FLOWSIC600
Ultrasonic Gas Flow Meter

For Custody Transfer and
Process Applications

The Technology Leader in Gas Ultrasonic Metering

SICK
Sensor Intelligence.

FLOWSIC600
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.

FLOWSIC600 – Key Benefits at a Glance

- Integrated realtime health monitoring with user programmable limits on all diagnostics
- 3 logbooks (Alarms, Warnings and Parameter changes)
- 3 data logs (user programmable Hourly, Daily and Diagnostic data)
- Very small, high frequency sealed titanium transducers
- Virtually insensitive to regulator noise
- Meter sizes from 2"... 48", and ANSI 150...2500
- Same 4-path chordal design for 3" and larger meters
- Transducers extractable: 6"...48" ANSI 150...900
- Most 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
- Bi-directional measurement with no pressure drop
- Low power usage <1 watt (12/24 VDC, intrinsically safe)

The FLOWSIC600 uses the proven 4-path Westinghouse® chordal configuration for superior performance, even in the most adverse piping conditions. This design is used for all 4-path meters 3" and larger.

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.

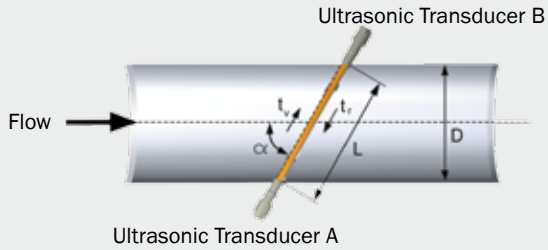
FLOWSIC600 – Applications at a Glance

- Custody transfer (fiscal metering)
- Low pressure custody and non-custody (atmospheric)
- Landfill (low pressure and high CO_2 [**including 100%**])
- 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)
- Steam up to 536 °F (280 °C)
- Process gases like N_2, O_2, H_2, CO_2, Cl_2, Ethylene, etc.
- Gases with high H_2S content (>25%) like sour gas or biogas
- Flare gas

The FLOWSIC600 meets or exceeds the requirements of 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 (4). The uncorrected measurement is not affected by the pressure, temperature or gas composition.



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

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

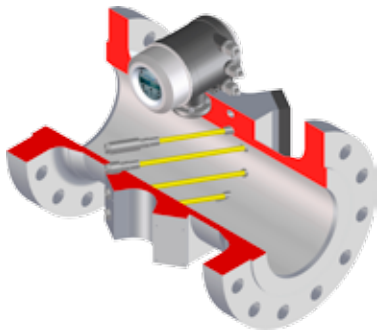
v = Gas velocity
L = Path length
α = Installation angle
Q = Volume flow
D = Diameter
t_v = Transit time with flow
t_r = Transit time against flow

www.mvandc.com | sales@mvandc.com | Phone 877.566.3837 | Fax 925.407.2903

FLOWSIC600
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.

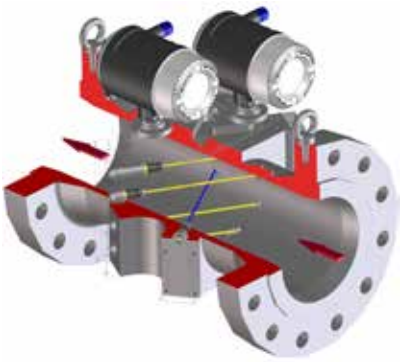
With the shorter path length of the chordal meter, control valve noise immunity is further enhanced by the very strong transmit signal level of the fully sealed titanium transducers. This high signal strength reduces the amount of signal amplification, and thus also improves the signal-to-noise ratio. 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. Most 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 Meter

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.

