FLOWSIC200

Ultrasonic flow measurement of air flow in tunnel systems

For long-term operation

- Representative measurement across the entire width of the tunnel
- Very reliable measuring, compared to spot-measuring process
- Exact measurement of even very low flow velocities
- Long maintenance interval of up to five years
- Low operating costs thanks to reliable operation and low maintenance
- High device availability and therefore also the measurement data

Endress+Hauser

People for Process Automation

Safe driving in tunnels – from start to finish

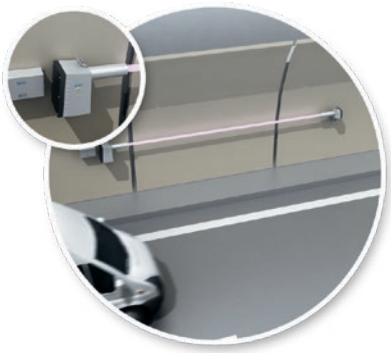
Measurement of the air flow is subject to strict requirements. The measurement technology used must reliably and accurately measure the flow in the tunnel cross section, even when there is varying traffic volume. In order to avoid traffic interruptions, maintenance work on the measuring device must be kept to a minimum.

The FLOWSIC200 gas flow measuring instruments offer not only the modern and powerful ultrasound technology but also exceptional durability. Using the FLOWSIC200, ventilation systems in tunnels are controlled and sufficient aeration and ventilation of the tunnel is ensured over the long term. The maintenance interval for this application is typically up to five years.

Measurements inside the tunnel

Our portfolio of tunnel monitors is designed for urban tunnels, overland tunnels, and tunnels in rail and subway systems. Whether it be for routine operation or emergency situations, we are your one-stop-shop for virtually all tunnel monitoring applications.

The Monitoring Box provides an effective solution for monitoring and maintaining devices and sensors in tunnels. If required, every significant change to the device states is visualized concisely and clearly in a browser-based dashboard



Air quality

NO_2 measurement in ppb

Continuous and precise measurement of minimal NO_2 concentrations provides the basis for ventilation control inside the tunnel.

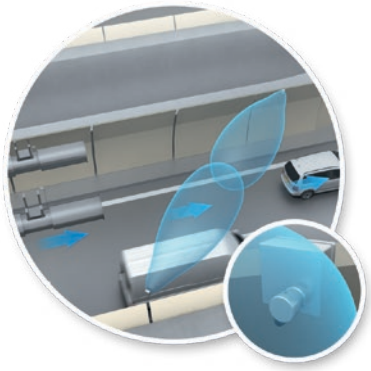
- VICOTEC320

Air quality

Measurement of CO, NO, NO_2, and visibility for ventilation control

By capturing exact measured values, monitoring the atmosphere inside the tunnel provides the basis for effective ventilation control.

- VISIC100SF
- VICOTEC410



Air flow

Monitoring of the air speed and direction for ventilation

The speed and direction of the air flow inside the tunnel have to be measured to control ventilation. In the event of an emergency, this is the most important measurement to enable the fans to be controlled.

- FLOWSIC200

Monitoring Box

Continuous condition monitoring for measuring devices and sensors

The Monitoring Box is a browser application and enables visualization of sensor and machine data as well as diagnosis and monitoring of error states.

- Monitoring Box

Reliable measurement of flow velocity for tunnel ventilation

Air flow velocity monitoring in road and rail tunnels is a key component of ventilation technology in tunnel systems. Measurement of the air flow is subject to strict requirements. The measurement technology used must reliably and accurately measure the flow in the tunnel cross section, even when there is varying traffic volume. In order to avoid traffic interruptions, maintenance work on the measuring device must be kept to a minimum.

Representative measurement

The FLOWSIC200 measures the air flow over the entire width of the tunnel and therefore gives representative results of the air flow in the tunnel. Tunnel fittings such as fans or lighting and varying traffic can change the flow profile of the air in the tunnel. The FLOWSIC200 has a decisive advantage over single point measuring methods here: The influence of tunnel fittings and traffic on the measured result is significantly lower. Thanks to the FLOWSIC200's rugged technology, differences in density and temperature fluctuations in the tunnel air do not influence the measurement result.

