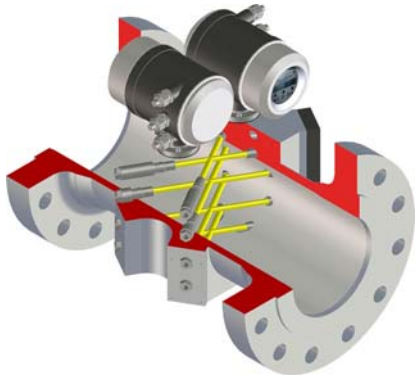


2plex (4 + 1 CBM design)

FLOWSIC600 Quatro (Redundant Design)

The Quatro redundant design provides two 4-path chordal meters for full redundancy with equal accuracy within one meter body. Both electronics operate 4 independent chordal pairs of transducers, and each determines the flow independently. This design significantly reduces cost for installations that traditionally were utilizing two separate meters with their associated piping.

The primary benefit of this design is that two different companies can utilize one meter body, but have totally electrically (and electronically) isolated systems. This permits each company to compute flow with equal accuracy, but be totally independent of each other. Additionally, should one of the electronics develop a problem, the secondary unit will continue to provide accurate measurement data.



Quatro (redundant design)

Meter Firmware

Automated Self Diagnostics

One benefit of ultrasonic meters is the ability to diagnose potential measurement issues using the comprehensive diagnostics provided by the ultrasonic meter. For several years the FLOWSIC600 meter has provided the user with some basic automated diagnostics to help identify potential issues. Recently new diagnostic tools have been added to further improve monitoring the meter's health. For the first time, all important diagnostic parameter values are monitored in the meter and alarms are provided via Modbus and a digital output. The FLOWSIC600 is the first meter to provide automated alarms in the meter.

Ultrasonic meters provide a wide array of diagnostics that can be viewed with software These diagnostics are sometimes not thoroughly understood, or there is a lack of time to review them regularly. This can lead to over-looking issues that may impact metering accuracy. Additionally, since customers typically only review diagnostic data periodically, a problem can go undetected for some period of time, or worse, occur and then not be present when the periodic inspection is performed.

Now, for the first time, the FLOWSIC600 provides fully automated monitoring and warning of all diagnostic parameters. This new CBM (condition based maintenance) firmware further enhances the performance of the FLOWSIC600 meter so that it is the first USM to provide "real-time" monitoring of all important diagnostic parameters. These include, but are not limited to, the following:

- Path velocity information – Profile Factor and Symmetry
- Speed of Sound deviation by path
- Performance by path
- Automatic Gain (AGC) by transducer
- Signal-to-noise (SNR) by transducer
- Turbulence by path
- Gas velocity exceeds normal operating limits
- Power supply voltage below a specified minimum value

Each of these warning diagnostics can now be programmed in the FLOWSIC600 with site-specific values that are monitored on a "real-time" basis. As different meter stations have a variety of piping, line sizes and metering pressures, it is important these alarm limits be incorporated in the meter. These can be easily adjusted for optimal performance on a site-by-site basis.

All of these diagnostic warnings, and more, can now be communicated to a local flow computer using either a status output (DO), or by serial communication via Modbus. This fully automated diagnostic feature will alert the user within moments of a potential problem that may have an impact on measurement accuracy long before it becomes significant.

This new automated diagnostic feature is now standard in all FLOWSIC600 meters. Older meters can be upgraded by installing new firmware to provide this enhanced, automated feature. In addition to the automated diagnostics, a new, high capacity memory SPU (signal processing unit) board now permits significantly enhanced flow data audit logging.

- The six new audit logs include the following:
- 1,000 custody events and alarms
- 500 warning alarms
- 250 parameter changes
- 40 days of hourly flow data
- 2 years of daily flow data
- A separate logging to monitor key diagnostics weekly for up to 3 years
- The following are available for existing older meters with a simple firmware upgrade:
- 500 custody events and alarms
- 250 warning alarms
- 100 parameter changes

All of these CBM features are supported with the completely new MEPAFLOW600 CBM software. In addition to the new automated diagnostics, many new features are now standard with this CBM firmware. This includes many new LCD display variables, new volume totalizers, site-specific information like station name and address, and many others.

Meter Software – MEPAFLOW600 CBM

Today, insuring measurement equipment is operating optimally has never been more important. For years the promise that the ultrasonic meter will alert the user of potential problems didn't materialize. The primary reason for this is a lack of automation within the meter, and to some degree, a lack of understanding of the diagnostics and how they can best be presented in the software. This has all changed with the release of the new CBM (condition based maintenance) firmware and the new CBM software for the FLOWSIC600 meter. The SICK MAIHAK meter now provides the user with fully automated warnings and alerting on all meter diagnostics.

This completely new, easy to use, software takes full advantage of the automated diagnostics incorporated into the advanced FLOWSIC600 meter. If any of the diagnostic warnings are active when connected to the meter, they are displayed very clearly with color coded graphs (green = OK or Normal, yellow = Warning, red = Alarm). This way any, and all, diagnostic warnings are clearly visible.

