PRODUCT INFORMATION

FLOWSIC100 Flare

RELIABLE GAS FLOW MEASUREMENT IN FLARE GAS APPLICATIONS

Mass flow measuring devices

SICK
Sensor Intelligence.

MEASUREMENT CERTAINTY AND PRECISION EVEN UNDER EXTREME APPLICATION CONDITIONS – FLOWSIC100 FLARE.

The measurement of flare gas in the chemical and petrochemical industry is widely considered to be the leading discipline in gas flow measurement. In no other area do the application conditions and resulting requirements for measuring technology pose such a challenge.
The primary area of application involves calculating greenhouse gas emissions based on the amount of flare gas measured in accordance with regulatory requirements. FLOWSIC100 Flare has been developed for precisely this purpose. State-of-the-art sensor technology and high-quality components ensure highly accurate and reliable measurement with the utmost failure safety protection – even under extreme conditions on oil rigs and at remote oil fields. Even very low flow rates can be accurately detected, the measuring device is also suitable for continuous process monitoring and optimization as well as for detecting the smallest leaks in the flare gas network.

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Performance and durability

FLOWSIC100 Flare is based on more than 30 years of experience in ultrasonic sensor technology at SICK and offers outstanding performance and durability. Changing gas compositions and corrosive components have no impact on the measurements, as all parts that come into contact with the gas flow are made of resistant materials.

Reliable low flow measurements

A high signal time resolution combined with state-of-the-art signal processing mean that even very small amounts of gas can be detected accurately with flow velocities of close to zero. As a result, the measuring device offers excellent reliability when monitoring processes and detecting leakages in the flare gas system.

Works even under extreme conditions

The optimized sensor design even allows measurements to be taken during emergency system shutdowns and at extreme gas velocities of up to 120 m/s. In tandem with a high-speed measuring algorithm, the measuring process is also safeguarded in the event that conventional ultrasonic technology has failed due to extreme system noise and turbulence.

Excellent application reliability

The high power EX/EX-RE model is specially designed for use in pipes with large diameters of up to 72 inches and with extremely challenging gas compositions. Even flare gas with excessive contamination (e.g., associated gas) does not affect the measurement.
All device versions meet explosion protection requirements according to ATEX, CSA, and IECEx.

Comprehensive diagnostic functions

An automatic control cycle checks the device function periodically, while the integrated self-diagnosis continually monitors all important function parameters. In the event of impermissible deviations that could affect the measurement result, warning messages are generated so that maintenance can be planned in time. A special testing procedure allows the device functions to be verified according to factory standards with ease – even for quality assurance in the field.

Ideal configuration

FLOWSIC100 Flare is available as 1- or 2-path version. The 2-path version offers higher measurement accuracy also in the case of flow conditions that are less than ideal. The probe version FLOWSIC100 EX-PR is a special device version providing simple and cost-saving installation on one side of the flare gas line. Device retraction mechanism allows sensors to be replaced quickly and simply during plant operation.

Product overview

FLOWSIC100 Flare is available in three different versions, each capable of overcoming all of the difficulties that arise from the measuring task. These include extreme flow conditions, challenging gas compositions, and special installation and ambient conditions.

FLOWSIC100 EX-S

- "Cross-duct" high-speed version (patent pending)
- 90° nozzle installation
- Retractable under process conditions
- Hermetically sealed stainless steel and titanium probes
- ATEX, IECEx, and CSA approved for use in hazardous areas

FLOWSIC100 EX/EX-RE

- "Cross-duct" high-speed version for exceptionally large nominal pipe sizes and gaseous mixtures with a high CO2 content (patent pending)
- Retractable under process conditions
- Hermetically sealed stainless steel and titanium probes
- ATEX, IECEx, and CSA approved for use in hazardous areas

FLOWSIC100 EX-PR

- High-speed "probe version" (patent pending)
- Single nozzle installation only
- Retractable under process conditions
- Hermetically sealed titanium probe
- ATEX, IECEx, and CSA approved for use in hazardous areas

CUTTING-EDGE ULTRASONIC TECHNOLOGY FOR ONE OF THE MOST DEMANDING APPLICATIONS IN GAS FLOW MEASUREMENT.

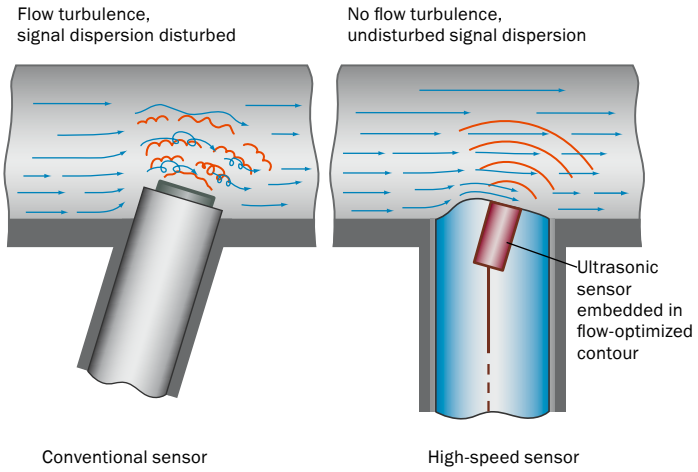
Ultrasonic technology by SICK

FLOWSIC100 Flare combines state-of-the-art ultrasonic sensor technology with proven, high-precision signal processing from the field of custody transfer measurement.
The ultrasonic sensors can operate even under atmospheric pressure conditions without any restrictions on performance. Under practical application conditions, the acoustic signal resolution reaches a value of up to +/–5 ns, which enables gas velocities of up to 0.001 m/s to be detected, and the tiniest quantities of flare gas to be reliably recorded.
To ensure this performance, every device in the FLOWSIC100 Flare series passes a specially developed testing procedure under zero point conditions, in which extremely demanding performance criteria must be met.

