



Steam Flow Measurement

RELIABLE STEAM FLOW MEASUREMENT FOR THE MOST CHALLENGING APPLICATIONS

Flexible ultrasonic flow measurement solutions

SICK
Sensor Intelligence.



Steam flow measurement often requires compromise, but it doesn't have to...

With an ever increasing focus on steam producers and users to increase revenues, reduce costs and minimize waste, traditional flowmeter technologies sometimes struggle to meet the challenge.

Measurement point design, procurement, installation and commissioning costs are only the start of the story. Whilst vortex, differential pressure based flow measurement and turbine meters are adequate in many situations, more demanding applications often see rapid payback and ongoing savings using SICK Ultrasonic steam measurement technology.



High flow turn-down
>100:1

Virtually no
pressure drop

FLAWSIC

High accuracy &
repeatability

Resistant to
pulsations and
condensate slugs

Steam is generated and used in all industries for a wide variety of purposes, including heating, drying, optimizing combustion and motive power to pumps and compressors.

While DP flow and vortex meters are a good fit in many cases, there are applications where a more capable meter is needed; these are the applications where a FLOWVIC may be the optimum solution and can provide a fast payback:

- Where widely varying steam demand (flow rate) results in loss of measurement at low flowrates
- Where the lowest pressure loss is critical
- Where large steam lines limit the selection of suitable technologies
- Where poor accuracy results in lost revenue

FLAWSIC600 and FLOWVIC100 meters operate around the world on challenging, high-value steam flow installations. These include challenging applications and steam injection into flares, where the challenges of low uncertainty over a wide flow turndown cannot be met by traditional steam flow measurement technologies such as vortex and differential pressure (DP) based meters.

With a maximum process temperature of 280°C (536 °F) FLOWVIC solutions are suitable for a wide range of saturated and superheated steam applications.



VORTEX METER



ORIFICE PLATE



AVERAGING PITOT



TURBINE



ULTRASONIC

Steam flow applications requiring
great **performance** over a **wide
flow range** and the **lowest
pressure loss?**

FLAWSIC!

FLWSIC600 Steam Flow Measurement

The FLWSIC600 ultrasonic flow meter is ideal for high accuracy and greenfield installations where an in-line meter must meet the challenges of low uncertainty:

- Greater than 100:1 flow turndown
- Virtually no pressure loss
- In-situ validation
- No wear
- No routine maintenance