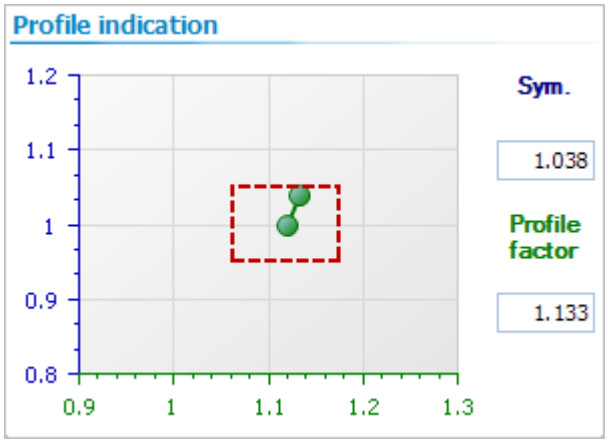
In addition to supporting all the new features of the FLOWSIC600 CBM firmware, the MEPAFLOW600 CBM software provides a host of other innovative features to simplify operation and maintenance of the USM. Some of the many new features include the following:

- Meter Values screen that graphically displays all diagnostic information including flow data and warnings/alarms
- Field Setup Wizard to quickly modify any configuration changes required during commissioning
- I/O Wizard for checking and validating all frequency and digital (DO) outputs are working properly with the flow computer
- Waveform viewer for evaluating transducer performance and signal quality
- Ability to capture (record data) and playback any live data including Meter Values, Waveforms, Maintenance Reports, etc.
- Ability to generate a Maintenance Report which can be viewed/printed immediately, stored in the MEPAFLOW600 CBM database and exported to Excel at any time
- Ability to compare the meter's configuration from any two periods in time when the software was connected to the meter
- Automatic configuration verification when connecting to the meter and presentation of any differences
- Flow calibration wizard that computes all coefficients (piecewise, polynomial, or single meter factor) and then displays the "as-found" and "as-left" in a graphical format
- The Diagnostic Session permits collection, exporting and playback of live data in a separate file

Perhaps one of the most innovative features is the ability to display the path velocity information in an easy to understand format in the *Meter Values Screen*. In the past, users had difficulty in understanding if the gas velocity profile was normal, or was distorted due to flow conditioner blockage or other pipeline contamination. That has now changed with the introduction of an advance diagnostic graph called *Profile Indication* in the *Meter Values Screen*.

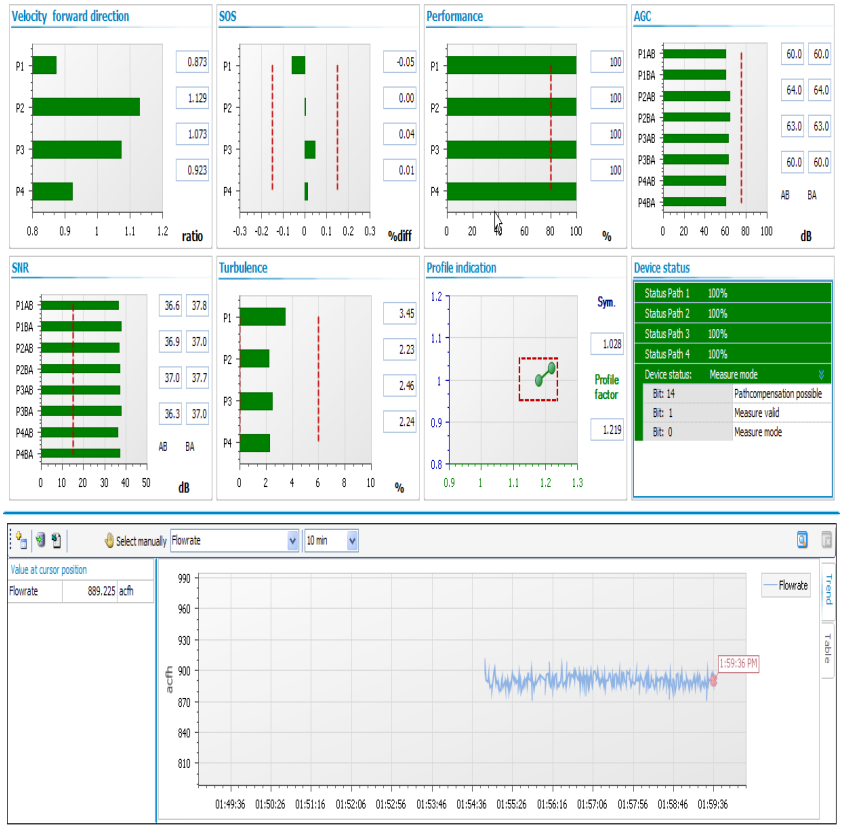
The *Profile Indication* makes path velocity information easy to understand. The two methods of understanding the FLOWSIC600 chordal paths involve analyzing Profile Factor and Symmetry (both computed in the meter). Profile Factor is computed as (Path 2 + Path 3) / (Path 1 + Path 4). Symmetry is similar but instead is determined as follows: (Path 1 + Path 2) / (Path 3 + Path 4). With these two diagnostics it is far easier to verify if the meter's velocity profile is normal, or has changed due to some contamination or blockage. Warning limits (shown by the red boundary line) are programmed into the meter electronics based upon site specific flow conditions. Once the Profile Factor or Symmetry deviate outside the limits, an alarm in the meter (Warning) is activated and the green line turns yellow.