The upper measuring range presents yet a further challenge: In the case of emergency shutdowns in the flare gas system, the gas velocity can reach well over 100 m/s within just a few seconds, leading to heavy background noise, gas flow turbulence, and signal drift effects. This is where a good flow measuring device comes into its own. FLOWSIC100 Flare has already recorded low flow measurements in the flare gas system, now it is switching its attention to extreme measuring. Its unique, streamlined sensor design smoothens turbulence and minimizes background noise on the sensor surface. Even at 120 m/s.

High-speed sensor design

An innovative sensor design has been developed for the FLOWSIC100 Flare.
The ultrasonic sensors are embedded in a flow-optimized contour that has been specially designed for high gas flows. The unique sensor design reduces flow noise and signal drift to a minimum and provides stable and reliable readings. The optimized 2-stage signal algorithm offers optimum signal processing across the entire measuring range.



Outstanding reliability and durability

Significant fluctuations in gas compositions and/or corrosive process conditions are taken into account by selecting specially adapted ultrasonic sensors.
The broadband transmission behavior and large signal amplitudes ensure a reliable measuring operation in a variety of gas mixtures with a molecular weight of between 2 and 120 g/mol. The large signal range and good coverage of the SICK ultrasonic sensors are yet further factors of success for optimal functioning of the device.

Depending on the gas mixture, specially adapted sound frequencies with optimal transmission properties can be used. "High-power sensors" allow a cross-duct measurement in nominal pipe sizes of up to 72 inches and sound-absorbing gases with a high carbon dioxide content. The sensors are made exclusively in hermetically sealed, solid metal designs, preferably from titanium. For particularly aggressive gas compositions, highly-resistant alloys (e.g. Hastelloy) are used to ensure durability.

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Device testing to factory standards

To provide regular evidence of its functionality, FLOWSIC100 Flare can also be checked in the field according to SICK factory standards. Zero point deviation and time-of-flight measurements are checked in a specially designed testing box and adjusted if necessary.

By comparing the theoretical and measured sound velocity under defined test conditions (pressure, temperature, humidity), it is possible to assess the accuracy of the time-of-flight measurement and provide evidence of its zero point stability with ease.

Even if the measuring device cannot be removed from the measuring line, a periodic functional test is carried out via an integrated control cycle (zero point test, span test).

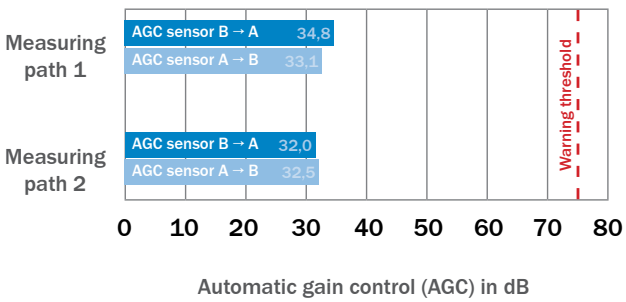
Continuous self-diagnosis

Using ultrasonic technology parameters such as automatic gain control, error rate, and signal-noise ratio, the device is automatically monitored for compliance with the permitted operating range using the integrated self-diagnosis. Impermissible deviations from the parameters can be signaled immediately by means of a continuous internal evaluation before the measuring function is even affected. This means that any signs of wear, sensor contamination, or background noise can be detected and eliminated as early as possible.

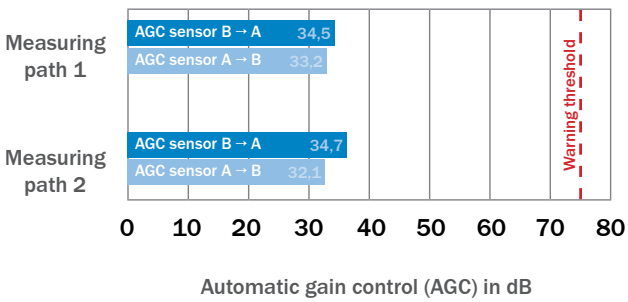
By comparing diagnostic values when commissioning the device ("fingerprint") and at any given point in the future, it is furthermore possible to identify changes in process conditions. In this case, device performance can be ensured even under special challenging conditions by parameter optimization. Thus application reliability can be increased. Under conditions where conventional ultrasonic technology has already failed.

Device diagnosis by evaluating gain control values using the example of a 2-path measuring system and a measuring operation of one year

Automatic gain control (AGC) during device commissioning



Automatic gain control (AGC) after one year of measuring operation



RELIABLE GAS FLOW MEASUREMENT FOR FLARE GAS APPLICATIONS

Additional information

Product description

The FLOWSIC100 Flare measures the flow rate of flare gas. The device operates according to the principle of ultrasonic transit time difference measurement and has been specially developed for the high requirements involved in measuring flare gas. With their flow-optimized design, the innovative sensors reduce flow-generated noise and signal drift when gas velocities are particularly high and even ensure measurement availability under extreme conditions. Even very low gas flows can be measured with precision.

