



MARSIC SHIP EMISSIONS MEASURING DEVICES

SAFELY ON THE RIGHT COURSE

Analyzer solutions

SICK
Sensor Intelligence.

SAFELY ON THE RIGHT COURSE

With MARSIC, the ship emissions measuring solution from SICK, you can sail across the sea with the DNV GL certification, safe in the knowledge that the measured values are reliably available in maritime emission control areas. You can also rest assured that maintenance and calibration costs will stay low in the long term.



HIGH LEVEL OF RELIABILITY, NOW AND IN THE FUTURE

DNV GL Certified

With MARSIC ship emissions measuring devices, ship operators and scrubber manufacturers can remain compliant for years to come, regardless of how the limit values may change, since MARSIC can also accurately measure the very low emissions expected in the future and make them available for reporting and inspection. The MARSIC systems are certified for monitoring DeSO_x systems according to MEPC.184(59) and DeNO_x systems according to MARPOL Annex VI. Anyone equipping a ship with state-of-the-art technology for exhaust gas cleaning and with a MARSIC measuring device will also comply with all emission regulations in the long term.

Efficient Solution that Reduces Costs

With MARSIC ship emissions measuring devices and modern exhaust gas cleaning, ships can also be operated at low cost in emission control areas (ECA) using heavy fuel oil. With MARSIC, scrubber manufacturers are able to provide their customers with an up-to-date and good value measuring solution. The operation and maintenance costs are low since the reliable measuring technology was designed for quick and simple servicing on board. In addition, MARSIC provides important information for the monitoring and fuel-optimized operation of the ship propulsion.

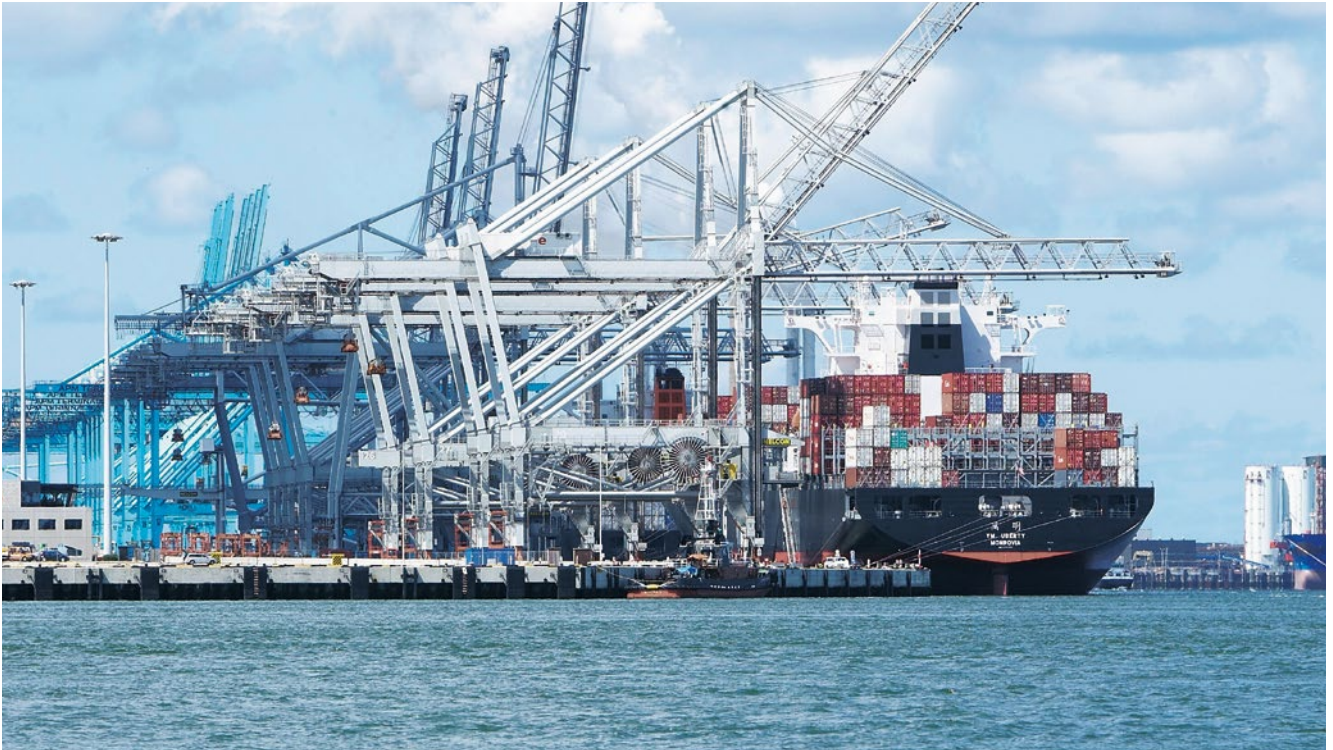


Current Regulations and Guidelines

Ships are required to use low-sulfur fuels while within emission control areas. Alternatively, exhaust gas cleaning systems may be implemented to reduce the sulfur content. NO_x limit values are also defined for ship engine emissions. The exhaust gas cleaning results must be measured and documented.