Profile Indication

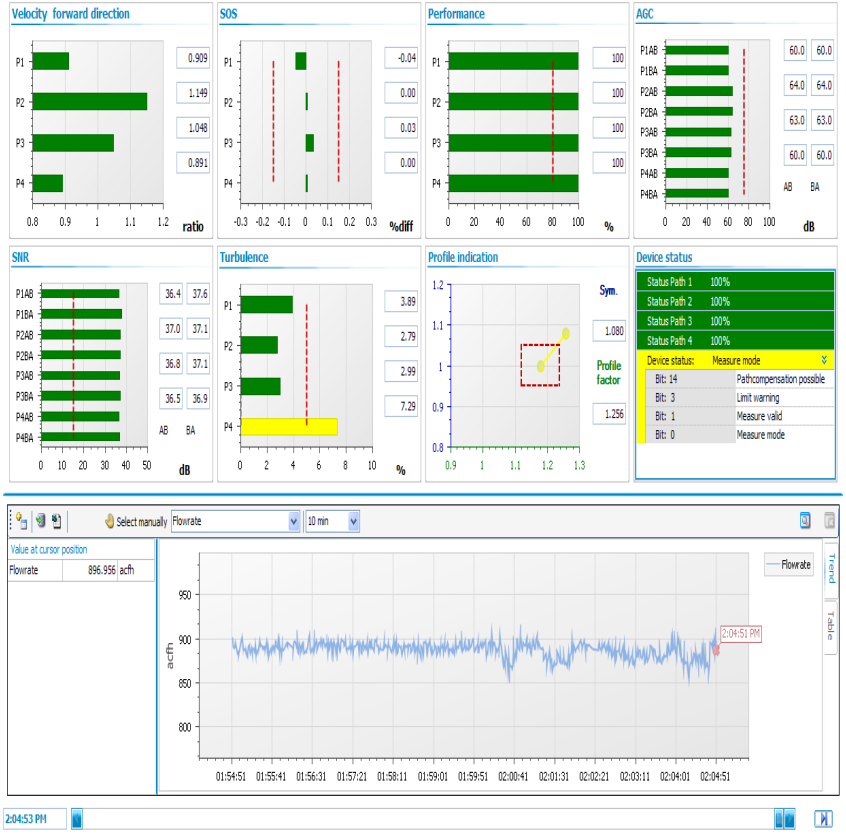


Meter Software – MEPAFLOW600 CBM

An example of *Meter Values* screen (display that shows all important flow and diagnostic data) is shown below. All graphs are green indicating normal performance. This includes Path Velocity, SOS, Performance, Automatic Gain Control (AGC), Signal-to-Noise (SNR), Turbulence and both Profile Factor and Symmetry (in one graph).



The next image shows the Profile Factor and Symmetry are both outside of normal and the turbulence on Path 4 is high (beyond the limit). Both of these are shown in yellow to indicate there is a Warning active. These warnings can be monitored by a digital output or read via Modbus by the flow computer. By setting the values in the meter, all diagnostic parameters can now be automatically monitored and alarms (Warnings) can be activated by the meter when problems occur.



Perhaps the most powerful feature of the new MEPAFLOW600 CBM software is that all information is stored in a database. That means all log files, recorded waveforms, configuration changes, date and time the technician logged on and off from the meter are recorded in this “easy to use” database.

Each time a connection to a meter is established, the software opens up a new *Session* to record all activity. The Session captures all recorded data, maintenance reports, and all configuration changes. All Sessions are managed by the MEPAFLOW600 CBM software database so they can be easily located for review of previous activity. This database then permits importing and exporting each Session(s) so that all collected data can be shared making review of a meter's history much simpler.

Meter Explorer is the tool for accessing all information in the database. The following is an example of the Meter Explorer screen and a Session that is open showing some configuration changes, measurement recordings and operational mode changes. Note that all parameter changes (as found, as left and time) are recorded.

Within the *Meter Explorer* all previously collected information can be accessed very quickly and reviewed. If a Maintenance Report needs to be generated a second time, it can be done from here and then exported to Excel if required. If a recorded file (Meter Values, Waveforms, etc.) needs to be played back, it is done from here. *Even the data collected for a Maintenance Report can be played back*. The playback feature permits selecting one of four speeds to facilitate quick review for larger records.

Any of the individual meter records can be imported and exported quickly for sharing. This way an entire history of a meter can be saved on a single computer no matter how many sessions are recorded. This greatly reduces chances for field errors, simplifies record keeping, and significantly reduces measurement uncertainty.

Sessions (66)

Date	Begin	End	Connection	Description
04/18/2008	01:13:14 PM	01:31:30 PM	Direct	
04/18/2008	01:11:14 PM	01:11:50 PM	Offline	
04/18/2008	09:43:35 AM	01:10:52 PM	Direct	

Event	Name	Event Time	Description
Maintenance report	Maintenance report	12:47:12 PM	
Operating mode change		12:24:13 PM	Configuration -> Measurement
Operating mode change		12:20:24 PM	Measurement -> Configuration
Error volume counter reset		12:19:08 PM	
Operating mode change		12:18:38 PM	Configuration -> Measurement
Operating mode change		12:14:57 PM	Measurement -> Configuration
Measurement record		11:24:58 AM	5 fps
Operating mode change		11:20:21 AM	Configuration -> Measurement
Parameter change	WarningSymmetryValidValue	11:20:17 AM	1.1 -> 1.05
Operating mode change		11:20:04 AM	Measurement -> Configuration
Operating mode change		9:44:55 AM	Configuration -> Measurement
Parameter change	WarningSymmetryValidValue	9:44:51 AM	1.05 -> 1.1
Operating mode change		9:44:23 AM	Measurement -> Configuration
Last parameter set		1:10:52 PM	

