



# 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

High accuracy &  
repeatability

Resistant to  
pulsations and  
condensate slugs

# FLAWSIC

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 FLAWSIC 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 FLAWSIC100 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) FLAWSIC solutions are suitable for a wide range of saturated and superheated steam applications.



VORTEX METER



ORIFICE PLATE



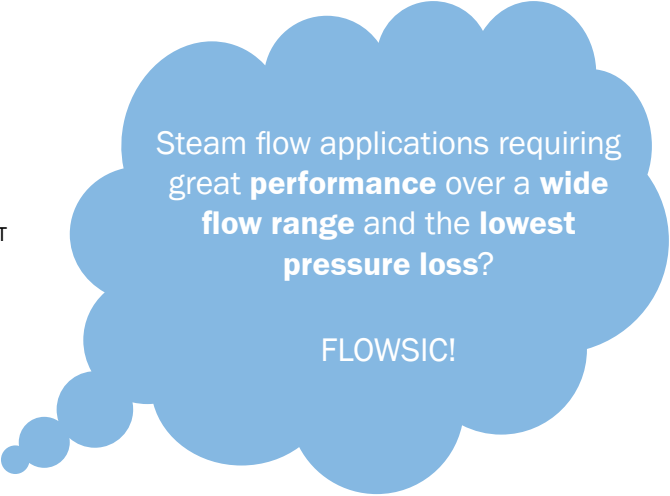
AVERAGING PITOT



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

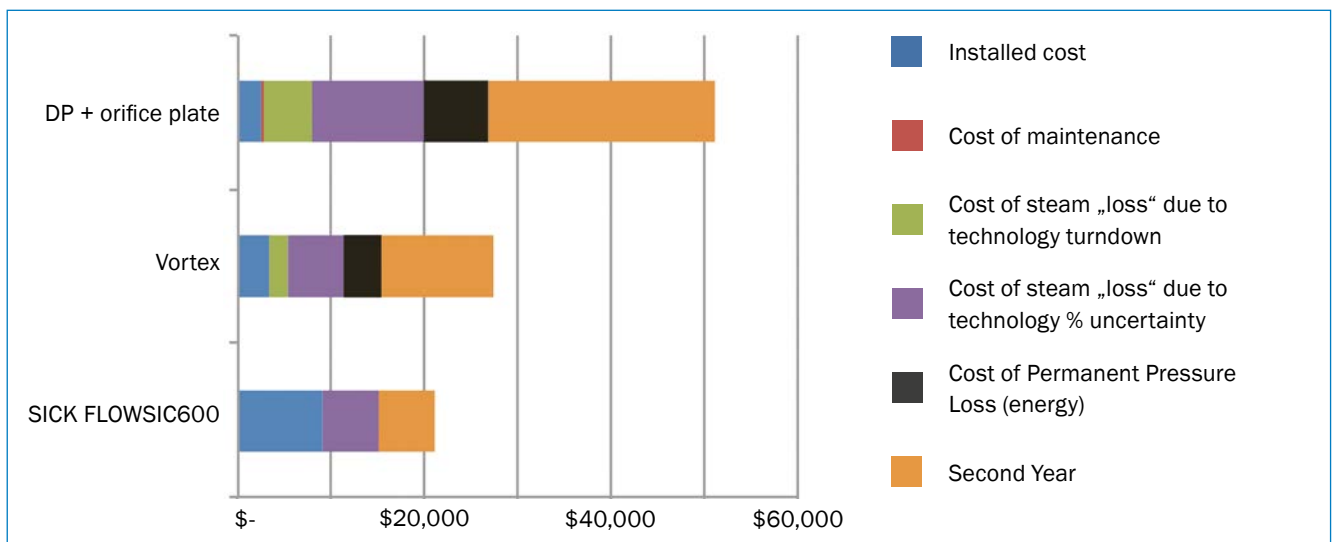


### Maximum Reliability

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

<b>Meter characteristics</b>												
Nominal size	Flow rate				Max. Velocity		Length		Weight		Order code <sup>4)</sup>	
	[m <sup>3</sup> /h]		[ft <sup>3</sup> /h]		[m <sup>3</sup> /h]	[ft/s]	[mm]	[in]	[kg]	[lbs]		
	Min.	Max.	Min.	Max.								
DN 50/2"	4	400	140	14,000	55	180	250	9.8	55	121	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	90	198	FL6ST-04CL600-*	
DN150/6"	20	3,000	710	106,000	46	151	450	17.6	150	330	FL6ST-06CL600-*	
DN200/8"	32	4,500	1,130	159,000	39	128	600	23.5	220	485	FL6ST-08CL600-*	
DN250/10"	50	7,000	1,770	247,000	38	125	750	29.4	330	727	FL6ST-10CL600-*	
DN300/12"	65	8,000	2,300	282,000	30	98	900	35.3	500	1,102	FL6ST-12CL600-*	
DN350/14"	80	10,000	2,830	353,000	30	98	1,050	41.2	580	1,278	FL6ST-14CL600-*	
DN400/16"	120	14,000	4,240	494,000	30	98	762	29.9	650	1,433	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											
<b>Measuring parameters</b>												
Fluid	Steam up to 120 °C (248 °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 <sup>1)</sup>							DN50 / 2"		DN80 / 3" or larger			
	10% Q <sub>max</sub> ... Q <sub>max</sub>						±1.5% of rate		±1% of rate <sup>3)</sup>			