Powerful sensors

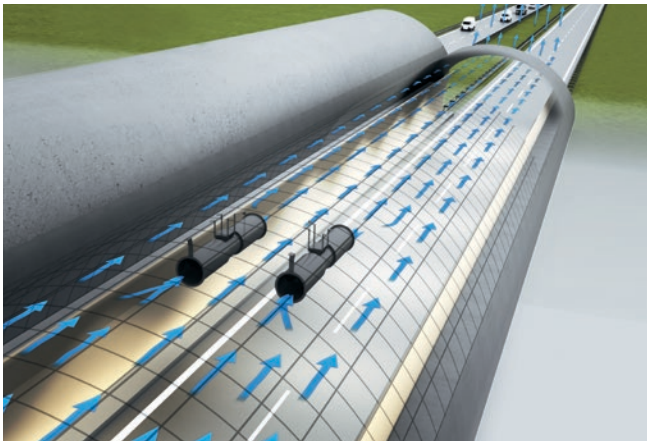
The FLOWSIC200 ultrasonic sensors are the result of our 30 years' plus experience in the area of ultrasonic technology. The sonic coupling of the ultrasonic transducer in the air is performed in a highly efficient manner with minimal signal losses. Signal transmission works reliably, even in challenging measurement conditions with damp and particle-laden tunnel air or fluctuating temperatures, the measuring device's fully automated gain control ensured by. For tunnels with widths up to 35 m (115 ft), the FLOWSIC200 offers a version with increased acoustic power.

High level of robustness and device availability

The FLOWSIC200 is manufactured from rugged stainless steel or die-cast aluminum components. For corrosive tunnel atmospheres we offer highly resistant titanium transducers. A further advantage: The maintenance interval of the measuring device is up to five years. Additionally, in case of fire, its rugged full-metal components have a clear advantage compared to conventional measurement technology made from plastic.

Comprehensive diagnostic functions

A fully automated check cycle periodically validates the device functions. while the integrated self-diagnosis continuously monitors all important function parameters. In case of impermissible measurement deviations, the FLOWSIC200 provides alert messages. This allows maintenance work to be planned well in advance and signs of wear to be fixed promptly, which ensures that the device continues to measure accurately.



Tailored to your specific requirements: Product Overview

The FLOWSIC200 consists of the ultrasonic sensors and the optional MCU control unit.
It offers a solution for multiple applications resulting from the measuring task. Even large tunnel widths and corrosive ambient conditions are no problem for this solution.

Ultrasonic sensors

FLOWSIC200 M

- Medium transducer power for tunnel widths up to 22 m (72 ft)
- Design featuring aluminum die-cast housing
- For tunnels with low salt input or environments with low levels of corrosion.
- Maintenance interval typically 1 to 2 years

FLOWSIC200 H-M

- Medium transducer power for tunnel widths up to 22 m (72 ft)
- Design featuring stainless-steel housing and titanium transducer for corrosive tunnel environments
- Maintenance interval typically up to five years

FLOWSIC200 H

- High transducer power for tunnel widths up to 35 m (115 ft)
- Design featuring stainless-steel housing and titanium transducer for corrosive tunnel environments
- Maintenance interval typically up to five years
- Has been fire-tested

Smart Connectivity

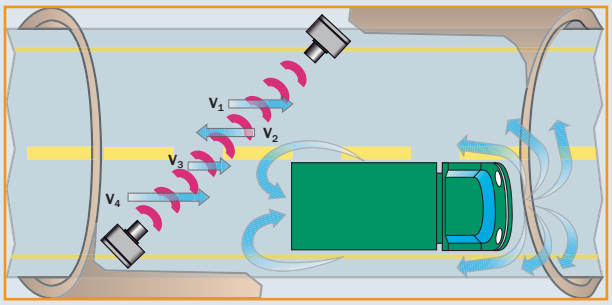
I/O concept suitable for modular expansion:
- Analog and digital inputs and outputs
- Modbus RS485
- Modbus® TCP
- Ethernet
- PROFIBUS DP

LC display with status LED and operating buttons (option)
- Visualization of measured values
- Diagnostic information
- Parameterization

The optional MCU control unit is used to input and output signals and permits simple connection of the FLOWSIC200 to higher-level distributed control systems. Different interfaces are available for this which can be optionally expanded if necessary. A display unit permits especially convenient operation of the FLOWSIC200. There is a version with 19-inch housing available for mounting the control unit in a control cabinet.