- The following apply:
- MARPOL Annex VI and NTC 2008 – MEPC.177(58)
 - Guidelines for exhaust gas cleaning systems – MEPC.184(59)

LEADING TECHNOLOGY FOR MAXIMUM EFFICIENCY



Low Costs and Minimum Effort

- Minimal maintenance, few moving parts subject to wear and tear
- Several measurement points can be covered by one analyzer
- Automatic calibration with internal calibration filters

High Availability

- Service can be carried out on board by on-board engineers
- Simple, quick servicing thanks to modular design
- Expert help quickly available via remote servicing

MARSIC Ship Emissions Measuring Devices Soon Pay for Themselves

The use of exhaust gas cleaning technology allows heavy fuel oil to be used in the emission control areas (ECA). This results in considerable potential for savings with regard to fuel costs. The financial cost of implementing the cleaning and measurement technology is paid back after just a short while.

Reduction of Costs Through Process Monitoring

MARSIC measurement technology provides important information for the monitoring and economic optimization of the ship propulsion:

- Measurement of the methane slip with LNG and dual-fuel drives
- Optimization of machine performance to reduce consumption

YOU CAN RELY ON MARSIC

Reliable Thanks to Proven Technology

As an onshore market leader in emissions measurement technology, SICK has decades of experience in the development and integration of gas analysis and emissions measurement. Furthermore, SICK offers comprehensive on-board measurement systems and has a long tradition within maritime applications. MARSIC therefore comprises proven technology, which has demonstrated its quality and reliability all over the world.



High Level of Operational Safety Through Quick Servicing

With employees in more than 80 countries, the global SICK network ensures that servicing and spare parts are available globally at all times. If maintenance or spare parts are required, SICK technicians and service partners can be on site quickly. Appropriate storage of spare parts in the service hubs along the main global shipping routes means that such parts can be provided very quickly when required. Alternatively, remote maintenance via the SICK Meeting Point Router ensures that the MARSIC technology functions safely and that the ship can continue on its journey.



MARSIC200 AND MARSIC300: SUPERIOR TECHNOLOGY IN DIRECT COMPARISONS

CEMS at Sea – Made by SICK

- Ship emissions measurement device fully certified according to MARPOL Annex VI and MEPC 184(59)
- For monitoring of DeSO_x systems (scrubber) DeNO_x systems (SCR)

Measurement technology

Measurement points

Number of measurement points

Simultaneous measuring components

Sample gas lines

Response time (T_{90})