Repeatability	< 0.1 %											
Process temperature	ATEX: -40 °C ... +105 °C (-40 °F ... +221 °F) CSA, IECEx: -40 °C ... +120 °C (-40 °F ... +248 °F)											
Pressure rating	PN100 / CL600 <sup>2)</sup>											
<b>Approvals</b>												
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											
<b>Ambient conditions</b>												
Temperature	-40 °C ... + 60 °C (-40 °F ... +140 °F)											
Humidity	≤ 95%											
<b>Power supply, Outputs and Interfaces</b>												
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 <sub>max</sub> = 2 kHz											
Digital interfaces	RS485, Modbus ASCII/RTU, HART rev. 5											
Display	2-line LCD											

1) 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

2) Other pressure ratings or flange types available on request

3) Accuracy ±0.5% available on request

4) Order of ATEX/IECex version - replace \* with A, Order of CSA version - replace \* with C

## 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.

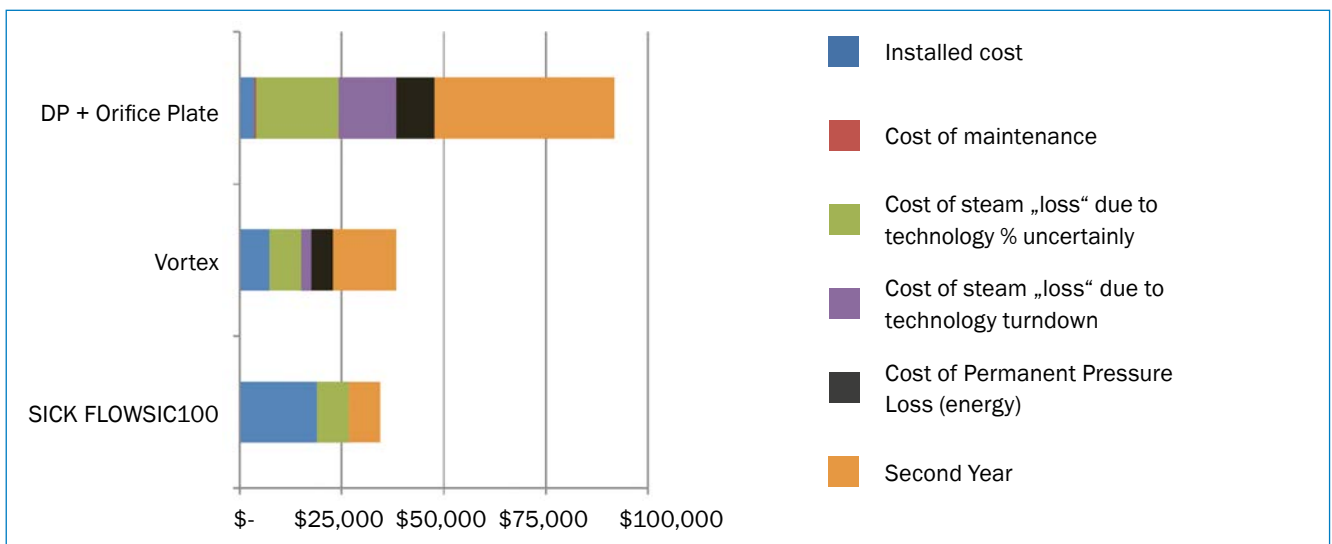


Illustration based on 6" line

Technical Data <sup>1)</sup>

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 $\geq 10$ m/s (33 ft/s)	
Uncertainty of measurement <sup>2)</sup>	Volumetric flow a. c. (1-path measurement): $\pm 5$ % Volumetric flow a. c. (2-path measurement): $\pm 3$ % in the range 0.3 m/s (1 ft/s) up to the upper range value	
Nominal pipe size	1-path measurement 4" ... 24" 2-path measurement 12" ... 24"	12" ... 72" 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 <sup>3)</sup>	1 active output: 0/2/4 ... 22 mA, max. load 500 W, according to NAMUR NE43	
Analog inputs <sup>3)</sup>	2 inputs: 0 ... 5/10 V or 0 ... 20 mA	
Digital outputs <sup>3)</sup>	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.