04/17/2008	02:37:51 PM	02:48:23 PM	Direct	
04/17/2008	02:35:23 PM	02:37:17 PM	Offline	
04/17/2008	12:36:08 PM	02:35:16 PM	Direct	
04/17/2008	09:55:48 AM	10:19:14 AM	Direct	
04/17/2008	09:53:06 AM	09:54:07 AM	Offline	
04/17/2008	09:45:37 AM	09:52:56 AM	Direct	
04/17/2008	07:39:17 AM	09:44:43 AM	Direct	
04/16/2008	10:53:44 AM	11:31:16 AM	Direct	
04/16/2008	09:44:57 AM	10:53:20 AM	Direct	
04/15/2008	07:10:32 PM	10:35:21 PM	Direct	

Meter Capacity (Metric)

		Corrected Volumetric Capacity in MSCMH ($10^3 m^3/H$) at Various Operating Pressures (kPag) (Based on gas velocity in pipe = 30 m/sec)										
Meter Size →		2"	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"
ACMH →		234	515	887	2,013	3,486	5,494	7,799	12,313	19,366	28,010	43,673
Operating Pressure (kPag)	150	0.570	1.26	2.16	4.91	8.50	13.4	19.0	30	47	68	106
	300	0.913	2.01	3.46	7.86	13.6	21.4	30.4	48	76	109	170
	400	1.14	2.52	4.33	9.8	17.0	26.8	38.1	60	95	137	213
	700	1.84	4.05	6.97	15.8	27.4	43.2	61.3	97	152	220	343
	1000	2.65	5.84	10.1	22.8	39.5	62.3	88.4	140	220	318	495
	1500	3.74	8.23	14.2	32.1	55.7	87.7	124.5	197	309	447	697
	2000	4.96	10.9	18.8	42.6	73.8	116.4	165.2	261	410	593	925
	2500	6.20	13.6	23.5	53.3	92.4	145.6	206.6	326	513	742	1,157
	3000	7.47	16.4	28.3	64.3	111.3	175.4	249.0	393	618	894	1,394
	3500	8.77	19.3	33.2	75.4	130.6	205.8	292.2	461	726	1,049	1,636
	4000	10.1	22.2	38.3	86.8	150.3	236.9	336.3	531	835	1,208	1,883
	4500	11.4	25.2	43.4	98.4	170.4	268.6	381.3	602	947	1,370	2,135
	5000	12.8	28.2	48.6	110.3	191.0	301.0	427.2	674	1,061	1,534	2,392
	5500	14.2	31.3	53.9	122.3	211.9	333.9	474.0	748	1,177	1,702	2,654
	6000	15.7	34.4	59.3	134.6	233.2	367.5	521.6	824	1,295	1,873	2,921
	7000	18.6	40.9	70.5	159.9	276.9	436.4	619.4	978	1,538	2,225	3,469
	8000	21.6	47.6	81.9	185.9	322.0	507.4	720.3	1,137	1,789	2,587	4,034
	9000	24.7	54.4	93.7	212.6	368.2	580.3	823.8	1,301	2,046	2,959	4,613
	10000	27.9	61.4	105.7	239.9	415.4	654.7	929.4	1,467	2,308	3,338	5,204

		Corrected Volumetric Capacity in MMSCMD ($10^6 m^3/D$) at Various Operating Pressures (kPag) (Based on gas velocity in pipe = 30 m/sec)										
Meter Size →		2"	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"
ACMH →		234	515	887	2,013	3,486	5,494	7,799	12,313	19,366	28,010	43,673
Operating Pressure (kPag)	150	0.014	0.030	0.052	0.118	0.204	0.321	0.456	0.720	1.13	1.64	2.55
	300	0.022	0.048	0.083	0.189	0.327	0.515	0.731	1.15	1.81	2.62	4.09
	400	0.027	0.060	0.104	0.236	0.409	0.644	0.915	1.44	2.27	3.29	5.12
	700	0.044	0.097	0.167	0.380	0.658	1.04	1.47	2.32	3.65	5.28	8.24
	1000	0.064	0.140	0.241	0.548	0.95	1.50	2.12	3.35	5.27	7.62	11.9
	1500	0.090	0.197	0.340	0.772	1.34	2.11	2.99	4.72	7.42	10.7	16.7
	2000	0.119	0.262	0.451	1.02	1.77	2.79	3.96	6.26	9.8	14.2	22.2
	2500	0.149	0.327	0.564	1.28	2.22	3.49	4.96	7.83	12.3	17.8	27.8
	3000	0.179	0.395	0.680	1.54	2.67	4.21	5.98	9.43	14.8	21.5	33.5
	3500	0.210	0.463	0.798	1.81	3.14	4.94	7.01	11.1	17.4	25.2	39.3
	4000	0.242	0.533	0.918	2.08	3.61	5.69	8.07	12.7	20.0	29.0	45.2
	4500	0.275	0.604	1.04	2.36	4.09	6.45	9.15	14.4	22.7	32.9	51.2
	5000	0.308	0.677	1.17	2.65	4.58	7.22	10.3	16.2	25.5	36.8	57.4
	5500	0.341	0.751	1.29	2.94	5.09	8.01	11.4	18.0	28.2	40.9	63.7
	6000	0.376	0.827	1.42	3.23	5.60	8.82	12.5	19.8	31.1	45.0	70.1
	7000	0.446	0.98	1.69	3.84	6.65	10.5	14.9	23.5	36.9	53.4	83.3
	8000	0.519	1.14	1.97	4.46	7.73	12.2	17.3	27.3	42.9	62.1	96.8
	9000	0.593	1.31	2.25	5.10	8.84	13.9	19.8	31.2	49.1	71.0	110.7
	10000	0.669	1.47	2.54	5.76	10.0	15.7	22.3	35.2	55.4	80.1	124.9