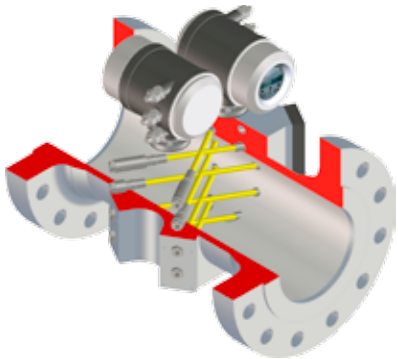
FLOWSIC600 2Plex (4+1) CBM Design
The 2Plex (4+1) CBM (Condition Based Maintenance) design provides for continuous hourly or daily verification by employing a 4-path fiscal meter and single path meter in one body. Testing has shown that a single-path, center-line meter is much more sensitive to flow 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.



2Plex (4+1) CBM Design

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.

FLOWSIC600 Quatro (4+4) Redundant Design
The Quatro (4+4) redundant design provides two independent 4-path chordal meters for full redundancy with equal accuracy within one meter body. Both electronics operate 4 chordal pairs of transducers, and each determines the flow. This design significantly reduces cost for measurement stations that traditionally were utilizing two separate meters with their associated piping, calibrations and installations.



Quatro (4+4) Redundant Design

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.

FLOWSIC600
MEPAFLOW600 CBM Firmware

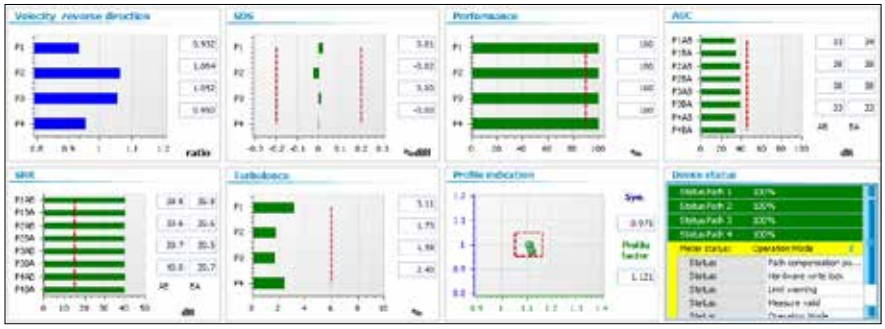
Automated Self Diagnostics

One benefit of ultrasonic meters is the ability to diagnose potential measurement issues using the comprehensive diagnostics provided by the electronics. For several years the FLOWSIC600 meter contained 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 diagnostics are monitored in the meter, and alarms (warnings) are provided via Modbus and a digital output. The FLOWSIC600 is the first meter to provide automated warnings 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, and recently improved, 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:

- 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
- Logbook(s) full of unacknowledged entries



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. The blue velocity profile indicates reverse flow and does not constitute a warning.

All of these diagnostic warnings, and more, can 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 <u>STANDARD</u> in all FLOWSIC600 meters. 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 audit logs include the following (Hourly, Daily and Diagnostic "Fingerprint" logs are all user configurable):

- 1,000 custody events and alarms
- 500 warnings
- 250 parameter changes
- 60 days of hourly flow data
- 1.5 years of daily flow data
- Diagnostic "Fingerprint" log

All of these CBM features are supported with the recently updated MEPAFLOW600 CBM software. In addition to the new automated diagnostics, many new features are available with the latest CBM firmware. This includes the first USM with a diagnostic "Fingerprint" log, several LCD display variables, six uncorrected volume totalizers, last hour and last day forward and reverse accumulated volume, site-specific information like station name and address, and many others.

FLOWSIC600
MEPAFLOW600 CBM Software

MEPAFLOW600 CBM Software - All features are fully functional

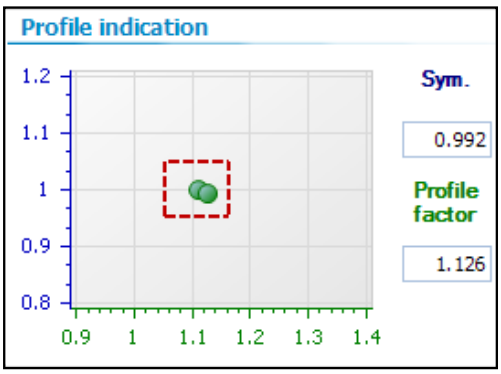
This recently updated and easy to use software takes full advantage of the automated diagnostics incorporated into the advanced FLOWSIC600 meter. If any of the diagnostic warnings are active when connected to the meter, they are displayed very clearly with color coded graphs (green = OK or Normal, yellow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