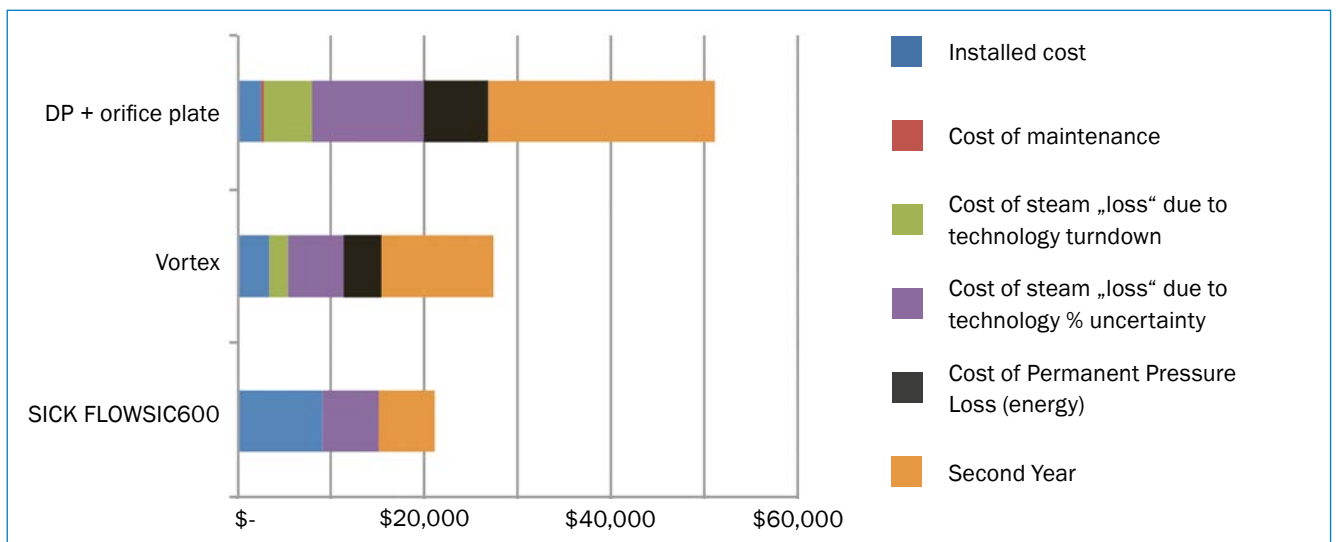


Maximum Reliability

The FLWSIC600 ultrasonic flow meter has no moving parts and does not rely on intrusions into the vapor stream, making it highly resistant to contamination and wear. Self-diagnostics combine to ensure years of reliable measurement.

High Measurement Accuracy

The FLWSIC600 measures saturated and superheated steam flow using ultrasonic technology. SICK ultrasonic sensors offer excellent measurement performance even at low flow rates and varying line pressures and provide outstanding long term performance.



Technical Data

Meter characteristics											
Nominal size	Flow rate				Max. Velocity		Length		Weight		Order code ¹⁾
	[m ³ /h]		[ft ³ /h]		[m ³ /h]	[ft/s]	[mm]	[in]	[kg]	[lbs]	
	Min.	Max.	Min.	Max.							
DN 50/2"	4	400	140	14,000	55	180	250	9.8	40	88	FL6ST-02CL600-*
DN80/3"	8	1,000	280	35,000	61	200	320	12.5	60	132	FL6ST-03CL600-*
DN100/4"	13	1,600	460	56,000	55	180	300	11.8	80	176	FL6ST-04CL600-*
DN150/6"	20	3,000	710	106,000	46	151	450	17.6	140	309	FL6ST-06CL600-*
DN200/8"	32	4,500	1,130	159,000	39	128	600	23.5	200	441	FL6ST-08CL600-*
DN250/10"	50	7,000	1,770	247,000	38	125	750	29.4	320	705	FL6ST-10CL600-*
DN300/12"	65	8,000	2,300	282,000	30	98	900	35.3	490	1,080	FL6ST-12CL600-*
DN350/14"	80	10,000	2,830	353,000	30	98	1,050	41.2	570	1,257	FL6ST-14CL600-*
DN400/16"	120	14,000	4,240	494,000	30	98	762	29.9	630	1,389	FL6ST-16CL600-*
Materials	Meter body: Low temperature carbon steel Transducers: Titanium Electronics: Aluminum										
Flange type	ASME B16.5, Raised face ²⁾										
Meter body finish	Meter body: nickel plated, covers: RAL7012										
Measuring parameters											
Fluid	Steam up to 280 °C (536 °F)										
Process value	Volumetric flow, volume totals at actual conditions velocity of gas, speed of sound										
Measurement principle	Ultrasonic transit time difference measurement										
Typical accuracy ^{3) 4)}							DN50 / 2"		DN80 / 3" or larger		
	10% Q _{max} ... Q _{max}						±1.5% of rate		±1% of rate ⁵⁾		
Repeatability	< 0.1 %										
Process temperature	- 15 °C ... + 280 °C (+5 °F ... +536 °F)										
Pressure rating	CL600 ²⁾										
Approvals											
Conformities	ISO 17089-2										
Ex approvals	CSA, ATEX, IECEx, zone 1 and zone 2 IIC T4 rating, transducers intrinsically safe										
Electrical Safety	CE										
IP classification	IP 67										
Ambient conditions											
Temperature	-40 °C ... + 60 °C (-40 °F ... +140 °F)										
Humidity	≤ 95%										
Power supply, Outputs and Interfaces											
Voltage	15 ... 28.8 V DC, ≤ 1 W										
Analog output	4 ... 20 mA (@ 200 Ω), Active/passive mode, isolated										
Digital outputs	1x pulse, 2x status, isolated, OC or NAMUR, frequency @ Q _{max} = 2 kHz										
Digital interfaces	RS485, Modbus ASCII/RTU, HART rev. 5										
Display	2-line LCD										

1) Order of ATEX version – replace * with A, Order of CSA version - replace * with C, IIECEX version on request
 2) Other pressure ratings or flange types available on request
 3) With good piping conditions (developed flow profile). Typical uncertainty below Qt is ±3.0% for DN50 (2") and ±2.0% for DN80 (3") or larger
 4) With a steam quality of ≥ 80%
 5) Accuracy ±0.5% available on request

FLWSIC100 Steam Flow Measurement

The FLWSIC100 ultrasonic gas and steam flow meter family delivers an optimum combination of performance and installation flexibility, especially in brown-field and large pipe installations.