The FLOWSIC100 EX-S and EX/EX-RE devices take integral measurements across the entire nominal pipe size up to 72 inches and ensure stable readings even when flow conditions are less than ideal. The FLOWSIC100 EX-PR probe version is installed on one side of the pipe, making it particularly cost-effective. The compulsory MCUP control unit is used for signal input and output, and for calculating process variables such as standard flow, molecular weight, and mass flow.

At a glance

- High-resolution measurement close to zero
- Innovative sensor design for very high gas velocities
- Reliable and accurate measurement even under atmospheric pressure
- Function testing at the installation site according to factory standards
- Integral measurement for nominal pipe sizes of up to 72"
- Probe version for single-sided installation
- Hermetically sealed sensors made of titanium or stainless steel

Your benefits

- Continuous process monitoring through precise measurement of very small gas volumes
- High measurement availability even in the case of emergency shutdowns with gas velocities of up to 120 m/s
- High measurement reliability thanks to continuous function monitoring and extended diagnosis
- Precise measurement results even in the case of non-ideal flow conditions and large nominal pipe sizes
- Excellent application reliability even with significant fluctuations in gas compositions and contaminated gases
- Minimal installation effort due to single-sided installation of the EX-PR probe version
- Cost-effective installation of the control unit possible in the safe area
- Complete solution with a spool piece and factory-set device parameters for Plug&Play installation

→ www.mysick.com/en/FLOWSIC100_Flare
For more information, just enter the link and get direct access to technical data, CAD design models, operating instructions, software, application examples and much more.

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Subject to change without notice

Fields of application

- Calculation of carbon dioxide emissions in petrochemical plants and during oil production to comply with legal regulations and guidelines.
- Reduction of carbon dioxide emissions to a minimum by measuring flare gas quantities continuously and precisely (basis for calculating carbon dioxide emissions).
- Monitoring and optimization of petrochemical processes, accurate mass balancing.
- Leakage detection in the flare gas system and reduction of gas wastage to a minimum.
- Control of steam injection in flare gas combustion and reduction of pollutant emissions.

Detailed technical data

The exact device specifications and performance data of the product may deviate from the information provided here, and depend on the application in which the product is being used and the relevant customer specifications.

FLOWSIC100 Flare system

Measured values	Mass flow, volumetric flow s. c., volumetric flow, a. c., molecular weight, gas volume and mass, gas velocity, gas temperature, sound velocity
Measurement principle	Ultrasonic transit time difference measurement
Number of measuring paths	1, 2
Measuring medium	Mixtures of hydrocarbons with or without H_2 content
Repeatability	0.2 % at ≥ 10 m/s
Resolution	0.001 m/s
Uncertainty of measurement	
Volumetric flow a. c. (1-path measurement):	± 1.5 % ... 5 % Of the measured value (in the range 0.3 m/s up to the upper range value) [1]
Volumetric flow a. c. (1-path measurement):	± 0.5 % Of the measured value (in the range 1 m/s up to the upper range value) [1,2]
Volumetric flow a. c. (2-path measurement):	± 1 % ... 3 % Of the measured value (in the range 0.3 m/s up to the upper range value) [1]
Volumetric flow a. c. (2-path measurement):	± 0.5 % Of the measured value (in the range 1 m/s up to the upper range value) [1,2]
Mass flow (1-path measurement):	± 2.5 % ... 5 % Of the measured value (in the range 0.3 m/s up to the upper range value) [1,3]
Mass flow (2-path measurement):	± 2 % ... 4 % Of the measured value (in the range 0.3 m/s up to the upper range value) [1,3]
Molecular weight:	≤ 2 % Of the measured value (in the range 2 ... 120 kg/kmol) [3]
	[1] For fully developed flow profiles, [2] After flow calibration, [3] Hydrocarbon mixtures with < 10% of non-hydrocarbonic content
Gas temperature	
Standard:	–70 °C ... +180 °C
High-temperature Zone 1:	–70 °C ... +280 °C
High-temperature Zone 2:	–70 °C ... +260 °C
Low-temperature:	–196 °C ... +100 °C Not for FLOWSIC100 EX/EX-RE Zone 1 and Class I, Division 1
Operating pressure	–0.5 bar (g) ... 16 bar (g)
Ambient temperature	
Sensors, ignition group IIC T4:	–40 °C ... +70 °C
Sensors, ignition group IIC T4:	–50 °C ... +70 °C Optional
Sensors, ignition group IIC T6:	–40 °C ... +55 °C
Sensors, ignition group IIC T6:	–50 °C ... +55 °C Optional
Storage temperature	–40 °C ... +70 °C –50 °C ... +70 °C Optional

Ambient humidity	≤ 95 % Relative humidity
Electrical safety	CE

FLOWSIC100 EX-S

Measuring ranges	
Gas velocity	0.03 ... 120 m/s
Rangeability	4000 : 1
Nominal pipe size	
1-path measurement:	4" ... 24" Depending on gas composition
2-path measurement:	12" ... 24" Depending on gas composition
Ex-approvals	
IECEx	Ex d [ia] IIC T4 Optional: temperature class T6; ex zone 0 for ultrasonic transducers
ATEX	II 1/2 G Ex d [ia] IIC T4 II 1/2 G Ex de [ia] IIC T4 Optional: temperature class T6; ex zone 0 for ultrasonic transducers II 3 G Ex nA II T4 Gc
NEC/CEC (US/CA)	Cl I, Div1 Group B, C, D T4 Ex/AEx d [ia] IIB + H2 T4 Optional: temperature class T6 Cl I, Div2 Group A, B, C, D T4 Ex/AEx nA [ia] IIC T4
Enclosure rating	
ATEX zone 1 with terminal box	IP 65
ATEX zone 1 without terminal box	IP 65 / IP 67
ATEX zone 2 with terminal box	IP 65
NEC/CEC (US/CA)	Enclosure type 4, IP 65
Dimensions (W x H x D)	For details see dimensional drawings
Weight	≤ 11 kg