Notes:

Volumetric calculations based on Amarillo gas compositions (see AGA Report No. 8) flowing at 21 °C (Atm Press=101.325 kPa)

The 30 m/sec gas velocity is the velocity in the pipe assuming Schedule 40 (NPS 2 through 24 pipe) and equivalent wall thickness for pipe > NPS 24

Meter Dimensions

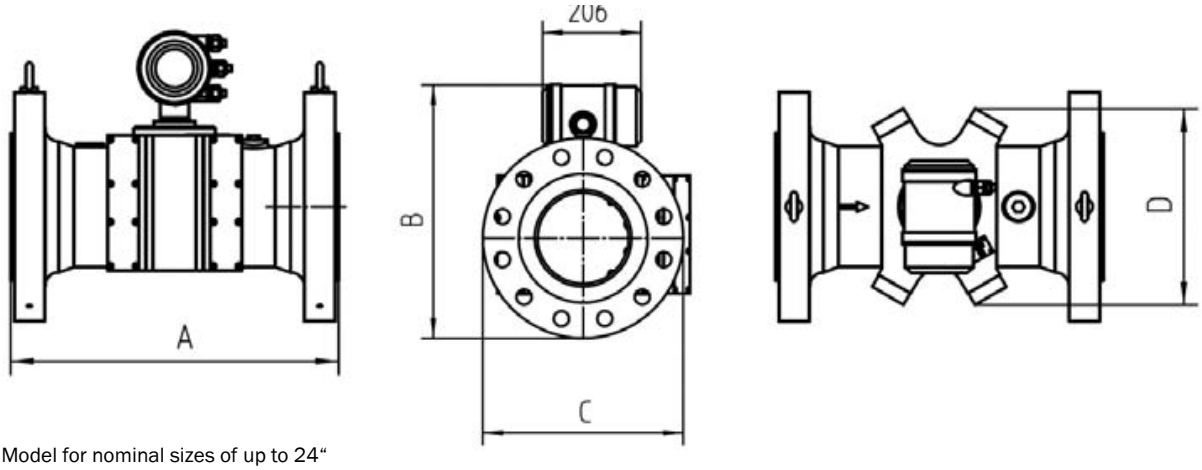
Nominal Meter Size	ANSI Class	Weight		Length (A)		Height (B)		Flange Diameter (C)	
		lb	kg	inches	mm	inches	mm	inches	mm
2"	150	62	28	9,84	250	12,99	330,00	6,00	152,40
	300	64	29			13,39	340,00	6,50	165,10
	600	66	30			13,39	340,00	6,50	165,10
	900	95	43	11,81	300	14,17	360,00	8,50	215,90
3"	150	73	33	9,45	240	13,20	335,30	7,50	190,50
	300	75	34			13,57	344,75	8,25	209,50
	600	84	38			13,57	344,75	8,25	209,50
	900	168	76	15,75	400	14,20	360,65	9,50	241,30
4"	150	88	40	11,81	300	15,33	389,30	9,00	228,60
	300	110	50			15,83	402,00	10,00	254,00
	600	132	60			16,20	411,55	10,75	273,10
	900	198	90	19,69	500	16,58	421,05	11,50	292,10
6"	150	187	85	17,72	450	17,51	444,70	11,00	279,40
	300	209	95			18,26	463,75	12,50	317,50
	600	265	120			19,01	482,80	14,00	355,60
	900	430	195	29,53	750	19,51	495,50	15,00	381,00
8"	150	287	130	23,62	600	19,55	496,45	13,50	342,90
	300	353	160			20,30	515,50	15,00	381,00
	600	419	190			21,05	534,55	16,50	419,10
	900	595	270			22,05	559,95	18,50	469,90
10"	150	463	210	29,53	750	21,39	543,20	16,00	406,40
	300	496	225			22,14	562,25	17,50	444,50
	600	661	300			23,39	594,00	20,00	508,00
	900	860	390			24,14	613,05	21,50	546,10
12"	150	661	300	35,43	900	23,48	596,30	19,00	482,60
	300	772	350			24,23	615,35	20,50	520,70
	600	926	420			24,98	634,40	22,00	558,80
	900	1.190	540			25,98	659,80	24,00	609,60
16"	150	1.235	560	47,24	1.200	27,54	699,45	23,50	596,90
	300	1.389	630			28,54	724,85	25,50	647,70
	600	1.742	790			29,29	743,90	27,00	685,80
	900	2.337	1.060			29,66	753,40	27,75	704,80
20"	150	2.072	940	59,06	1.500	31,51	800,25	27,50	698,50
	300	2.425	1.100			33,01	838,35	30,50	774,70
	600	2.723	1.235			33,76	587,40	32,00	812,80
	900	4.079	1.850			34,63	879,60	33,75	857,20
24"	150	3.142	1.425	70,87	1.800	35,72	907,40	32,00	812,80
	300	3.748	1.700			37,72	958,20	36,00	914,40
	600	4.189	1.900			38,22	970,90	37,00	939,80
	900	5.071	2.300			40,22	1.021,70	41,00	1.041,40
30"	150	4.960	2.250	59,06	1.500	42,58	1.081,63	38,75	984,25
	300	5.622	2.550			44,71	1.135,60	43,00	1.092,20
	600	6.173	2.800			45,46	1.154,65	44,50	1.130,30
	900	7.275	3.300			48,50	1.231,90	48,50	1.231,90