- 400:1 flow turndown
- Virtually no pressure loss
- In-situ validation
- No wear
- No routine maintenance



Maximum Reliability

The FLWSIC100 ultrasonic flow meter has no moving parts and offers outstanding performance and durability.

Contaminated steam carrying corrosive components has no impact on the measurement. Highly corrosion resistant materials (such as titanium) are selected for critical transducer wetted parts. Material suitability is assessed for each application.

High Installation Flexibility

The FLWSIC100 offers high flexibility enabling optimized solutions for even the most challenging saturated and superheated applications.

- Cross-duct type for easy installation on an existing pipeline using welding nozzles.
- Single-probe type for simple and cost-saving installation on one side of the steam line.
- Retraction mechanism for quick and simple replacing of sensor during plant operation.

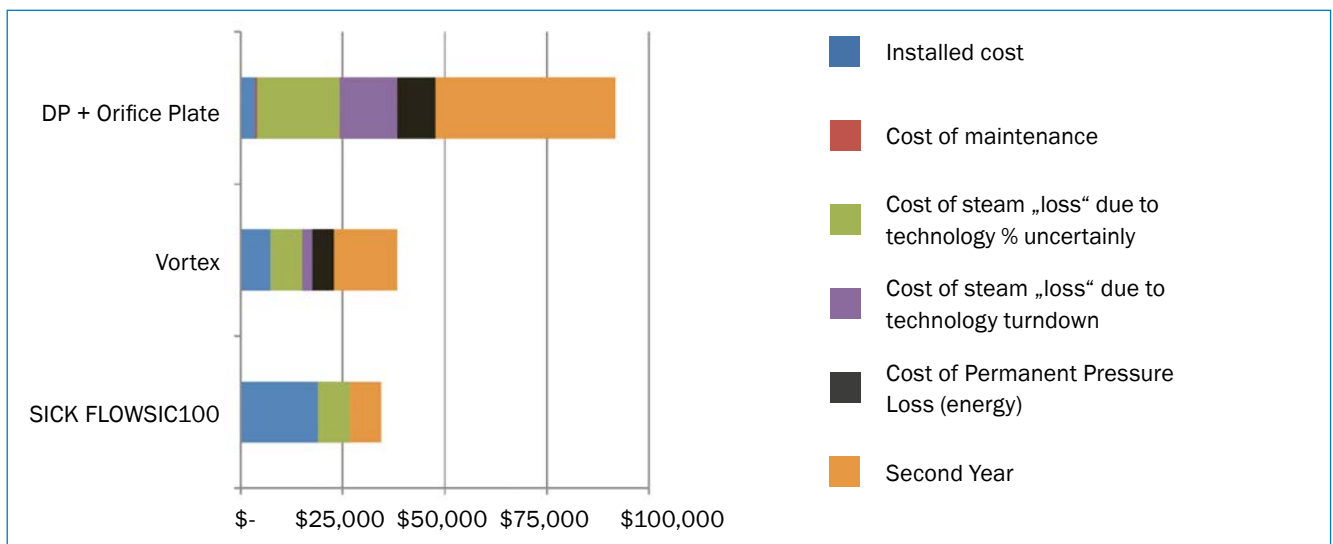


Illustration based on 6" line

Technical Data ¹⁾

Meter characteristics		
	FLWSIC100 EX-S	FLWSIC100 EX-PR
Measurement configuration	Cross-duct 1-path or 2-path	Probe version 1-path or 2-path
Measuring parameters		
Measured values	Flow velocity, volumetric flow	
Measuring range	0.03 ... 120 m/s (0.1 ... 393 ft/s)	0.03 ... 90 m/s (0.1 ... 295 ft/s)
Repeatability	0.2 % at ≥ 10 m/s (33 ft/s)	
Uncertainty of measurement ²⁾	in the range 0.3 m/s (1 ft/s) up to the upper range value	
Volumetric flow a. c. (1-path measurement):	± 5 %	
Volumetric flow a. c. (2-path measurement):	± 3 %	
Nominal pipe size		
1-path measurement	4" ... 24"	12" ... 72"
2-path measurement	12" ... 24"	18" ... 72"
Process temperature	Standard: -70 °C ... +180 °C (-94 °F ... +356 °F) High-temperature: Zone 1: -70 °C ... +280 °C (-94 °F ... +536 °F) Zone 2: -70 °C ... +260 °C (-94 °F ... +500 °F)	
Operating pressure	-0.5 bar (g) ... 16 bar (g), optional up to 20 bar (g)	
Approvals		
Ex approvals	S/R units Control unit	ATEX zone 1 and 2, IECEx, CSA CI I, Div 1 ATEX zone 1 and 2, IECEx, CSA CI I, Div 1; CI I Div 2
Outputs and interfaces		
Analog outputs ³⁾	1 active output: 0/2/4 ... 22 mA, max. load 500 W, according to NAMUR NE43	
Analog inputs ³⁾	2 inputs: 0 ... 5/10 V or 0 ... 20 mA	