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
- Automatic configuration verification when connecting to the meter and presentation of any differences
- Field Setup Wizard to quickly modify any configuration changes required during commissioning
- I/O Wizard for checking and validating all frequency and digital outputs (DO) 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.
- Generate a Maintenance Report which can be viewed/printed immediately, stored in the MEPAFLOW600 CBM database and exported to Excel at any time (also, replay at a later time)
- Ability to compare the meter's configuration from any two periods in time when the software was connected to the meter
- 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
- Diagnostic Session which permits collection, exporting and playback of live data in a separate file
- Ethernet connectivity for LAN/WAN access
- Ability to e-mail reports directly from the CBM software

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 advanced 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 path velocities involve analyzing Profile Factor and Symmetry (both computed in the meter).

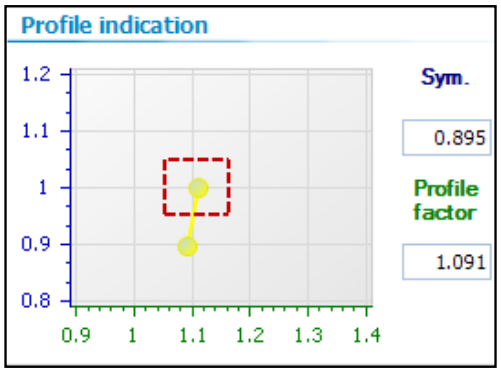


Profile Indication above: Normal

Profile Factor is computed as follows: (Path 2 + Path 3) / (Path 1 + Path 4).

Symmetry is similar to Profile Factor but 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. If the Profile Factor or Symmetry deviate outside the limits, an alarm in the meter (Warning) is activated and the green line turns yellow as shown in the graph on the right.



Profile Indication above: Abnormal

FLOWSIC600
MEPAFLOW600 CBM Software (continued)

MEPAFLOW600 CBM Software

An example of the **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). Blue velocity ratios indicate reverse flow.

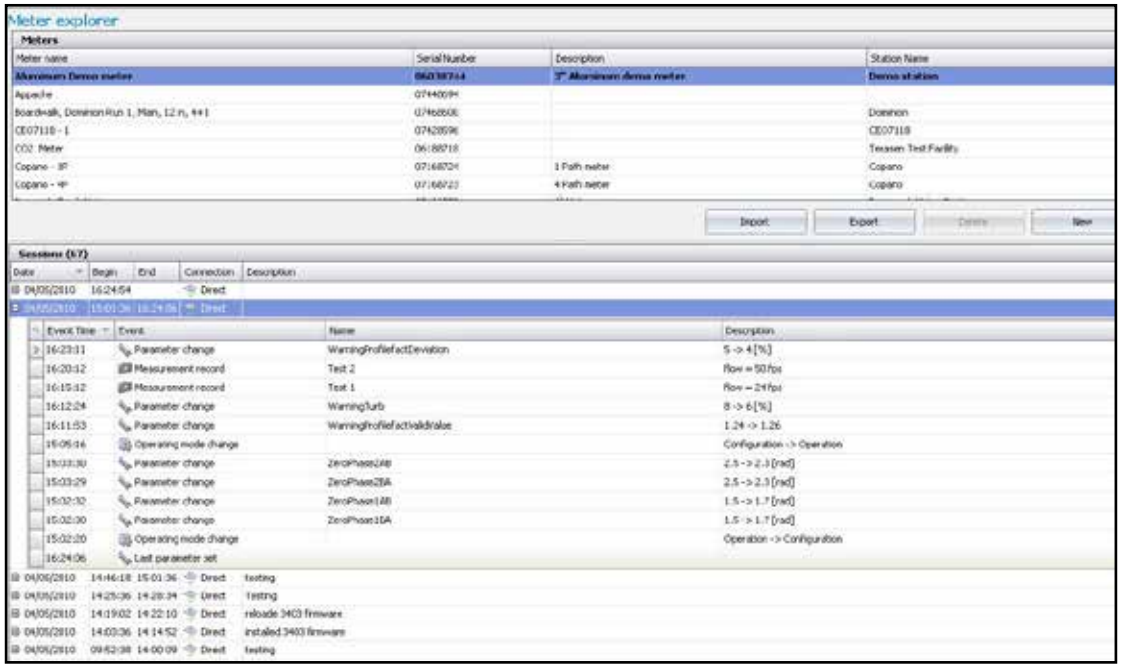
The next image shows the Profile Factor and Symmetry are both outside of normal and the turbulence on Path 4 is high (approaching the limit). Both of these are shown in yellow to indicate there is a Warning active. These warnings can be monitored by a digital output or read via Modbus by the flow computer.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