Instrument air

Power consumption

Replacement parts

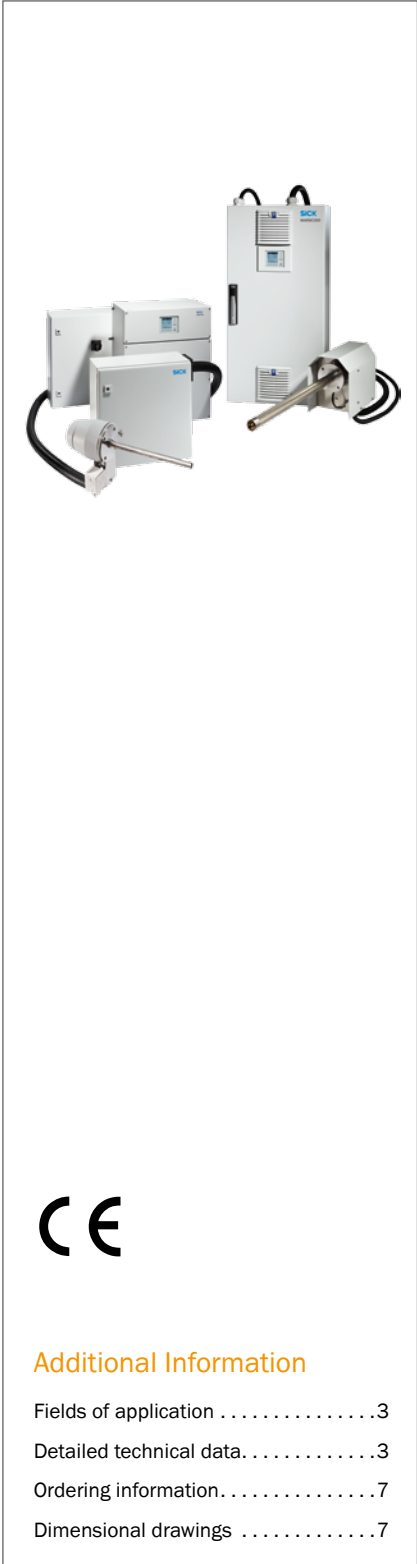
Installation

Operation, Service



MARSIC200	MARSIC300
Cold extractive, via cooler	Hot extractive, no condensation
Measurement after scrubber and before and/or after SCR	Measurement before and/or after Scrubber, SCR
4	2
SO ₂ , CO ₂ , NO, NO ₂ , O ₂	SO ₂ , CO ₂ , CO, NO, NO ₂ , NH ₃ , CH ₄ , H ₂ O and O ₂
Maximum length: 50 m Short distance with self-regulating, heated sample gas line Long distance with unheated sample gas line	Maximum length: 35 m Controlled heated sample gas line
15 ... 30 s	< 140 s, component-specific based on certification
Purge air only (standby 60 l/h)	Component-specific via ejector pump, approx. 1,3 m ³ /h (1300 l/h)
approx. 1,150 W for 1 measurement point approx. 3,480 W for 4 measurement points	approx. 3,100 W for 1 measurement point approx. 5,200 W for 2 measurement points
Predefined replacement part sets	Predefined replacement part sets
3 small/light housing; long, heated sample gas line	1 housing, heated sample gas line
Minimal equipment, modular housing concept, predefined modules for easy replacement	Internal adjustment function without test gases, predefined modules for easy replacement

SAFELY ON THE RIGHT COURSE



Additional Information

Fields of application3
 Detailed technical data3
 Ordering information7
 Dimensional drawings7

Product Description

SICK's MARSIC ship emission measuring device is an innovative solution that can be used to reliably measure emissions on ships in accordance with MARPOL Annex VI and MEPC.184(59). MARSIC is type-approved by DNV GL for this application and measures both SO_x and CO₂ before and after scrubber, and NO_x before and after SCR (selective catalytic reduction) systems. In addition, MARSIC can be used for process measurements of

CH₄ with LNG (liquefied natural gas) and dual-fuel engines. As a leading manufacturer of emissions measurement technology, SICK offers two variants of MARSIC. MARSIC200 has an impressive modular housing concept. MARSIC300 is available as a compact complete system. Designed to be used on ships, they boast extremely straightforward maintenance, and modules that are easy to replace.

At a Glance

- Rugged design and high level of measurement accuracy
- Up to 4 measurement points with one analyzer
- DNV GL type approval in accordance with MARPOL Annex VI, NO_x Technical Code 2008, MEPC.184(59) and MEPC.198(62)
- Measuring ranges adapted to low and high concentrations of SO₂ and NO_x
- Up to 9 measuring components at the same time: SO₂, CO₂, CO, NO, NO₂, NH₃, CH₄, H₂O and O₂

Your Benefits

- Low costs due to minimal maintenance requirements
- No need for expensive calibration gases thanks to internal drift correction
- Multiple measurement points with just one analyzer
- High levels of availability and reliability
- Assemblies that are easy to replace during servicing
- Servicing support is available globally
- Quick access to expert support with remote maintenance
- Equipped for existing and future requirements thanks to its rugged design and high level of measurement accuracy

→ www.mysick.com/en/MARSIC

For more information, simply visit the above link to obtain direct access to technical data, CAD design models, operating instructions, software, application examples, and much more.

Fields of Application

- Reliable emission monitoring on ships
- Accurate DeNO_x and DeSO_x measurements for ship engines
- Cost-efficient process monitoring upstream and downstream of the scrubber and catalytic converters