FLOWSIC100 EX/EX-RE

Measuring ranges	
Gas velocity	0.03 ... 120 m/s
Rangeability	4000 : 1
Nominal pipe size	
1-path measurement:	8" ... 72" Depending on gas composition
2-path measurement:	12" ... 72" Depending on gas composition
Ex-approvals	
IECEx	Ex d IIC T4 Optional: temperature class T6
ATEX	II 2 G Ex d IIC T4 II 2 G Ex de IIC T4 Optional: temperature class T6 II 3 G Ex nA IIC T4 Gc
NEC/CEC (US/CA)	Cl I, Div1 Group B, C, D T4 Ex/AEx d IIB + H2 T4 Optional: temperature class T6 Cl I, Div2 Group A, B, C, D T4 Ex/AEx nA IIC T4

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Enclosure rating	
ATEX zone 1 with terminal box	IP 65
ATEX zone 1 without terminal box	IP 65 / IP 67
Version for Ex-zone 2	IP 65
NEC/CEC (US/CA)	Enclosure type 6, IP 65/67, single seal
Dimensions (W x H x D)	For details see dimensional drawings
Weight	≤ 14 kg

FLOWSIC100 EX-PR

Measuring ranges	
Gas velocity	0.03 ... 90 m/s
Rangeability	3000 : 1
Nominal pipe size	
1-path measurement:	12" ... 72" Depending on gas composition
2-path measurement:	18" ... 72" Depending on gas composition
Ex-approvals	
IECEx	Ex d [ia] IIC T4 Optional: temperature class T6; ex zone 0 for ultrasonic transducers
ATEX	II 1/2 G Ex d [ia] IIC T4 II 1/2 G Ex de [ia] IIC T4 Optional: temperature class T6; ex zone 0 for ultrasonic transducers II 3 G Ex nA IIC T4 Gc
NEC/CEC (US/CA)	Cl I, Div1 Group B, C, D T4 Ex/AEx d [ia] IIB + H2 T4 Optional: temperature class T6 Cl I, Div2 Group A, B, C, D T4 Ex/AEx nA [ia] IIC T4
Enclosure rating	
ATEX zone 1 with terminal box	IP 65
ATEX zone 1 without terminal box	IP 65 / IP 67
Version for Ex-zone 2	IP 65
NEC/CEC (US/CA)	Enclosure type 4, IP 65
Dimensions (W x H x D)	For details see dimensional drawings
Weight	≤ 32 kg

MCUP control unit

Description	Compulsory unit for controlling the sender/receiver units, calculation, evaluation and output of measured values
Ambient temperature	
MCUP control unit (non-Ex):	–40 °C ... +60 °C
MCUP control unit (Cl I, Div2, Zone 2, 115/230 V AC):	–25 °C ... +60 °C
MCUP control unit (Cl I, Div1, temp. group A, B, C, D):	-25 °C ... +50 °C
MCUP control unit (Cl I, Div2, Zone 2, 24 V DC):	–40 °C ... +60 °C
MCUP control unit (Zone 1):	–40 °C ... +55 °C
Ex-approvals	
IECEx	Ex de IIC T6
ATEX	II 2 G Ex de IIC T6 II 3 G Ex nA II T4

NEC/CEC (US/CA)	CSA Cl 1, Div2; groups A, B, C, D; T4 Ex/AEx nA IIC T4 CSA Cl I Div1, groups A, B, C, D; T6
Enclosure rating	
Version for Ex-zone 1	IP 66
Versions for Ex-zone 2, Div2, Div1	Enclosure type 4 or 4X/IP 66
Version for non-Ex areas	IP 66
19"-type	IP 20
Analog outputs	1 output: 0/2/4 ... 22 mA, 500 Ω According to NAMUR NE43; up to 7 outputs if using I/O modules (option)
Analog inputs	2 inputs: 0 ... 5 V 0 ... 10 V Or 2 inputs: 0 ... 20 mA Without galvanic isolation; up to 6 outputs if using I/O modules (option)
Digital outputs	5 relay contacts: 48 V DC, 1 A Floating; for status signals; up to 7 outputs if using I/O modules (option); Pulse/frequency output (option) 5 relay contacts: / 30 V DC, 1 A MCUP for Zone 2/Div2; floating; for status signals; up to 7 outputs if using I/O modules (option); Pulse/frequency output (option)
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	Ethernet TCP/IP (via optional interface module) Modbus (via optional interface module) HART (via optional interface module) PROFIBUS DP (via optional interface module) Foundation Fieldbus (via optional interface module) Modbus TCP (via optional interface module)
Indication	LC display Status LEDs: “Power”, “Maintenance request” and “Failure”
Operation	Via LC-display or software SOPAS ET
Dimensions (W x H x D)	For details see dimensional drawings
Weight	≤ 22 g Depending on version
Electrical connection	
Voltage	Version for non-Ex areas: 90 ... 250 V AC Version for Ex-zone 1: 100 ... 240 V AC Version for Ex-zone 2/Div2: 115 V AC / 230 V AC (automatically controlled) Version for Cl I, Div1: 100 ... 240 VAC Versions with 24 V DC available as an option
Frequency	50 Hz / 60 Hz
Power consumption	≤ 20 W
Options	Interface module(s) I/O module(s)