Digital outputs ³⁾	Pulse/frequency output (opt. module); 5 outputs: 48 V d.c./1A, 30 V d.c./1A (MCUP zone 2); floating status signals: operation/malfunction, maintenance, check cycle, limit value, maint. request	
Digital inputs	2 inputs for connection of floating contacts	
Interfaces	USB 1.1 (virtual COM, service interface) RS-232 (service interface) RS-485 (only Ex-versions) Digital transmitter interface (via optional interface module) Interface module (option)	
Bus protocol (via optional interface module)	Pulse, Ethernet + pulse, Ethernet triplex + pulse, MODBUS TCP + pulse, MODBUS RS485 + pulse, HARTBUS AO + pulse, PROFIBUS RS485 + pulse, Foundation Fieldbus + pulse	

1) No standard solution, available separately only. For full specification see product data sheet.

2) For fully developed flow profiles.

3) Optional extendable by using I/O modules.

Challenging flow conditions result in loss of measurement and high maintenance costs

A major European steel mill needed reliable measurement of steam flow over a wide flow turndown for internal cost metering. A turbine meter was chosen as this promised acceptable flow turndown and accuracy and would therefore avoid measurement losses at lower flow rates. A vortex meter was also considered however its inability to provide a measurement at lower flowing velocities made this technology unsuitable.

The turbine meter was installed and provided measurement over the full steam flow range; however linearity at lower flows was poor.

In addition to the disappointing low flow performance, the turbine meter required costly, regular maintenance. Rapid ch-

anges in steam velocity resulted in bearing wear and damaged blades; causing inaccurate measurement and subsequent frequent failure of the meter. The meter was returned to the manufacturer two to three times each year as a result.

The combination of loss of measurement, de-commissioning, repair costs and re-commissioning was unacceptable and drove the plant to seek a better solution.

The solution?

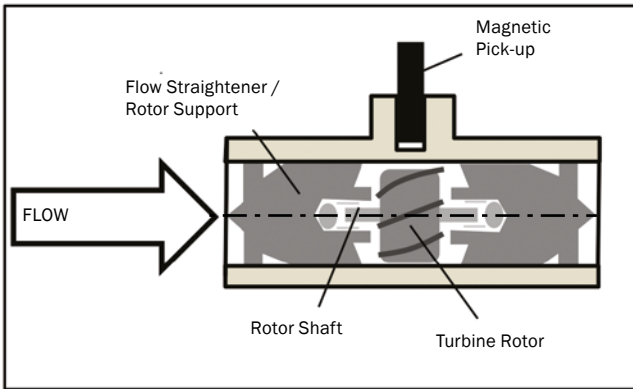
Following detailed consultation with SICK, a FLOWSIC100 was installed on the 8" (DN200) saturated steam flow line in 2010. The ultrasonic flow meter has provided a reliable and maintenance free measurement ever since.