Detailed Technical Data

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

MARSIC200 system

Measured values	CO ₂ , SO ₂ , NO, NO ₂ , O ₂										
Maximum number of measurands	5										
Measurement principles	NDIR spectroscopy, NDUV spectroscopy, electrochemical cell										
Sample quantity	60 l/h ... 100 l/h										
Measuring ranges	<table> <tr> <td>CO₂</td> <td>0 ... 25 Vol.-%</td> </tr> <tr> <td>SO₂</td> <td>0 ... 100 ppm / 0 ... 500 ppm</td> </tr> <tr> <td>NO</td> <td>0 ... 300 ppm / 0 ... 1,500 ppm</td> </tr> <tr> <td>NO₂</td> <td>0 ... 200 ppm / 0 ... 500 ppm</td> </tr> <tr> <td>O₂</td> <td>0 ... 21 Vol.-%</td> </tr> </table>	CO ₂	0 ... 25 Vol.-%	SO ₂	0 ... 100 ppm / 0 ... 500 ppm	NO	0 ... 300 ppm / 0 ... 1,500 ppm	NO ₂	0 ... 200 ppm / 0 ... 500 ppm	O ₂	0 ... 21 Vol.-%
CO ₂	0 ... 25 Vol.-%										
SO ₂	0 ... 100 ppm / 0 ... 500 ppm										
NO	0 ... 300 ppm / 0 ... 1,500 ppm										
NO ₂	0 ... 200 ppm / 0 ... 500 ppm										
O ₂	0 ... 21 Vol.-%										
Response time	15 s ... 30 s Including sample gas path and gas sampling probe										
Accuracy	< 1 % of measuring range full scale										
Sensitivity drift	< 2 % of measuring range full scale per week										
Zero point drift	< 2 % of measuring range full scale per week										
Reference point drift	< 2 % of measuring range full scale per week										
Detection limit	≤ 0.5 %										
Process temperature	+10 °C ... +550 °C										
Process pressure	-90 hPa ... 200 hPa Relative										
Dust load	≤ 200 mg/m ³										
Ambient temperature	+5 °C ... +45 °C										
Storage temperature	-20 °C ... +70 °C										
Ambient pressure	900 hPa ... 1,100 hPa										
Ambient humidity	≤ 90 % Non-condensing										
Conformities	MARPOL Annex VI and NTC 2008 – MEPC.177(58) Guidelines for exhaust gas cleaning systems – MEPC.184(59) Guidelines for SCR reduction systems – MEPC.198(62) DNV GL Rules for Type Approvals (2012)										
Electrical safety	CE, DNV GL Rules										
Enclosure rating	IP 54										
Analog outputs	8 outputs: 0 ... 24 mA Electrically isolated										
Analog inputs	2 inputs: 0 ... 20 mA										
Digital outputs	16 outputs: Changeover switch, 1-pin, 3 connections										
Digital inputs	8 inputs: 42 V										
Interfaces	Ethernet TCP/IP										

Bus protocol	Modbus TCP OPC								
Indication	LC display Status LEDs: "Power", "Maintenance request" and "Fault"								
Input	Functional keys								
Operation	Via LC display or SOPAS ET software, multiple operating levels, password-protected								
Model	Steel sheet enclosure								
Dimensions (W x H x D)	500 mm x 560 mm x 210 mm (sample conditioning) 600 mm x 660 mm x 210 mm (distribution unit) 550 mm x 740 mm x 319 mm (analyzer)								
Weight	Sample conditioning: 27 kg Distribution unit: 30 kg Analyzer: 37 kg								
Material in contact with media	PTFE, Viton B, PVDF, stainless steel 1.4571, platinum, nickel, Aluminum, CaF ₂ , Hastelloy								
Mounting	Wall-mounting								
Power supply	<table border="0"> <tr> <td style="text-align: right;">Voltage</td> <td>115 V / 230 V Different power supply via upstream transformer</td> </tr> <tr> <td style="text-align: right;">Frequency</td> <td>50 Hz / 60 Hz</td> </tr> <tr> <td style="text-align: right;">Current consumption</td> <td>At 230 V AC: 8 A</td> </tr> <tr> <td style="text-align: right;">Power consumption</td> <td>Analyzer: 300 W Gas sampling probe: 400 W Sample gas line, heated: 60 W/m Sample conditioning: 150 W</td> </tr> </table>	Voltage	115 V / 230 V Different power supply via upstream transformer	Frequency	50 Hz / 60 Hz	Current consumption	At 230 V AC: 8 A	Power consumption	Analyzer: 300 W Gas sampling probe: 400 W Sample gas line, heated: 60 W/m Sample conditioning: 150 W
Voltage	115 V / 230 V Different power supply via upstream transformer								
Frequency	50 Hz / 60 Hz								
Current consumption	At 230 V AC: 8 A								
Power consumption	Analyzer: 300 W Gas sampling probe: 400 W Sample gas line, heated: 60 W/m Sample conditioning: 150 W								
Auxiliaries	<table border="0"> <tr> <td style="text-align: right;">Compressed air:</td> <td>≤ 100 l/h Instrument air: 0.5 ... 1 bar; oil content max. 0.1 mg/m³</td> </tr> </table>	Compressed air:	≤ 100 l/h Instrument air: 0.5 ... 1 bar; oil content max. 0.1 mg/m ³						
Compressed air:	≤ 100 l/h Instrument air: 0.5 ... 1 bar; oil content max. 0.1 mg/m ³								
Sample connections	Swagelok DN 4/6								
Auxiliary connections	Compressed air: hose connector DN 4/6 Test gas: hose connector DN 4/6								
Corrective functions	Automatic zero point adjustment with N ₂ , weekly								
System components	Sampling probe, heated, including filter unit Sample gas line, partially heated Sample conditioning MARSIC200 distribution unit Analyzer								
Integrated components	Sample gas pump Pressure sensor Flow sensor								