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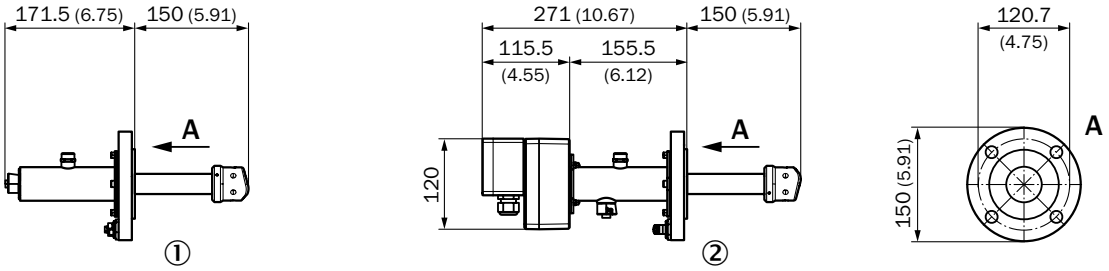
Ordering information

Our regional sales organization will help you to select the optimum device configuration.

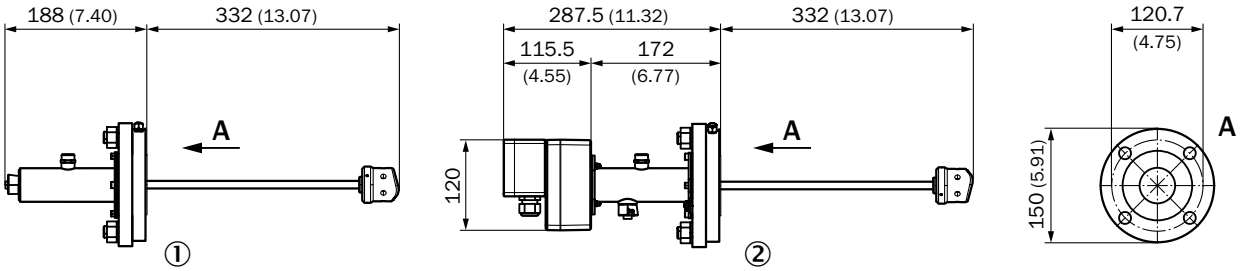
Dimensional drawings (Dimensions in mm (inch))

FLOWSIC100 EX-S, sender/receiver unit, non-retractable



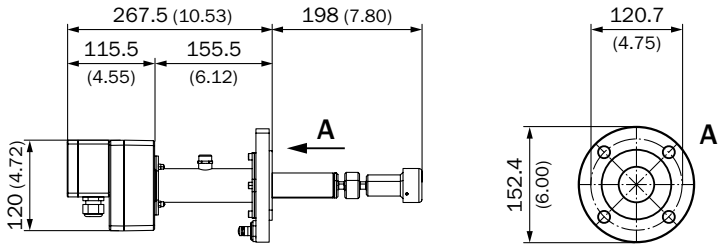
① Sender/receiver unit (analog) for ATEX Ex-zone 1 and Ex-zone 2 and CSA Cl I, Div 1/Div 2
② Sender/receiver unit (digital) for ATEX Ex-zone 2

FLOWSIC100 EX-S, sender/receiver unit, retractable



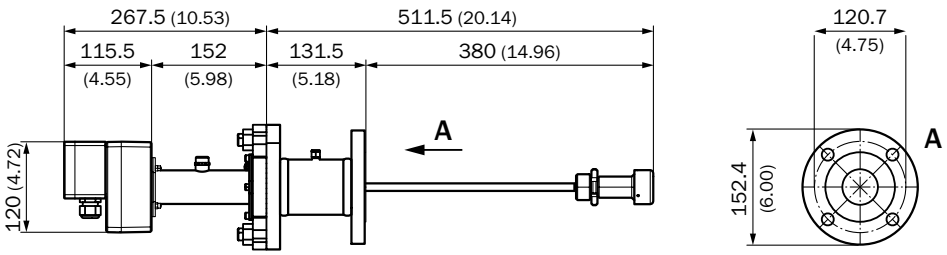
① Sender/receiver unit (analog) for ATEX Ex-zone 1 and Ex-zone 2 and CSA Cl I, Div 1/Div 2
② Sender/receiver unit (digital) for ATEX Ex-zone 2

FLOWSIC100 EX, sender/receiver unit, non-retractable



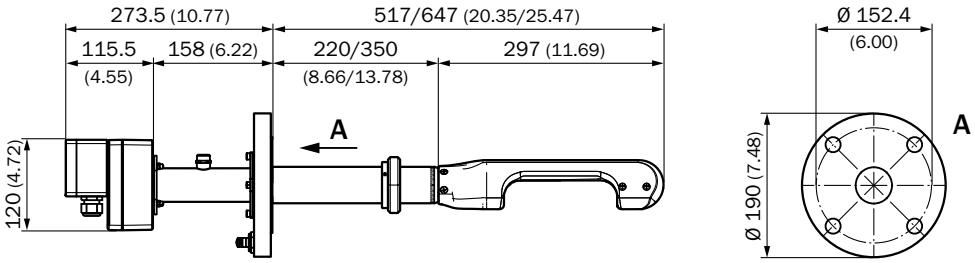
Sender/receiver unit (digital) with electronics unit for ATEX Zone 2