Rugged ultrasonic technology

Ultrasonic measurement principle
Two ultrasonic transducers, which are typically installed at an angle of 45 ° ... 60 ° to the tunnel axis, alternately function as sender and receiver. Different transit times result for each sonic impulse depending on the flow velocity and direction. In the forward direction, the runtime is shortened; in the opposite direction, it is extended. The flow velocity is determined by the differences in ultrasonic time-of-flight.



Advantages of this method:
- Measured and actual flow velocity (measured over the entire tunnel cross-section) always match very closely. With spot-measuring devices, large differences, or even incorrect indication of the flow direction, can occur.
- Independent of pressure and temperature
- Acoustic temperature measurement possible
- No moving parts ensure long operating time

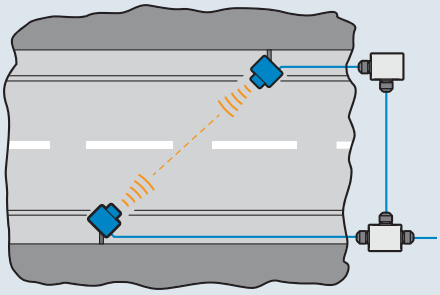
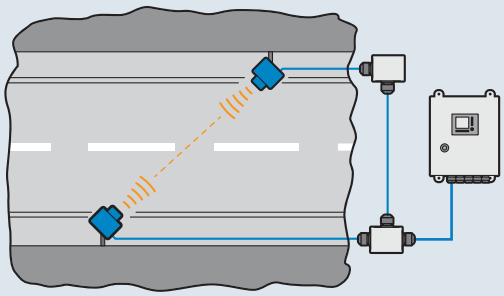
Reliable measurement in the event of fire

Measuring conditions completely change in the event of a fire in the tunnel. A large amount of thick smoke can develop in a short time. The gas composition changes significantly. The temperature increases very quickly at the site of the fire. The overall thermodynamic situation leads to a considerable change in the flow dynamics at the fire source. As part of fire testing with the Forschungsgesellschaft für Verbrennungskraftmaschinen und Thermodynamik mbH (FVT mbH) Austria, the FLOWSIC200 also proved itself under these extreme conditions.
Thanks to the high acoustic power and the on board automated signal gain control, transmission of the sonic signal is ensured at all times. Advanced signal evaluation algorithms reliably process the signals. This means that the measuring function of the FLOWSIC200 remains intact if the dynamics of the flow drastically increase within a short time as a consequence of a tunnel fire.

High acoustic power – for very large tunnel dimensions and reliable measurements, even in the event of fire

Comparison of variants

Tailored to your requirements: The FLOWSIC200 can be extended with an optional control unit that offers additional functions, for example more analog and digital interfaces, an additional 230 V AC voltage supply, and a display for showing the measured value. The FLOWSIC200 Transmitter variant consists of just the sensors and does not require a control unit.

	FLOWSIC200 Transmitter	FLOWSIC200
		
Standard scope of delivery	Sensors incl. connection cable	Sensors incl. connection cable
	-	MCU
I/O	Modbus® RTU	Modbus® RTU/TCP analog incl. HART digital/frequency PROFIBUS
Display	No	Yes
Voltage supply	+ 24 V DC	+ 24 V DC 90 V ... 250 V DC
Advantages	Lean measurement solution for basic requirements	Extended functionality

FLOWSIC200
The tunnel flow measuring device for long-term operation

Product description

The FLOWSIC200 is used for the non-contact and accurate measurement of flow velocity and flow direction inside tunnels or exhaust ventilation ducts. Ultrasonic measurement process provides the mean average value of the flow velocity across the tunnel width. The measuring device is vital for ensuring efficient and economical tunnel ventilation control when air flow is dictated by climatic conditions or by traffic. Even in the event of a fire in the tunnel, reliable, exact, and representative measurement of the flow velocity and direction over the entire tunnel width is now a requirement. Only in this way can the smoke dispersion be measured and the required information for optimal ventilation regulation be received.