FLOWSIC600
MEPAFLOW600 CBM Software (continued)

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 at a later date. This database then permits importing and exporting Session(s) so that all collected data can be shared with other technicians, thus, 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 (Session Files) can be imported and exported quickly for sharing. This way an entire history of a meter can be saved on a single computer (technician’s computer, measurement office, central mainframe, etc.) no matter how many sessions are recorded. This greatly reduces chances for field errors, simplifies record keeping, and significantly reduces measurement uncertainty.

FLOWSIC600
Meter Capacity (Imperial)

Corrected Volumetric Capacity in MSCFH at Various Operating Pressures (psig) (Based on gas velocity in pipe = 100 ft/sec)											
Meter Size		**2"**	**3"**	**4"**	**6"**	**8"**	**10"**	**12"**	**16"**	**20"**	**24"**	**30"**
ACFH		8,389	18,482	31,826	72,226	125,068	197,136	279,829	441,786	694,864	1,005,006	1,566,992
Operating Pressure (psig)	**20**	19.5	42.9	73.8	168	290	457	649	1,025	1,612	2,331	3,636
	45	33.6	74.0	127	289	501	789	1,120	1,769	2,782	4,023	6,273
	60	42.1	92.8	160	363	628	990	1,405	2,218	3,488	5,045	7,865
	100	65.0	143	247	560	969	1,528	2,169	3,424	5,385	7,789	12,145
	150	94.0	207	357	810	1,402	2,210	3,136	4,952	7,788	11,264	17,563
	200	123	272	468	1,063	1,840	2,901	4,118	6,501	10,226	14,790	23,060
	300	184	404	696	1,581	2,737	4,314	6,124	9,668	15,206	21,993	34,292
	400	245	541	931	2,113	3,660	5,768	8,188	12,927	20,332	29,407	45,851
	500	309	681	1,173	2,661	4,609	7,264	10,312	16,280	25,605	37,034	57,743
	600	375	825	1,421	3,225	5,585	8,803	12,496	19,728	31,029	44,878	69,973
	700	442	974	1,676	3,805	6,588	10,384	14,740	23,272	26,603	52,940	82,543
	800	511	1,126	1,939	4,400	7,618	12,008	17,045	26,911	42,326	61,218	95,450
	900	582	1,282	2,207	5,010	8,675	13,674	19,409	30,643	48,197	69,708	108,688
	1000	654	1,442	2,483	5,634	9,757	15,379	21,830	34,464	54,207	78,401	122,243
	1100	729	1,605	2,764	6,273	10,862	17,121	24,303	38,370	60,350	87,286	136,095
	1200	804	1,772	3,051	6,924	11,990	18,898	26,826	42,351	66,612	96,344	150,218
	1300	881	1,941	3,343	7,586	13,136	20,705	29,390	46,400	72,981	105,555	164,580
	1400	959	2,113	3,638	8,257	14,297	22,536	31,989	50,503	79,434	114,889	179,133
	1500	1,038	2,286	3,937	8,934	15,471	24,385	34,614	54,648	85,953	124,317	193,834