MARSIC300 system

Measured values	CO ₂ , SO ₂ , NO, NO ₂ , CO, CH ₄ , NH ₃ , O ₂ , H ₂ O
Maximum number of measurands	9
Measurement principles	NDIR spectroscopy, Zirconium dioxide sensor (oxygen measurement)
Spectral range	2,000 nm ... 11,000 nm
Length of measuring path	8.5 m
Sample quantity	200 l/h ... 300 l/h
Measuring ranges	CO ₂ 0 ... 25 Vol.-% SO ₂ 0 ... 30 ppm / 0 ... 2,000 ppm NO 0 ... 300 ppm / 0 ... 2,000 ppm NO ₂ 0 ... 200 ppm / 0 ... 500 ppm CO 0 ... 200 ppm / 0 ... 2,000 ppm CH ₄ 0 ... 500 ppm / 0 ... 10,000 ppm NH ₃ 0 ... 50 ppm / 0 ... 500 ppm O ₂ 0 ... 21 Vol.-% H ₂ O 0 ... 40 Vol.-%
Response time	≤ 140 s Including sample gas path and gas sampling probe
Accuracy	< 2 % Of measuring range full scale
Sensitivity drift	< 2 % of measuring range full scale per week
Zero point drift	< 2 % of measuring range full scale per week
Reference point drift	< 2 % of measuring range full scale per week
Detection limit	< 2 % of measuring range full scale
Process temperature	+10 °C ... +550 °C
Process pressure	-20 hPa ... 200 hPa Relative
Dust load	≤ 200 mg/m ³
Ambient temperature	0 °C ... +45 °C
Storage temperature	-20 °C ... +70 °C
Ambient pressure	900 hPa ... 1,100 hPa
Ambient humidity	≤ 90 % Non-condensing
Conformities	MARPOL Annex VI and NTC 2008 – MEPC.177(58) Guidelines for exhaust gas cleaning systems – MEPC.184(59) Guidelines for SCR reduction systems – MEPC.198(62) DNV GL Rules for Type Approvals (2012)
Electrical safety	CE, DNV GL Rules
Enclosure rating	IP 44
Interfaces	Ethernet TCP/IP
Bus protocol	Modbus TCP OPC PROFIBUS DP (option)
Indication	LC display Status LEDs: "Power", "Maintenance request" and "Fault"
Input	Functional keys
Operation	Via LC display or SOPAS ET software, multiple operating levels, password-protected
Dimensions (W x H x D)	600 mm x 1,300 mm x 434 mm
Weight	120 kg