At a glance

- Internal non-contact measurement
- High acoustic power for measuring across large tunnel widths
- Rugged components made of titanium, stainless steel, or die cast
- Versions for corrosive tunnel atmospheres
- No mechanical moving parts
- Advanced diagnostics for early detection of faults

Your benefits

- Representative measurement across the entire width of the tunnel
- Very reliable measuring, compared to spot-measuring process
- Exact measurement of even very low flow velocities
- Long maintenance interval of up to five years
- Low operating costs thanks to reliable operation and low maintenance
- High device availability and therefore also the measurement data

Fields of application

- Measuring in road and rail tunnels
- Controlling the tunnel ventilation
- Identifying the smoke dispersion

CE

More Information online
For more information, enter the link or scan the QR code to get direct access to technical data, operating instructions, software, application examples, and much more.
www.endress.com/flowsic200

Technical data

The exact device specifications and product performance data may vary and are dependent on the respective application and customer specifications.

FLOWSIC200

Measurands	Flow velocity, flow direction, temperature
Measurement principle	Ultrasonic transit time difference measurement
Measuring ranges	
Flow velocity	0 ... ± 20 m/s (0 ... ± 65 ft/s)
Accuracy	± 0.1 m/s (0.33 ft/s); depends on application
Diagnostic functions	Internal zero and reference point check Extended device diagnosis with SOPAS ET software
Tunnel width	
FLOWSIC200 M, H-M:	3.5 m ... 22 m (11.5 ft ... 72 ft)
FLOWSIC200 H:	3.5 m ... 35 m (11.5 ft ... 115 ft)
Ambient temperature	–40 °C ... +60 °C (–40 °F ... 140 °F)
Storage temperature	–40 °C ... +70 °C (–40 °F ... 158 °F)
Ambient humidity	≤ 100%; relative humidity
Conformities	RABT 2006 ASTRA A "Guideline – Ventilation of Road Tunnels" (2008) RVS 09.02.22 (FLOWSIC200 H-M, FLOWSIC200 H)
Electrical safety	CE
Enclosure rating	IP66 (sensors)
Operation	Via LC display (option) or SOPAS ET software
Type	FLSE200-M: Die-cast aluminum housing, aluminum sensor FLSE200-H-M/-H: Stainless-steel housing, titanium sensor
Dimensions (W x H x D)	Details, see dimensional drawings
Mounting	Typical height above the road surface: 4.2 m (13.8 ft); 45 ° ... 60 ° to tunnel axis
System components	2x FLSE200 sender/receiver unit 1x MCU control unit (optional) 2x Connection unit 2x Connection cable 2x Wall bracket

MCU control unit (optional)