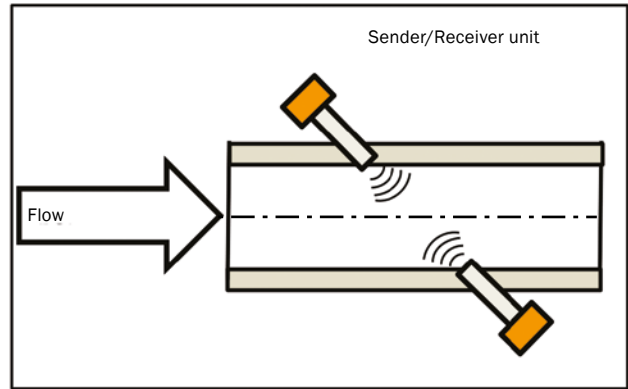
Steel maker replaces turbine meter with SICK Ultrasonic flow meter and sees rapid return on investment

Ultrasonic flow meter benefits

1. Full bore ultrasonic meter producing virtually no pressure drop and no corresponding energy loss.
2. Very high flow turndown enables reliable measurement over a wider flow range.
3. High accuracy, even at low flow rates, resulting in less “lost” steam.
4. No moving or damageable parts, enabling further maintenance savings.
5. No risk of damage to equipment downstream from failed turbine blades.



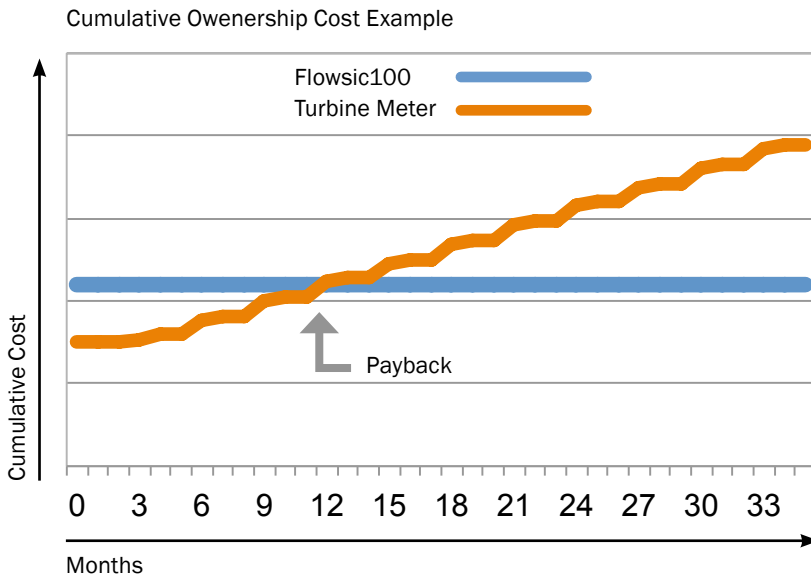
Gas flow in a typical turbine flow meter



Unhindered gas flow using an ultrasonic FLOWSIC100

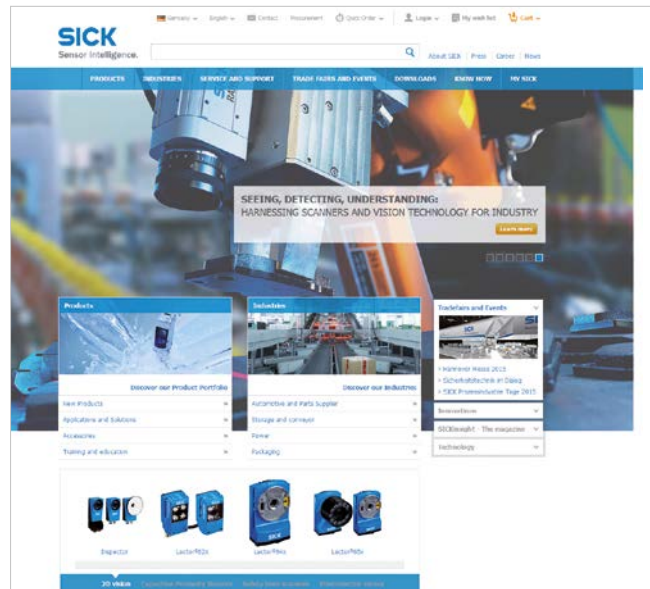
Rapid return on investment

In spite of an initially higher capex cost, the FLOWSIC100 Process flow meter delivered a return on investment of less than one year; considering maintenance savings alone.



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- 
Upgrade and retrofits
 Easy, safe and economical
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Training and education
 Practical, focused and professional

SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 9,700 employees and over 50 subsidiaries and equity investments as well as numerous agencies worldwide, SICK is always close to its customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents, and preventing damage to the environment.

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