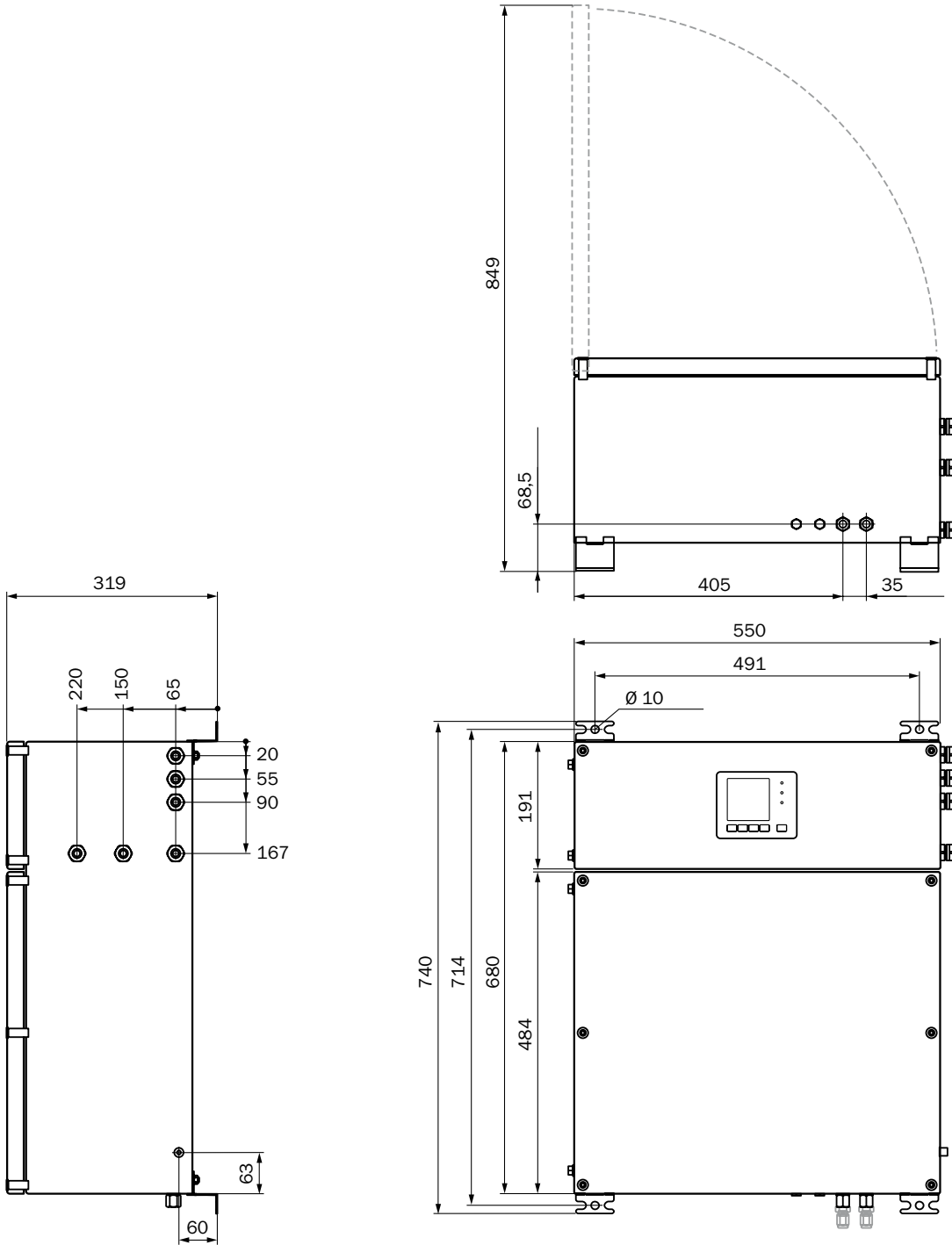
Material in contact with media	Stainless steel 1.4571, PTFE, aluminium, coated
Mounting	Wall-mounting
Power supply	
Three-phase current	3-phase: 115 V, 50/60 Hz 3-phase: 208 V, 50/60 Hz 3-phase: 230 V, 50/60 Hz Special configurations with minimal equipment are also possible
Current consumption	At 230 V AC: 14 A
Power consumption	Analyzer: 1,000 W Gas sampling probe: 750 W Sample gas line, heated: 90 W/m
Auxiliaries	
Compressed air:	≤ 1,300 l/h Instrument air: 5 ... 7 bar; particle size max. 1 µm; oil content max. 0.1 mg/m ³ ; pressure dew point max. -40 °C
Sample connections	Swagelok DN 4/6
Auxiliary connections	Compressed air: hose connector DN 6/8 and DN 8/10 Test gas: hose connector DN 6/8
Corrective functions	Drift correction and optical monitoring function via adjustment cell Automatic zero point adjustment with instrument air
System components	Sampling probe, heated, including filter unit Sample gas line, heated (max. 35 m) Analyzer
Integrated components	Ejector pump Pressure sensors

Ordering information

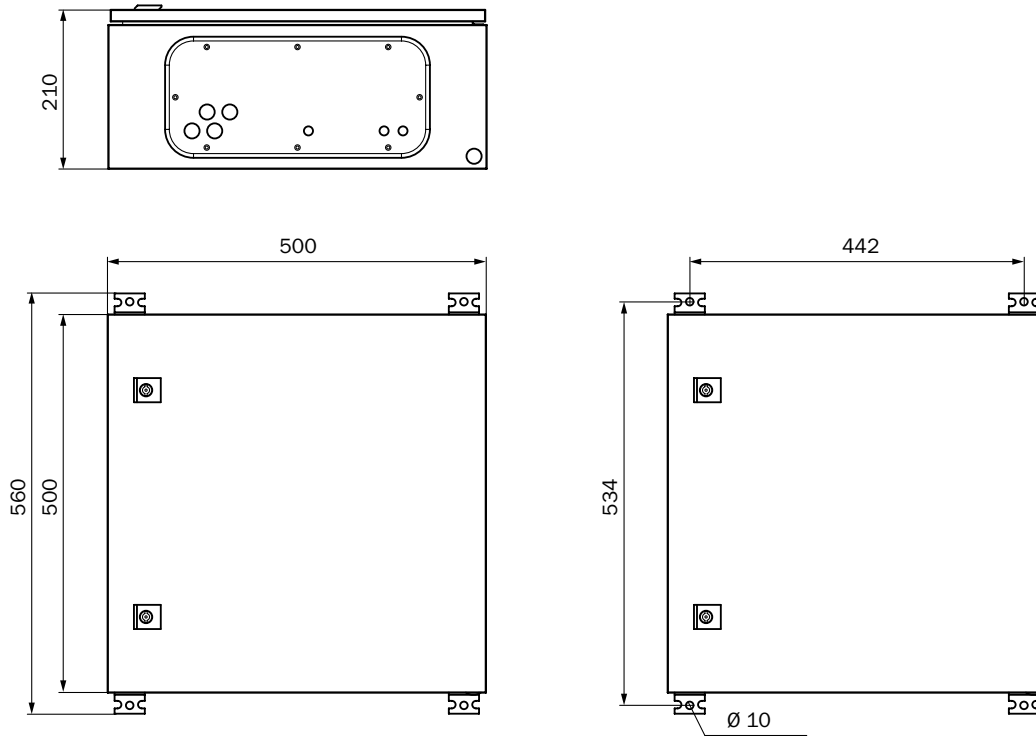
Our regional sales organization will be glad to advise you on which device configuration is best for you.