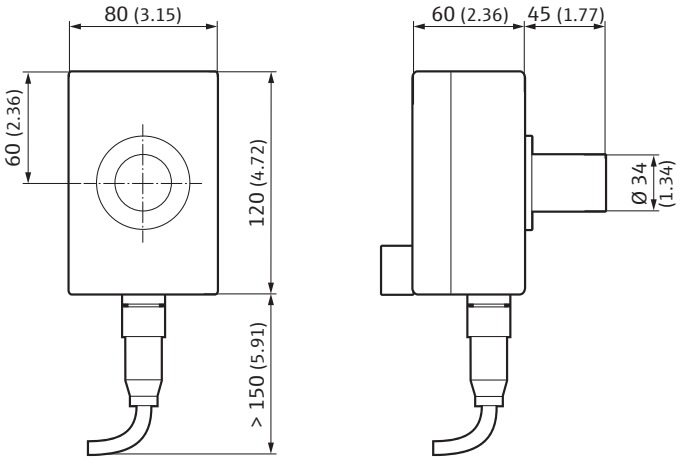
Description	Control and evaluation unit for up to eight measuring locations
Enclosure rating	IP65 (wall housing)
Analog outputs	1 output: 0/2/4 ... 20 mA, 750 Ω Electrically isolated; further outputs when I/O modules are used (optional)
Analog inputs	2 inputs: 0 ... 20 mA Not electrically isolated; additional inputs with use of I/O modules (option)
Digital outputs	5 relay outputs (changeover contacts), volt-free: 48 V AC, 1 A Safety extra-low voltage; for status signals "Operation/Fault", "Limit value", "Warning", "Maintenance" and "Control cycle"
Digital inputs	4 volt-free contacts: Additional inputs with use of I/O modules
Interfaces	USB 1.1 (virtual COM port; service interface) RS-232 (via terminal connection; service interface) RS-485 (for connection of sender/receiver unit(s))
Bus protocol	Ethernet TCP/IP, (via optional interface module) Modbus (via optional interface module) Modbus® TCP (via optional interface module) PROFIBUS DP (via optional interface module)
Display	LC display Status LEDs: "Power", "Maintenance", and "Fault"
Operation	Via LC display or SOPAS ET software
Dimensions (W x H x D)	Details, see dimensional drawings
Weight	5 kg (11 lbs)
Electrical connection	
Voltage	90 V AC ... 250 V AC + 24 V DC
Frequency	50 Hz / 60 Hz
Power consumption	≤ 50 W
Options	Interface module(s) I/O module(s)

Ordering information

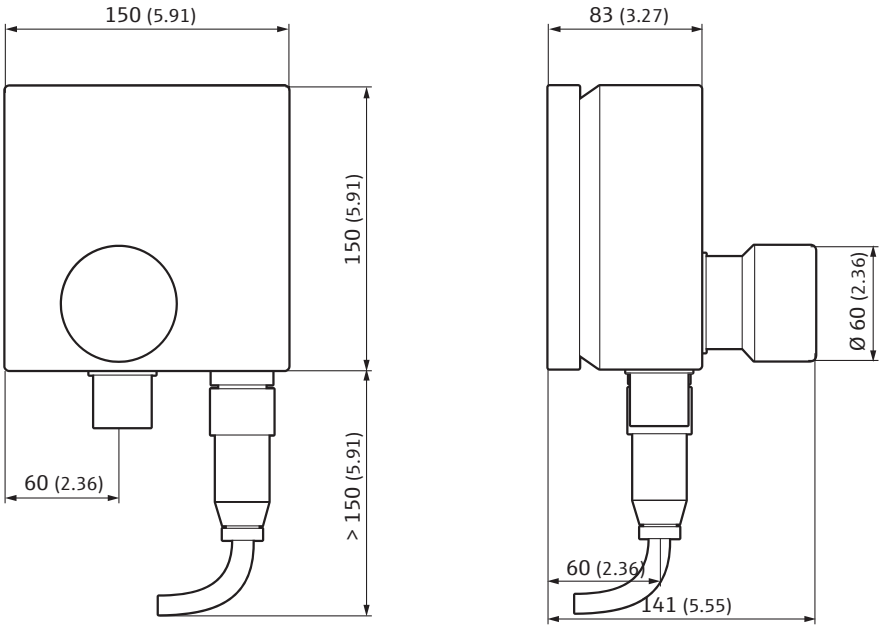
Our regional sales organization will help you to select the optimum device configuration.

Dimensional drawings

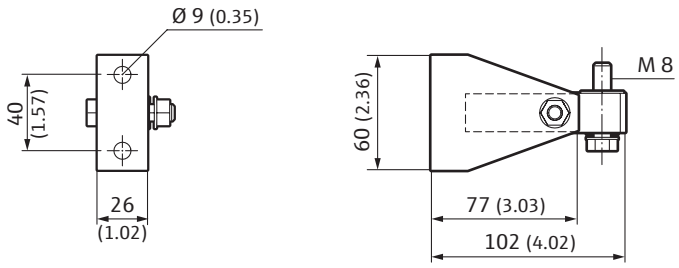
FLSE200-M sender/receiver unit (dimensions in mm (inch))