Characteristic Properties and Dimensions of the Meter Body

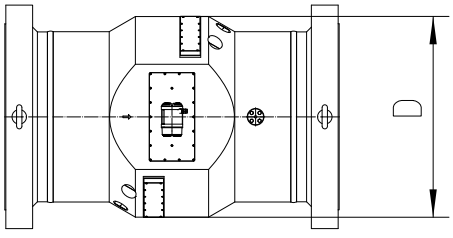
Material

Material		Application
Carbon steel	1.1120 (A216 WCC)	Nominal width ≤ DN 600 / NPS 24
	1.0460 (A105)	Flanges > DN 600 / NPS 24
LT carbon steel	1.6220 (A352 LCC)	Nominal width ≤ DN 600 / NPS 24
	1.0566 (A350, LF2 class 1)	Flanges > DN 600 / NPS 24
Stainless steel	1.4408 (A351 Gr. CF8M)	Nominal width ≤ DN 600 / NPS 24
	1.4571 (A182 Gr. F316)	Flanges > DN 600 / NPS 24
Duplex	1.4470 (A995 Gr.4A/UNS J92205)	Nominal width ≤ DN 600 / NPS 24
	1.4462 (A182 Gr. F51)	Flanges > DN 600 / NPS 24

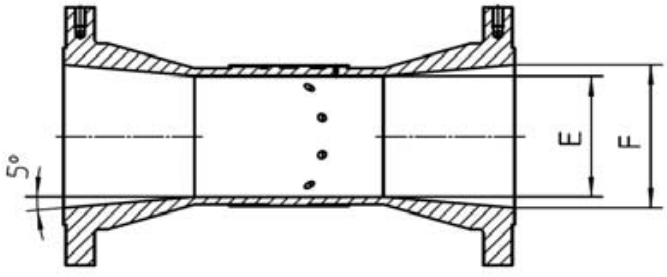
Weights and dimensions



Model for nominal sizes of up to 24“



Model for nominal sizes of 24“ up to48“



Adaption of pipeline diameter to measuring section

Dimension F must be specified by the customer, as it depends on the internal pipe diameter at the installation location.

Meter Dimensions

Nominal pipe size	Connec-tion flange	Standard	Weight	Length (A)	Height (B)	Flange diameter (C)	Width measur. section (D)	Inter-nal diame-ter (E)
			[kg]	mm	mm	mm	mm	mm
2"	cl. 150	ANSI B16.5	28	250	330	152.4	160	49.3
	cl. 300		29	250	340	165.1		49.3
	cl. 600		30	250	340	165.1		49.3
	cl. 900/ 1500		43	300	360	215.9		42.8
DN50	PN 16 *	DIN 2633	20	150	345	-	155	48
	PN 64	DIN 2636	31	250	345	180	160	49.1
	PN 100	DIN 2637	35	250	350	195		49..1
3"	cl. 150	ANSI B16.5	33	240	335.30	190.50	180	73
	cl. 300		34		344.75	209.50		
	cl. 600		38		344.75	209.50		
	cl. 900		76	400	360.65	241.30		
DN80	PN 16	DIN 2633	33	240	340.00	200.00		
	PN 64	DIN 2636	36		347.50	215.00		
	PN 100	DIN 2637	39		355.00	230.00		
4"	cl. 150	ANSI B16.5	40	300	389.30	228.60	240	95
	cl. 300		50		402.00	254.00		
	cl. 600		60		411.55	273.10		
	cl. 900		90	500	421.05	292.10		
DN100	PN 16	DIN 2633	36	300	385.00	220.00		
	PN 64	DIN 2636	47		400.00	250.00		
	PN 100	DIN 2637	55		407.50	265.00		
6"	cl. 150	ANSI B16.5	85	450	444.70	279.40	300	142
	cl. 300		95		463.75	317.50		
	cl. 600		120		482.80	355.60		
	cl. 900		195	750	495.50	381.00		
DN150	PN 16	DIN 2633	80	450	447.50	285.00		
	PN 64	DIN 2636	100		477.50	345.00		
	PN 100	DIN 2637	115		482.50	355.00		
8"	cl. 150	ANSI B16.5	130	600	496.45	342.90	350	190
	cl. 300		160		515.50	381.00		
	cl. 600		190		534.55	419.10		
	cl. 900		270		559.95	469.90		
DN200	PN 16	DIN 2633	120		495.00	340.00		
	PN 64	DIN 2636	170		532.50	415.00		
	PN 100	DIN 2637	190		540.00	430.00		
10"	cl. 150	ANSI B16.5	210	750	543.20	406.40	410	235
	cl. 300		225		562.25	444.50		
	cl. 600		300		594.00	508.00		
	cl. 900		390		613.05	546.10		
DN250	PN 16	DIN 2633	195		542.50	405.00		
	PN 64	DIN 2636	240		575.00	470.00		
	PN 100	DIN 2637	290		592.50	505.00		
12"	cl. 150	ANSI B16.5	300	900	596.30	482.60	470	270
	cl. 300		350		615.35	520.70		
	cl. 600		420		634.40	558.80		
	cl. 900		540		659.80	609.60		
DN300	PN 16	DIN 2633	275		585.00	460.00		
	PN 64	DIN 2636	370		620.00	530.00		
	PN 100	DIN 2637	460		647.50	585.00		

* Sandwich design (without flanges)