Corrected Volumetric Capacity in MMSCFD at Various Operating Pressures (psig) (Based on gas velocity in pipe = 100 ft/sec)											
Meter Size		**2"**	**3"**	**4"**	**6"**	**8"**	**10"**	**12"**	**16"**	**20"**	**24"**	**30"**
ACFH		8,389	18,482	31,826	72,226	125,068	197,136	279,829	441,786	694,864	1,005,006	1,566,992
Operating Pressure (psig)	**20**	0.467	1.03	1.77	4.02	6.96	11.0	15.6	24.6	38.7	55.9	87.2
	45	0.806	1.78	3.06	6.94	12.0	18.9	26.9	42.4	66.8	96.6	150.6
	60	1.01	2.23	3.83	8.70	15.1	23.7	33.7	53.2	83.7	121.1	188.8
	100	1.56	3.44	5.92	13.4	23.3	36.7	52.1	82.2	129.3	186.9	291.5
	150	2.26	4.97	8.56	19.4	33.6	53.0	75.3	118.8	186.9	270.3	421.5
	200	2.96	6.53	11.2	25.5	44.2	69.6	98.8	156.0	245.4	355.0	553.4
	300	4.41	9.71	16.7	37.9	65.7	103.5	147.0	232.0	365.0	527.8	823.0
	400	5.89	13.0	22.4	50.7	87.8	138.4	196.5	310.2	488.0	705.8	1,100.4
	500	7.42	16.3	28.1	63.9	110.6	174.3	247.5	390.7	614.5	888.8	1,385.8
	600	8.99	19.8	34.1	77.4	134.0	211.3	299.9	473.5	744.7	1,077.1	1,679.4
	700	10.6	23.4	40.2	91.3	158.1	249.2	353.8	558.5	878.5	1,270.6	1,981.0
	800	12.3	27.0	46.5	105.6	182.8	288.2	409.1	645.9	1,015.8	1,469.2	2,290.8
	900	14.0	30.8	53.0	120.2	208.2	328.2	465.8	735.4	1,156.7	1,673.0	2,608.5
	1000	15.7	34.6	59.6	135.2	234.2	369.1	523.9	827.1	1,301.0	1,881.6	2,933.8
	1100	17.5	38.5	66.3	150.6	260.7	410.9	583.3	920.9	1,448.4	2,094.9	3,266.3
	1200	19.3	42.5	73.2	166.2	287.7	453.6	643.8	1,016.4	1,598.7	2,312.3	3,605.2
	1300	21.1	46.6	80.2	182.1	315.3	496.9	705.4	1,113.6	1,751.5	2,533.3	3,949.9
	1400	23.0	50.7	87.3	198.2	343.1	540.9	767.7	1,212.1	1,906.4	2,757.3	4,299.2
	1500	24.9	54.9	94.5	214.4	371.3	585.2	830.7	1,311.6	2,062.9	2,983.6	4,652.0

Notes: Volumetric calculations based on Amarillo gas compositions (see AGA Report No. 8) flowing at 70°F (Atm Press=14.73 psi)

The 100 ft/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

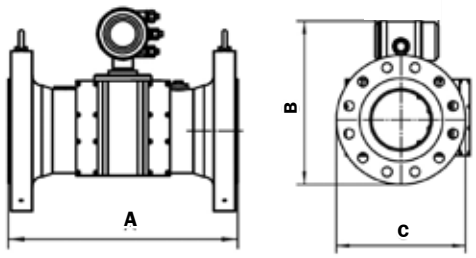
FLOWSIC600
Meter Capacity (Metric)

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	40.9	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