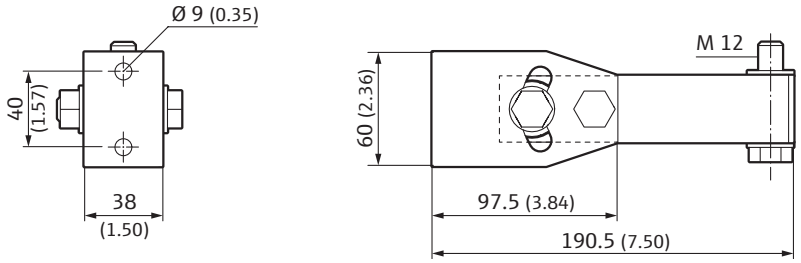
FLSE200-H and FLSE200-HM sender/receiver units (dimensions in mm (inch))



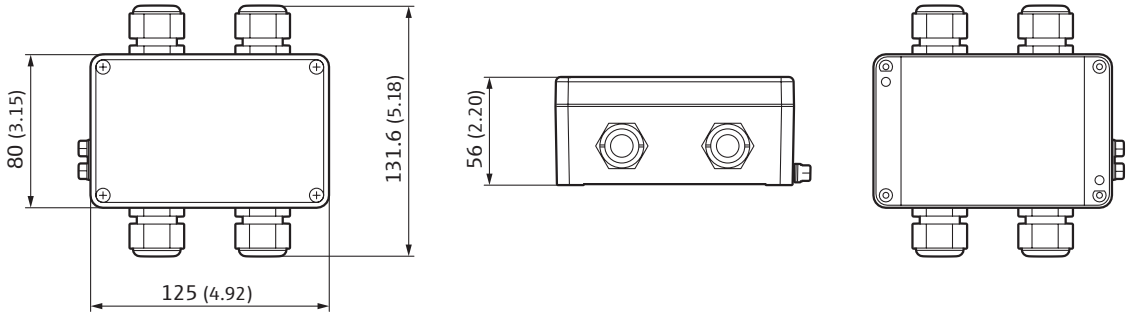
Wall bracket for FLSE200-M (dimensions in mm (inch))



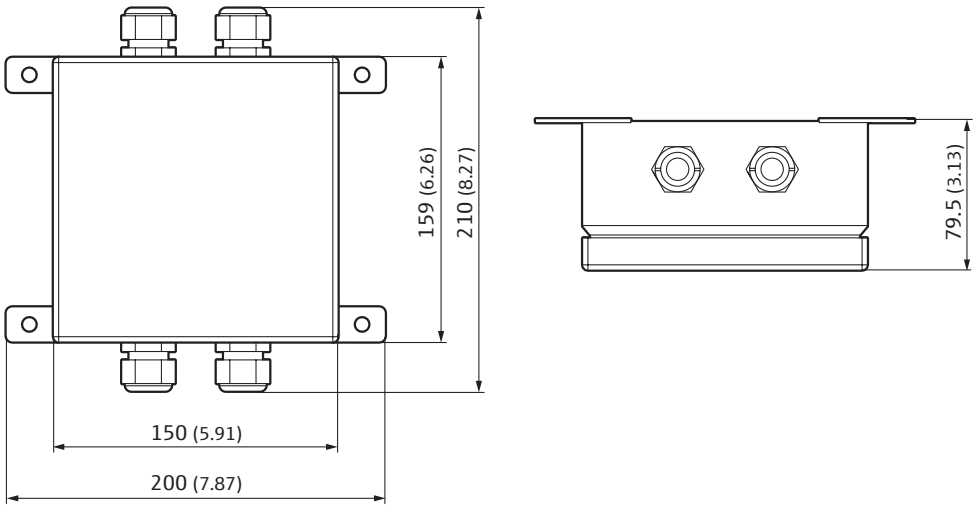
Wall bracket for FLSE200-H and FLSE200-HM (dimensions in mm (inch))



Connection unit, aluminum housing version (dimensions in mm (inch))



Connection unit, stainless steel housing version (dimensions in mm (inch))



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