Dimensional drawings (dimensions in mm)

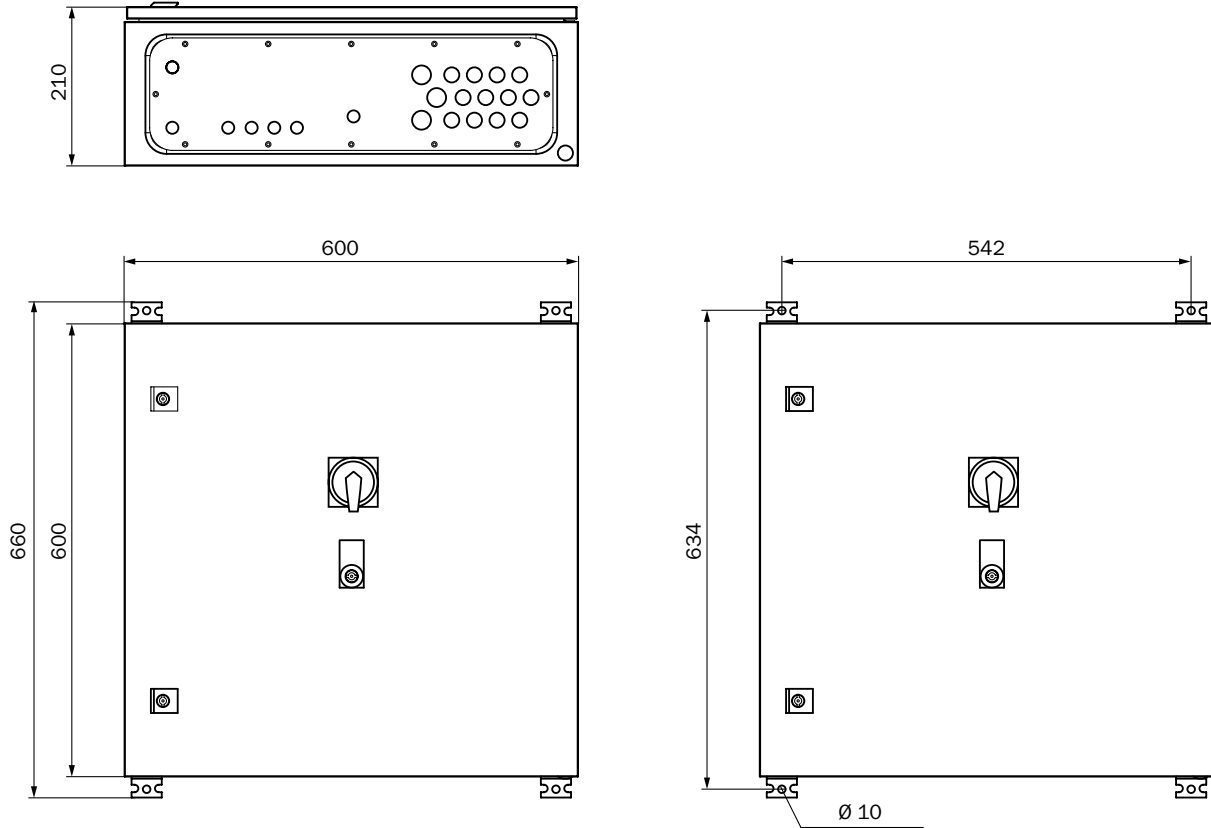
MARSIC200 Analyzer



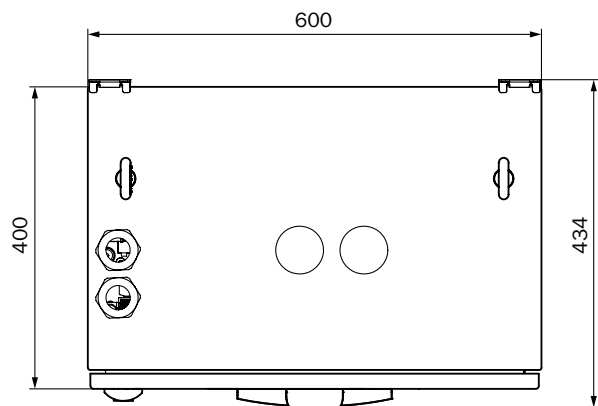
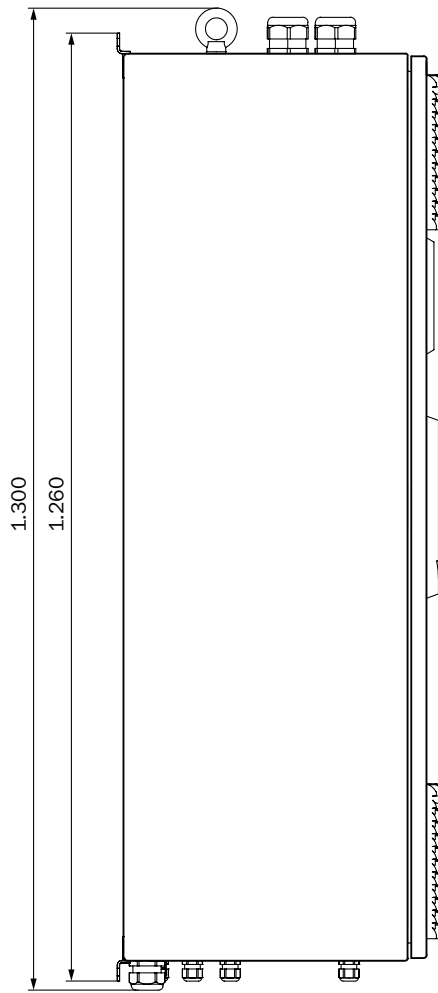
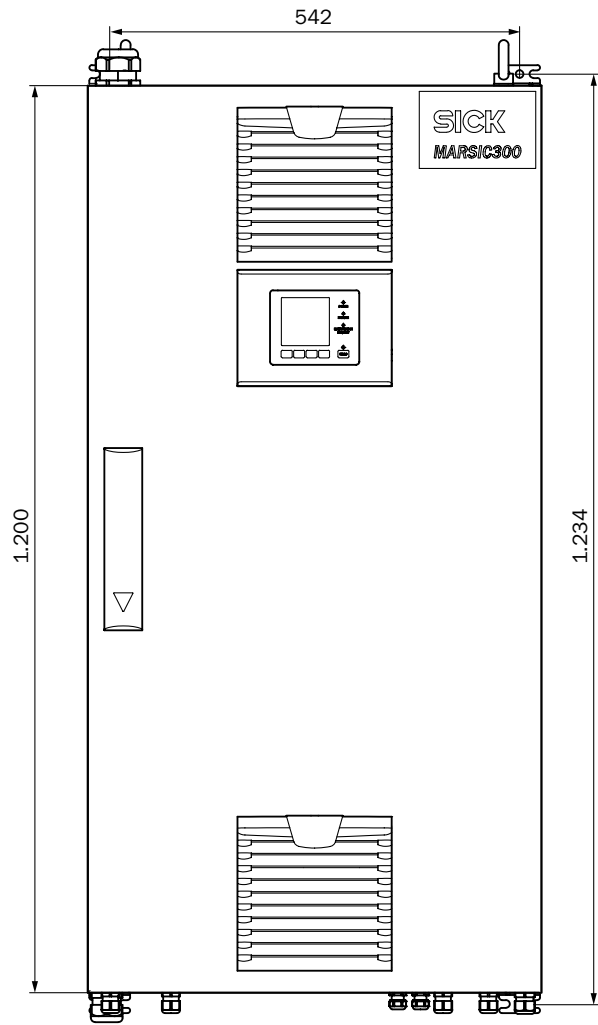
MARSIC200 Sample Preparation



MARSIC200 Distribution Unit



MARSIC300



SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 6,500 employees and over 50 subsidiaries and equity investments as well as numerous representative offices 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.

Comprehensive services round out our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is “Sensor Intelligence.”

Worldwide presence:

Australia, Austria, Belgium/Luxembourg, Brazil, Czech Republic, Canada, China, Denmark, Finland, France, Germany, Great Britain, Hungary, India, Israel, Italy, Japan, Mexico, Netherlands, Norway, Poland, Romania, Russia, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Turkey, United Arab Emirates, USA

Detailed addresses and additional representatives → www.sick.com