FLOWSIC100 EX-RE, sender/receiver unit, retractable



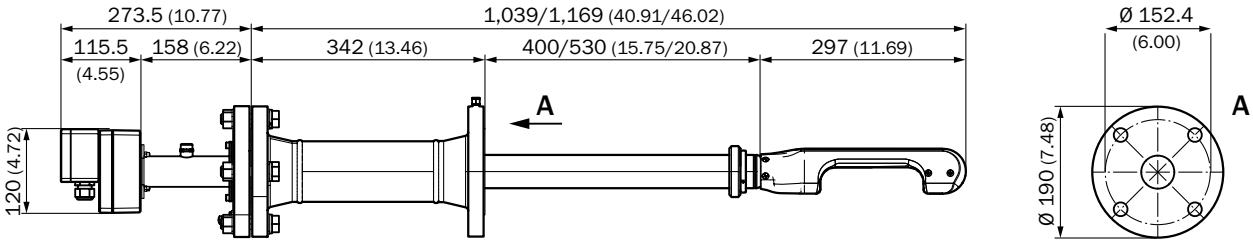
Sender/receiver unit (digital) with electronics unit for ATEX Zone 2

FLOWSIC100 EX-PR, sender/receiver unit, non-retractable



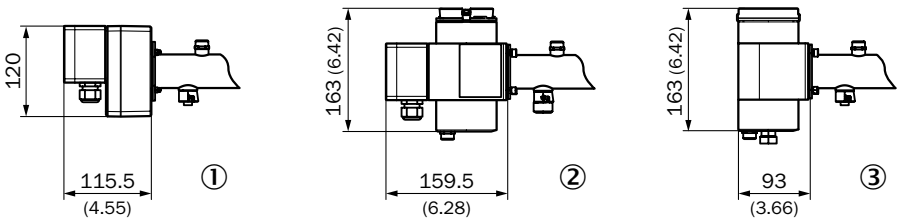
Sender/receiver unit (digital) with electronics unit for ATEX Zone 2: Nominal length 220 mm for pipe diameter up to 48″; nominal length 350 mm for pipe diameter > 48" up to 72"

FLOWSIC100 EX-PR, sender/receiver unit, retractable



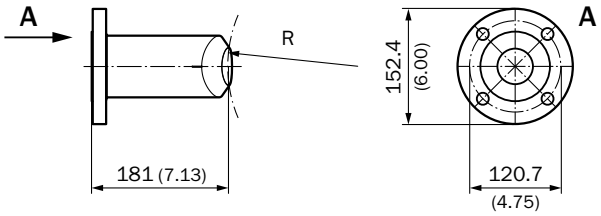
Sender/receiver unit (digital) with electronics unit for ATEX Zone 2: Nominal length 400 mm for pipe diameter up to 48″; nominal length 530 mm for pipe diameter > 48" up to 72"

Electronics units of sender/receiver units (digital)

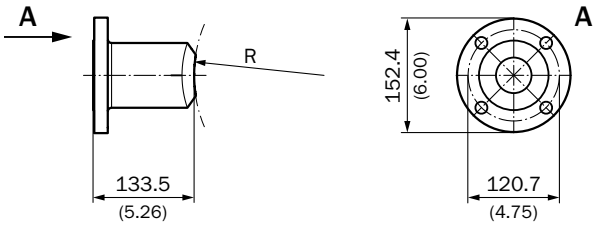


① Electronics unit of sender/receiver unit (digital) for ATEX Zone 2
② Electronics unit of sender/receiver unit (digital) for ATEX Zone 1
③ Electronics unit of sender/receiver unit (digital) for ATEX/IECEx Zone 1 and CSA Cl I, Div 1/Div 2

