



# MERCEM300Z MERCURY GAS ANALYZER

ADVANCED MEASUREMENT OF MERCURY IN FLUE GASES

Extractive gas analyzers

**SICK**  
Sensor Intelligence.

# PROVEN MEASUREMENT TECHNOLOGY, IDEAL FOR REFERENCE PURPOSES

Reliably measuring mercury in flue gases is difficult and places a great deal of demand on measuring technology. The innovative MERCEM300Z mercury gas analyzer from SICK is able to take reliable measurements in situations where other measuring systems have had to give up.

## Challenges of measuring mercury

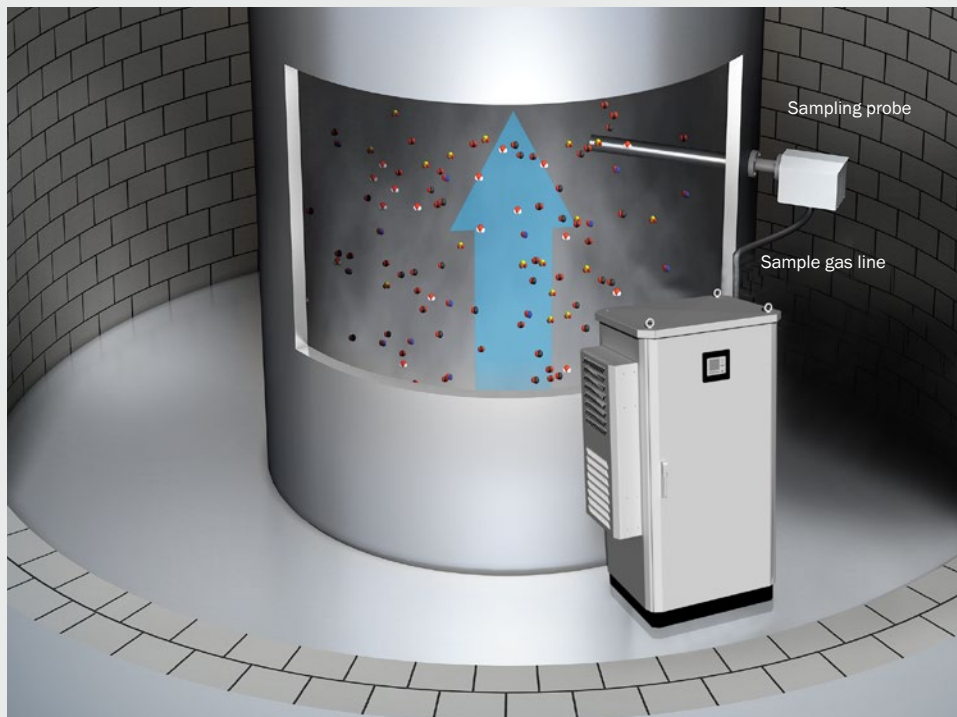
Continuously measuring mercury in flue gases presents a number of particular challenges for measuring systems. Firstly, the Hg concentrations to be detected are smaller than other flue gas components by a factor of 1,000. Limit values in the lower  $\mu\text{g}$  range must be monitored with high accuracy. Furthermore, any chemically bonded mercury must be converted into elemental mercury. Mercury analysis has already been carried out successfully for many years in waste incineration plants. In cement plants and power plants, the situation is different.

In plants where secondary fuels are used for power generation, Hg emissions also have to be monitored accurately as well.

Here too, this is done using continuous analyzer systems. The prevailing system conditions in cement and power plants, namely high levels of dust or high concentrations of interference components such as  $\text{SO}_2$ , CO, and  $\text{CO}_2$  mean that the conversion and measuring processes are not always reliable.

## The SICK solution

SICK offers the best solution for creating measurement certainty and for avoiding long downtime periods, high maintenance requirements, and therefore high operating costs for the operator: MERCEM300Z for high-precision mercury measuring.



MERCEM300Z measures using hot extraction: The flue gas is extracted using a sampling probe and is transported to the analyzer via a sample gas line. All components in contact with the sample gas, such as the probe, sample gas line, and converter in the analyzer are heated above the dew point.

### Reliable measuring technology thanks to a combination of conversion and photometers

With the MERCEM300Z gas analyzer, SICK has set a new standard when it comes to analyzing mercury. No mercury leaks, no chemicals used – instead, we apply hot measuring technology, which has been proven over many years.

### Measuring without moving parts – minimal maintenance

The production of the measuring gas is based on the low-maintenance ejector principle. What's more, taking the measurement itself does not require any moving parts. MERCEM300Z: The mercury gas analyzer characterized by its very low maintenance requirements and long maintenance intervals.

### Drift check without expensive test gas

At the push of a button, the MERCEM300Z carries out a quick and effective drift check with an internal adjustment cell. Using test gas is not necessary.