FLOWSIC600
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	6.00	155
	300	64	29			13.39	340	6.50	165
	600	66	30			13.39	340	6.50	165
	900	95	43	11.81	300	14.17	360	8.50	215
3"	150	82	37	9.45	240	13.54	344	7.50	190
	300	84	38			13.94	354	8.25	210
	600	93	42			13.94	354	8.25	210
	900	185	84	15.75	400	15.55	395	9.50	240
4"	150	97	44	11.81	300	14.76	375	9.00	230
	300	121	55			15.28	388	10.00	255
	600	146	66			15.67	398	10.75	275
	900	218	99	19.69	500	16.06	408	11.50	290
6"	150	220	100	17.72	450	17.52	445	11.00	280
	300	243	110			18.31	465	12.50	320
	600	309	140			19.02	483	14.00	355
	900	485	220	29.53	750	19.53	496	15.00	380
8"	150	331	150	23.62	600	19.61	498	13.50	345
	300	397	180			20.31	516	15.00	380
	600	463	210			21.10	536	16.50	420
	900	661	300			22.13	562	18.50	470
10"	150	529	240	29.53	750	21.57	548	16.00	405
	300	551	250			22.36	568	17.50	445
	600	758	330			23.62	600	20.00	510
	900	1036	470			24.61	625	21.50	545
12"	150	772	350	35.43	900	23.07	586	19.00	485
	300	882	400			23.82	605	20.50	520
	600	1080	490			24.61	625	22.00	560
	900	1587	720			26.97	685	24.00	610
16"	150	1378	625	47.24	1200	27.56	700	23.50	595
	300	1543	700			28.66	728	25.50	650
	600	1,742	790			29.33	745	27.00	685
	900	2590	1175			29.72	755	27.75	705
20"	150	2315	1050	59.06	1500	32.09	815	27.50	700
	300	2701	1225			33.58	853	30.50	775
	600	3031	1375			34.33	872	32.00	815
	900	4519	2050			35.12	892	33.75	855
24"	150	3472	1575	70.87	1800	36.50	927	32.00	815
	300	4134	1875			38.50	978	36.00	915
	600	4630	2100			38.98	990	37.00	940
	900	5622	2550			40.94	1040	41.00	1040
30"	150	5456	2475	59.06	1500	42.52	1080	38.75	985
	300	6228	2825			44.69	1135	43.00	1092
	600	6834	3100			45.43	1154	44.50	1130
	900	8047	3650			47.44	1205	48.50	1232

FLOWSIC600
Technical Data

Meter Size	Flow rate in ACFH		Q transition (Q_t)		Flow rate in ACMH		Max. Velocity	Max. Velocity
	@ 1 ft/s (Q_{min})	Maximum (Q_{max})	[ft/s]	[m/s]	@ 0.3 m/s (Q_{min})	Maximum (Q_{max})	[ft/s]	[m/s]
2“	70	15,600	8	2.4	2.0	440	213	65
3“	160	34,400	6	1.8	4.5	970	213	65
4“	270	54,100	5	1.5	7.6	1,530	197	60
6“	610	101,000	4	1.2	17.3	2,860	164	50
8“	1,100	163,000	4	1.2	31.1	4,620	148	45
10“	1,680	220,000	3	0.9	47.6	6,230	131	40
12“	2,220	240,000	3	0.9	62.9	6,800	108	33
16“	3,940	426,000	3	0.9	111.6	12,060	108	33
20“	6,170	666,000	3	0.9	174.7	18,860	108	33
24“	8,870	958,000	3	0.9	251.2	27,130	108	33
30“	13,860	1,358,000	3	0.9	392.5	38,450	98	30