Nominal pipe size	Connec-tion flange	Standard	Weight	Length (A)	Height (B)	Flange diameter (C)	Width of measur. section (D)	Inter-nal diame-ter (E)
			[kg]	mm	mm	mm	mm	mm
14“	cl. 150	ANSI B16.5	425	1050	644.20	533.40	540	315
	cl. 300		525		669.60	584.20		
	cl. 600		595		679.15	603.30		
	cl. 900		760		698.15	641.30		
DN350	PN 16	DIN 2633	420		637.50	520.00		
	PN 64	DIN 2636	550		677.50	600.00		
	PN 100	DIN 2637	680		705.00	655.00		
16"	cl. 150	ANSI B16.5	560	1200	699.45	596.90	570	360
	cl. 300		630		724.85	647.70		
	cl. 600		790		743.90	685.80		
	cl. 900		1060		753.40	704.80		
DN400	PN 16	DIN 2633	520		691.00	580.00		
	PN 64	DIN 2636	670		736.00	670.00		
	PN 100	Dimensions on request						
18"	cl. 150	ANSI B16.5	750	1350	768.50	635.00	620	405
	cl. 300		850		806.60	711.20		
	cl. 600		1000		822.50	743.00		
	cl.900		1400		844.70	787.40		
DN450	PN 16	Dimensions on request						
	PN 64							
	PN 100							
20“	cl. 150	ANSI B16.5	940	1500	800.25	698.50	670	450
	cl. 300		1100		838.35	774.70		
	cl. 600		1235		857.40	812.80		
	cl. 900		1850		879.60	857.20		
DN500	PN 16	DIN 2633	900		808.50	715.00		
	PN 64	Dimensions on request						
	PN 100							
24"	cl. 150	ANSI B16.5	1425	1800	907.40	812.80	760	540
	cl. 300		1700		958.20	914.40		
	cl. 600		1900		970.90	939.80		
	cl. 900		2300		1.021.70	1.041.40		
DN600	PN 16	DIN 2633	1350		921.00	840.00		
	PN 64	Dimensions on request						
	PN 100							
26“	cl. 150	ASME B16.47	1500	1300	947.48	869.95	828	585
	cl. 300		1800		1.025.28	971.55		
	cl. 600		2050		1.047.50	1.016.00		
	cl. 900		2500		1.085.85	1.085.85		
DN650	PN16	Dimensions on request						
	PN64							
	PN100							
28“	cl. 150	ASME B16.47	1950	1400	1.028.00	927.10	862	630
	cl. 300		2200		1.081.97	1.035.05		
	cl. 600		2400		1.101.02	1.073.15		
	cl. 900		2900		1.168.40	1.168.40		
DN700	PN16	DIN2633	1800		1.019.45	910.00		
	PN64	Dimensions on request						
	PN100							

Nominal pipe size	Connec-tion flange	Standard	Weight	Length (A)	Height (B)	Flange diameter (C)	Width of measur. section (D)	Inter-nal diame-ter (E)
			[kg]	mm	mm	mm	mm	mm
30“	cl. 150	ASME B16.47	2250	1500	1.081.63	984.25	902	675
	cl. 300		2550		1.135.60	1.092.20		
	cl. 600		2800		1.154.65	1.130.30		
	cl. 900		3300		1.231.90	1.231.90		
DN750	PN16	Dimensions on request						
	PN64							
	PN100							
32“	cl. 150	ASME B16.47	2625	1600	1.144.73	1.060.45	979	720
	cl. 300		2950		1.189.18	1.149.35		
	cl. 600		3200		1.211.40	1.193.80		
	cl. 900		3900		1.314.45	1.314.45		
DN800	PN 16	DIN2633	2450		1.127.00	1.025.00		
	PN 64	Dimensions on request						
	PN 100							
34“	cl. 150	ASME B16.47	3050	1700	1.195.13	1.111.25	1024	765
	cl. 300		3430		1.242.75	1.206.50		
	cl. 600		3710		1.261.80	1.244.60		
	cl. 900		4800		1.397.00	1.397.00		
DN850	PN 16	Dimensions on request						
	PN 64							
	PN 100							
36“	cl. 150	ASME B16.47	3325	1800	1.251.20	1.168.40	1082	810
	cl. 300		3700		1.302.00	1.270.00		
	cl. 600		4000		1.324.26	1.314.45		
	cl. 900		5250		1.460.50	1.460.50		
DN900	PN 16	DIN2633	2750		1.229.50	1.125.00		
	PN 64	Dimensions on request						
	PN 100							
38“	cl. 150	ASME B16.47	4135	1900	1.308.63	1.238.25	1160	855
	cl. 300		4050		1.273.70	1.168.40		
	cl. 600		4575		1.324.50	1.270.00		
	cl. 900		6000		1.460.50	1.460.50		
DN950	PN 16	Dimensions on request						
	PN 64							
	PN 100							
40“	cl. 150	ASME B16.47	4375	2000	1.361.53	1.289.05	1213	900
	cl. 300		4650		1.336.13	1.238.25		
	cl. 600		5150		1.377.40	1.320.80		
	cl. 900		6450		1.511.30	1.511.30		
DN1000	PN 16	DIN2633	4400		1.344.50	1.255.00		
	PN 64	Dimensions on request						
	PN 100							
42“	cl. 150	ASME B16.47	5150	2100	1.414.54	1.346.20	1261	945
	cl. 300		5125		1.385.97	1.289.05		
	cl. 600		5850		1.443.12	1.403.35		
	cl. 900		7150		1.562.10	1562.10		
DN1050	PN 16	Dimensions on request						
	PN 64							
	PN 100							