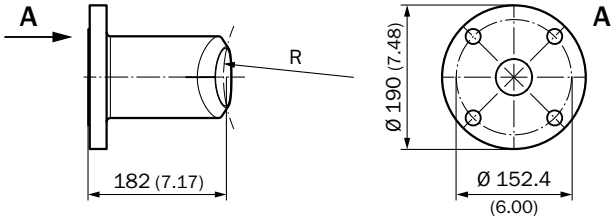
Mounting nozzle for FLOWSIC100 EX



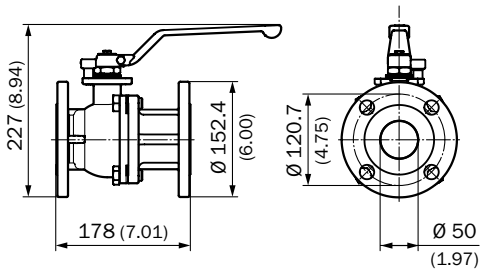
Mounting nozzle for FLOWSIC100 EX-S



Mounting nozzle for FLOWSIC100 EX-PR

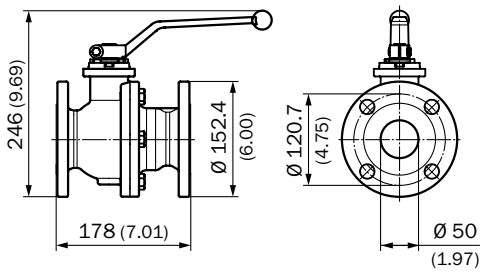


Ball valve, 2" version, for standard temperatures



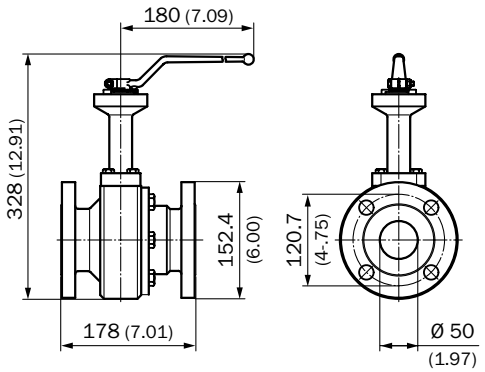
For FLOWSIC100 EX-S and EX-RE

Ball valve, 2" version, for high temperatures



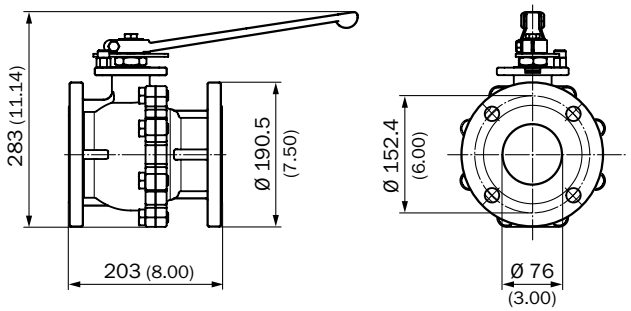
For FLOWSIC100 EX-S and EX-RE

Ball valve, 2" version, for low temperatures



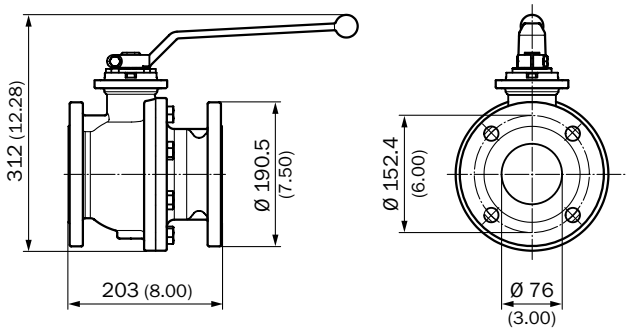
For FLOWSIC100 EX-S and EX-RE

Ball valve, 3" version, for standard temperatures



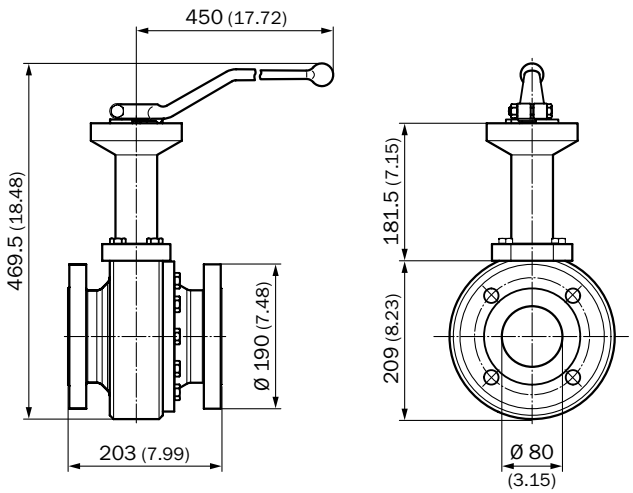
For FLOWSIC100 EX-PR

Ball valve, 3" version, for high temperatures



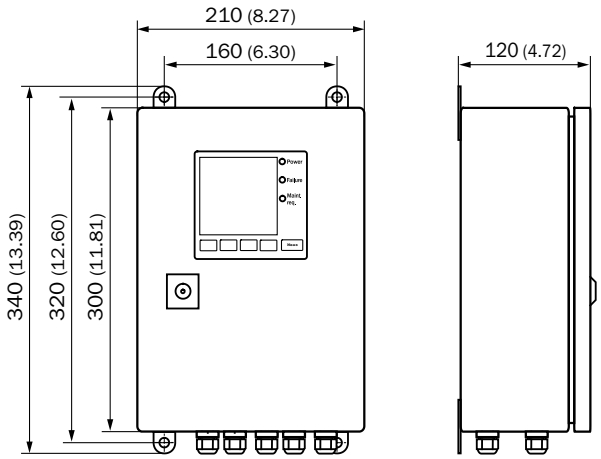
For FLOWSIC100 EX-PR

Ball valve, 3" version, for low temperatures

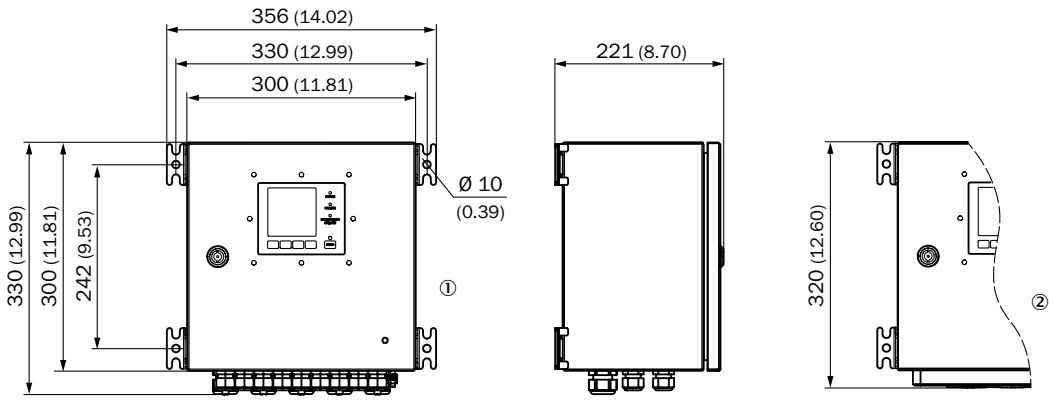


For FLOWSIC100 EX-PR

MCUP control unit: wall-mounting enclosure, compact version (non-hazardous area only)