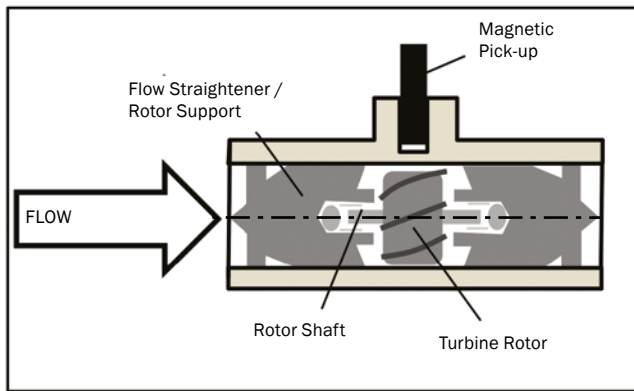


Steel maker replaces turbine meter with SICK Ultrasonic flow meter and sees rapid return on investment

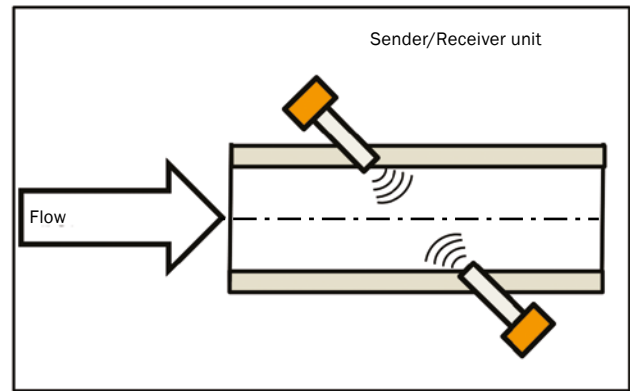


### Ultrasonic flow meter benefits

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.



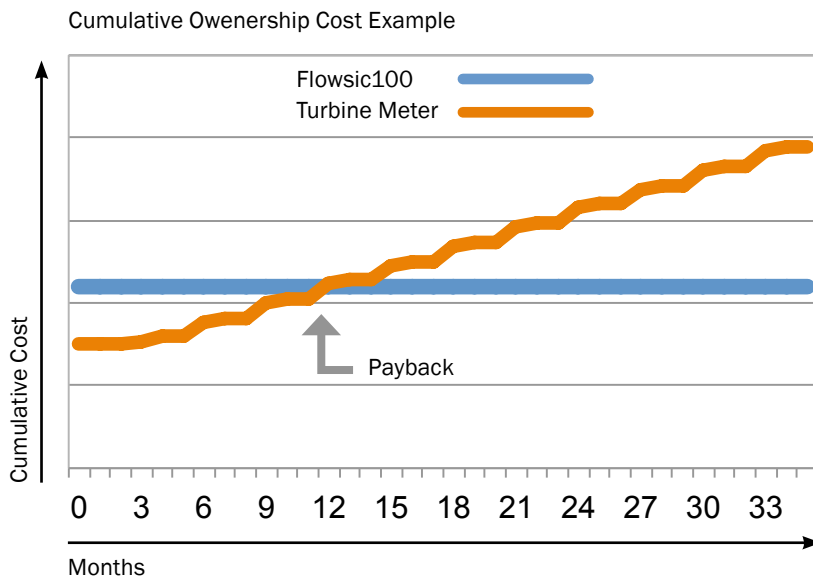
Gas flow in a typical turbine flow meter



Unhindered gas flow using an ultrasonic FLOWSIC100

### Rapid return on investment

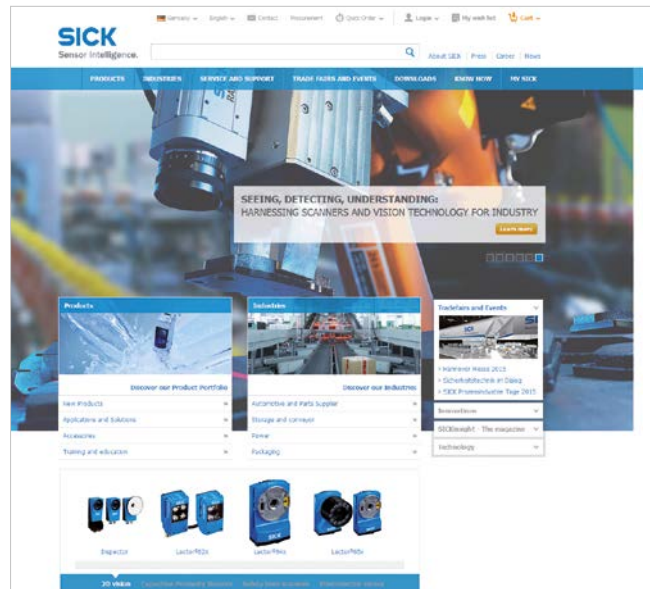
In spite of an initially higher capex cost, the FLOWSIC100 Process flow meter delivered a return on investment of less than one year; considering maintenance savings alone.





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- 
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- 
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- 
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- 
**Upgrade and retrofits**  
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- 
**Training and education**  
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## SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 8,800 employees and over 50 subsidiaries and equity investments as well as numerous agencies worldwide, we are always close to our 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.

We have extensive experience in various industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

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**For us, that is “Sensor Intelligence.”**

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