Nominal pipe size	Connec-tion flange	Standard	Weight	Length (A)	Height (B)	Flange diameter (C)	Width of measur. section (D)	Inter-nal diame-ter (E)
			[kg]	mm	mm	mm	mm	mm
44“	cl. 150	ASME B16.47	5925	2200	1.468.68	1.403.35	1310	990
	cl. 300		5900		1.443.28	1.352.55		
	cl. 600		6600		1494.08	1.454.15		
	cl. 900		8200		1.647.95	1.647.95		
DIN1100	PN 16	Dimensions on request						
	PN 64							
	PN 100							
48“	cl. 150	ASME B16.47	7075	2400	1.573.65	1.511.30	1416	1080
	cl. 300		7150		1.551.43	1.466.85		
	cl. 600		8100		1.614.96	1.593.85		
	cl. 900		9400		1.784.35	1.784.35		
DN1200	PN 16	DIN2633	6600		1.560.50	1.485..00		
	PN 64	Dimensions on request						
	PN 100							

Inner pipe diameter

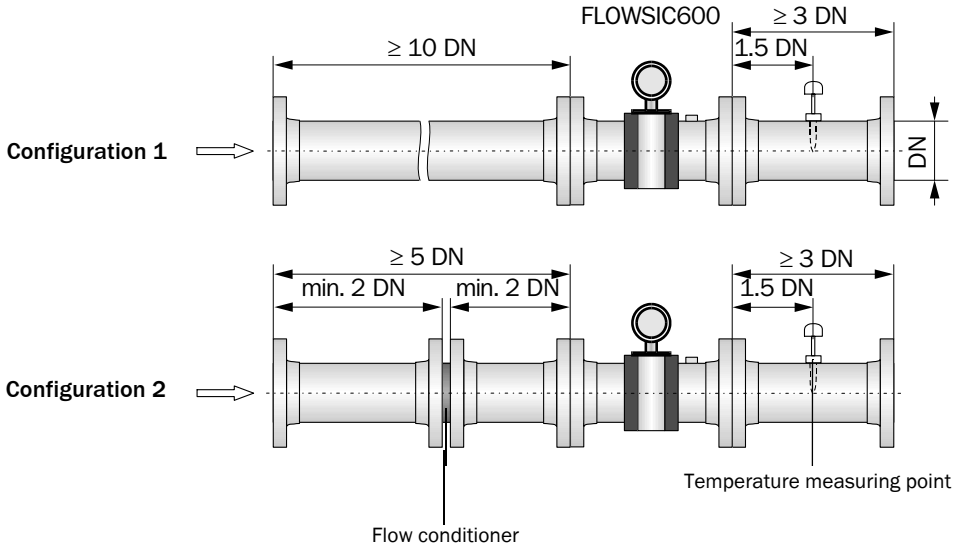
Nominal pipe size	Pipe dimensions in accordance with ANSI B36.10M - 1985					DIN 2633	DIN 2636	DIN 2637
	SC20	SC30	SC40	SC60	SC80	PN16	PN64	PN100
2"			52.5		49.3			
DN 50						54.5	54.5	54.5
3"			77.9		73.7			
DN 80						82.5	81.5	80.9
4"			102.3		97.2			
DN 100						107.1	106.3	104.3
6"			154.1		146.3			
DN 150						159.3	157.1	154.1
8"	206.4	205	202.7	198.5	193.7			
DN 200						206.5	204.9	199.1
10"	260.4	257.5	254.5	247.7	242.9			
DN 250						260.4	255.4	248.0
12"	311.2	307.1	303.2	295.3	288.9			
DN 300						309.7	301.9	295.5
14“	339.8	336.6	333.3	325.4	317.5			
DN 350						339.6	343.0	336.0
16"	390.6	387.4	381.0	373.1	363.5			
DN 400						390.4	378	
18“	441.4	434.9	428.7	419.1	409.5			
DN 450								
20“	489.0	482.6	477.8	466.8	455.6			
DN 500						492.0		
24“	590.6	581.1	574.6	560.4	547.7			
DN 600						592.4		

Installation Configuration

The choice of the installation configuration depends on type and extent of the flow disturbance at the installation position (according to TR G13).

Type of disturbance (distance upstream <20 DN)	Possible installation configuration
None	Configuration 1 or 2
Elbow, reducer	
Double elbow out of plane, T piece	
Gas pressure controller with/ without noise abatement trim	Configuration 2
Diffuser	
Diffuser with swirling flow	

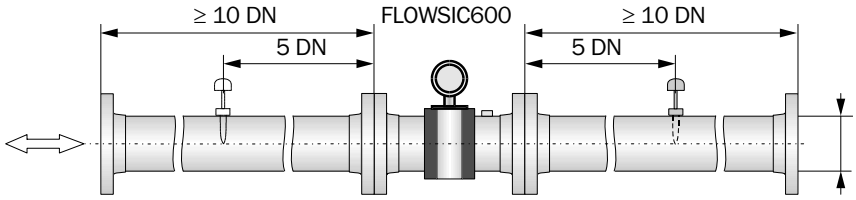
Unidirectional use



Bidirectional use

Two straight pipes shall be installed in the inlet and outlet sections if the meter is to be used bidirectionally. The temperature measuring point shall be disposed downstream the FLOWSIC600, seen in the direction of predominant use.

Configuration 1
Not applicable for meters marked with an asterisk (*) in table on page? “PTB approve example”



Configuration 2
Applicable for meters marked with an asterisk (*) in table on page? “PTB approve example”