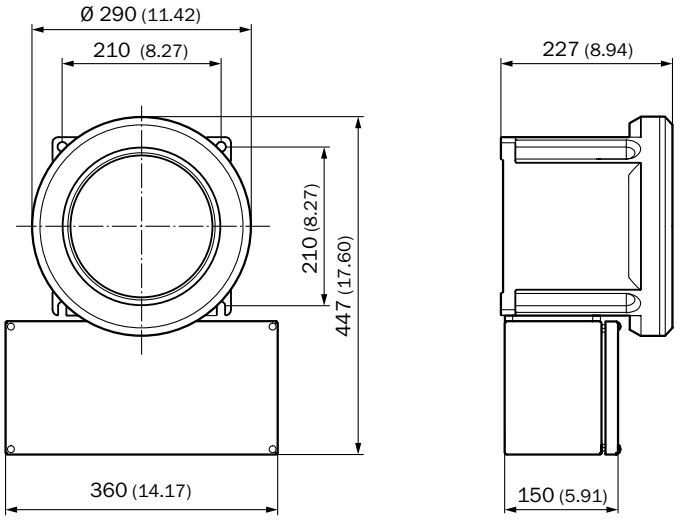


MCUP control unit: wall-mounting enclosure, medium version

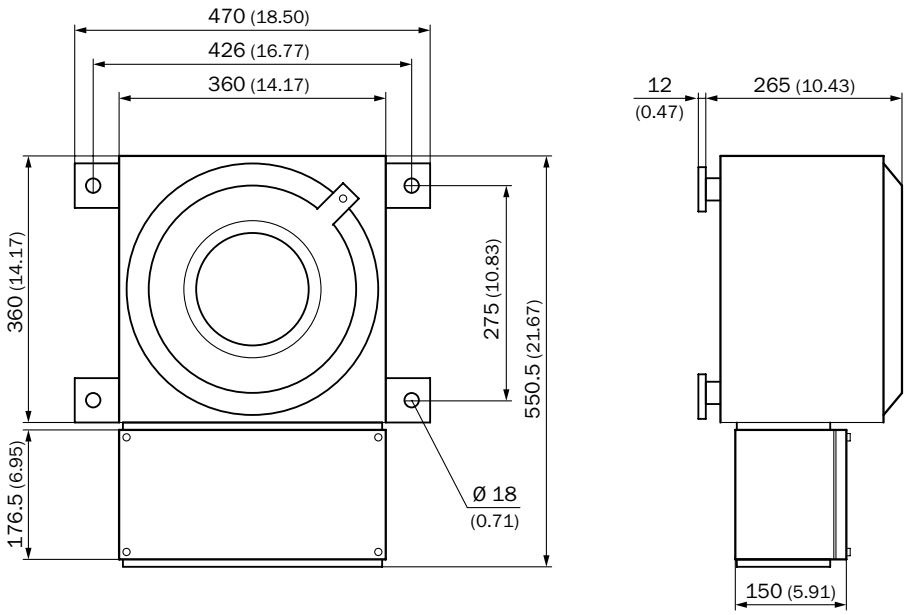


① Wall-mounting enclosure for ATEX Ex-zone 2 and non-hazardous areas
② Wall-mounting enclosure for CSA Cl I, Div2

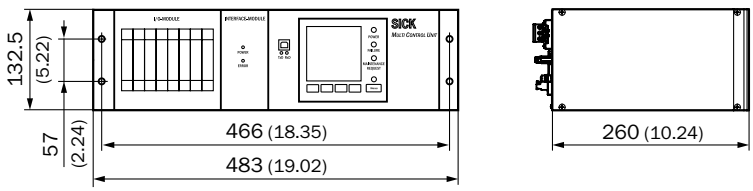
MCUP control unit: wall-mounting enclosure Exd/Exe, size 4, aluminum, ATEX Zone 1



MCUP control unit: wall-mounting enclosure Exd/Exe, stainless steel, ATEX Zone 1



MCUP control unit: 19"-rack enclosure (non-hazardous area only)



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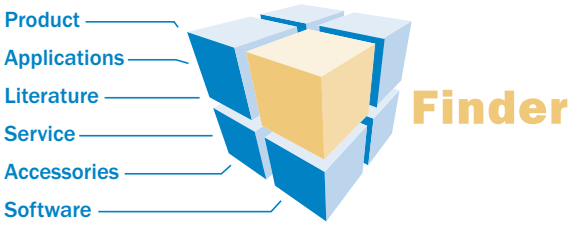

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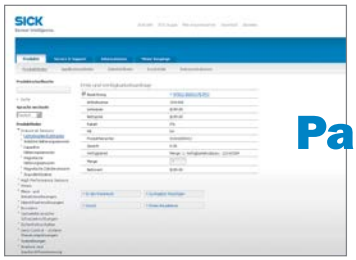

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