Material	Meter size ≤24"	Meter body with flanges in steel 1.1120/ASME A216 WCC or Low temperature carbon steel 1.6220/ASME A352 LCC Meter body with flanges in stainless steel or 1.4408/ASME A351 Gr. CF 8M
	Meter size >24"	Meter body in stainless steel or 1.1120/ASME A216 WCC, flanges in ASTM A105 Meter body in stainless steel or 1.4408/ASME A351 Gr. CF 8M, flanges in 1.4404/A182 Gr. F316L
Measured Medium		
Gases		Natural gas, process gases, air, hydrogen, oxygen, ethylene, CO_2, etc.
Temperature range (transducer)		–22 °F...248 °F; (**-50 °F...248 °F for LCC**); -317 °F...536 °F on request –30 °C...120 °C; (**-45 °C...120 °C for LCC**); -194 °C...280 °C on request
Pressure range		0...6,000 psig (higher on request)
Measurement Uncertainty		
Repeatability		<0.1 % of reading from Q_t to Q_{max} (<0.4% from Q_{min} to Q_t)
Accuracy		± 0.1 from Q_t to Q_{max} after flow calibration (2-path and 4-path meters)
Ambient Conditions		
Degree of protection		IP 67
Temperature range (electronics)		–40 °F...140 °F (–40 °C...60 °C)
Humidity		<95% non condensing
Power Supply		
Operating voltage		12...28.8 VDC (minimum 15 V for active current output)
Typical power consumption		<1 W
Outputs		
Measuring variables		Flow rate (actual), volume (actual), gas velocity, speed of sound
Current output (optional)		4...20 mA; active/passive; electrically isolated; max. load = 250 Ω
Pulse and frequency outputs		Passive, electrically isolated, open collector or NAMUR, fmax = 6 kHz (scalable)
Flow rate updates		Default 1 second, 0.1 second for surge control
Interfaces		
Modbus ASCII and RTU		2 RS-485 serial communication (1,200...57,600 BAUD), RTU / ASCII
HART® (optional)		Parameterization, measured values and diagnosis
Conduit connections		Three 1/2” NPT connections for I/O and power cabling.
Type of Protection		
USA/Canada		Class I, Division 1, Groups B, C, D T4; Class I Division 2, Groups A, B, C, D T4
The FLOWSIC600 meets or exceeds the requirements of AGA 9, API 21.1 and Measurement Canada		

8017661_DS_FLOWSIC600_en_US /2010-04 - Printed in USA (2010-04) Subject to change without notice

SICK MAIHAK, Inc.
15415 International Plaza Drive
Suite 100
Houston, Texas 77032
Phone: 281-436-5100
Fax: 281-436-5200

SICK MAIHAK, Inc.
6900 West 110th Street
Minneapolis, Minnesota 55438
Phone: 952-941-6780
Fax: 952-941-9287

SICK Ltd.
250 West Beaver Creek Road, Unit 6
Richmond Hill, Ontario L4B 1C7
Phone: 905-771-1444
Fax: 905-771-1616

SICK Ltd.
105, 150 Crowfoot Cr. NW, Suite 732
Calgary, Alberta T3G 3T2
Phone: 403-874-0570
Fax: 403-547-4288

Our Competence in the Business Segments

Factory Automation

With its intelligent sensors, safety systems, and auto ident applications, SICK offers comprehensive solutions for factory automation.

- Non-contact detecting, counting, classifying, and positioning of any type of object
- Accident protection and personal safety using sensors, as well as safety software and services

Logistics Automation

Sensors made by SICK form the basis for automating material flows and the optimization of sorting and warehousing processes.

- Automated identification with bar code and RFID reading devices for the purpose of sorting and target control in industrial material flow
- Detecting volume, position, and contours of objects and surroundings with laser measurement systems

Process Automation

Optimized system solutions from SICK ensure efficient acquisition of process and environmental data in many industrial processes.

- Precise measurement of gases, liquids and dust concentrations for continuous emissions monitoring and the acquisition of process data in production processes
- Gas flow measurements with maximum accuracy thanks to compact gas meters

SICK Process Automation Division
United States - Minneapolis, Minnesota | Houston, Texas | 281-436-5100
Canada - Calgary, Alberta | Toronto, Ontario | 905-771-1444
e-mail: information@sick.com | www.flowsic600.com

Affirmative Action (AA)/Equal Opportunity Employer (EOE) M/F/D/V

SICK
Sensor Intelligence.