### Large variety of certified measuring ranges

The certified measuring ranges of the MERCEM300Z start from an extremely low 0 ...10 µg/m<sup>3</sup> reach 0 ... 45/100 µg/m<sup>3</sup>, which is the current requirement, and go right up to the unusually high 0 ... 1,000 µg/m<sup>3</sup>. This range covers the requirements for both emissions and process measuring.

### Internal test gas generator

To avoid the need for expensive test gases completely, an optional integrated test gas generator is available. With up to 3 predefined concentrations, this enables an automatic reference point check and adjustment (QAL3). This provides measurement certainty and means that money does not need to be spent on specialist technicians and costly, external testing equipment.



# MERCEM300Z MODELS

## MERCEM300Z Indoor

For measurements in air-conditioned rooms at temperatures from +5 to +35 °C



Compact standard design for the installation in air-conditioned rooms. Possible to arrange additional cabinets on the left-hand side.

- Ambient temperature: +5 °C ... +35 °C.

## MERCEM300Z

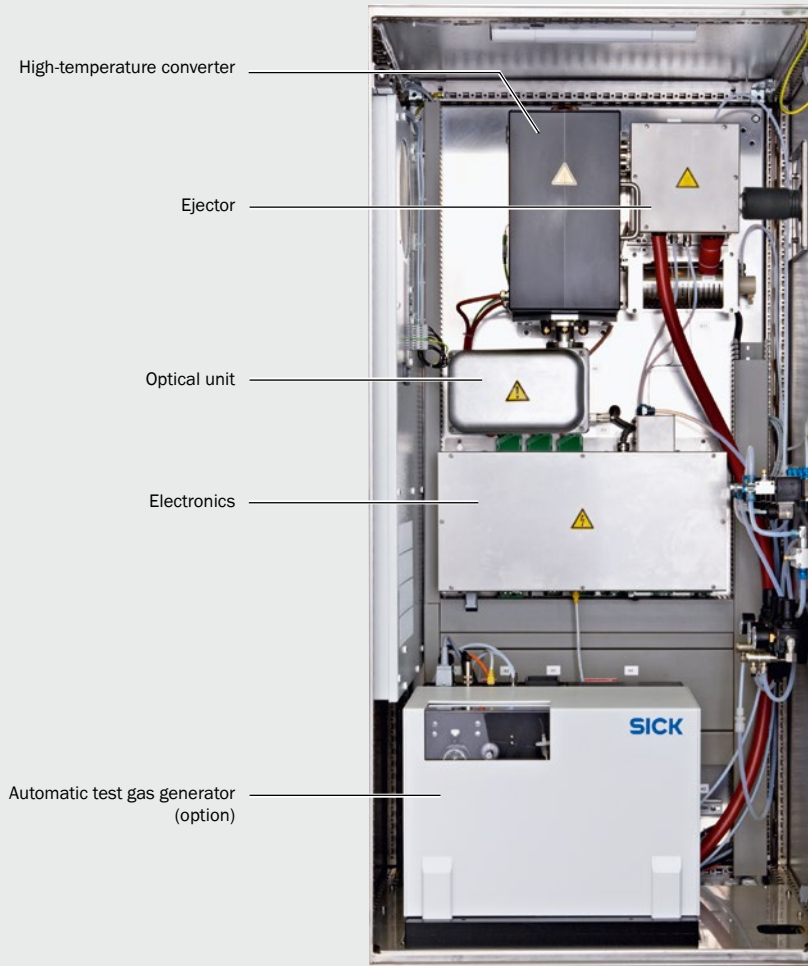
For measurements outdoors at temperatures from -20 to +50 °C



Optimized industrial design for measurements in harsh ambient conditions near to where the sample is taken – with integrated air conditioning.

- Ambient temperature: -20 °C ... +50 °C.

## MERCEM300Z – proven industrial design



### Hg conversion in high-temperature converter

Owing to the principles involved, mercury can only be measured in its elemental state. Therefore, it is essential to convert all mercury compounds to their elemental states before actually determining the Hg concentration. And this is where the key advantages of the MERCEM300Z really lie: The conversion is carried out using a purely thermal method, simply by using high temperatures of about 1,000 °C – no chemicals or non-durable catalyst materials are required.

### Patented direct measurement: Photometric measurement direct in the hot converter

The highlight of the MERCEM300Z: The photometric determination of the mercury content occurs directly in the hot converter without the need to change the sample further. This makes the process fast and continuous, and ensures that the conversion rate is steady. This means that the overall Hg concentration in the flue gas can be determined reliably. Chemicals and catalyst materials are not necessary. This direct measurement, which is patented by SICK, makes the MERCEM300Z a truly unique mercury gas analyzer. What's more, the resulting benefits make it exceptionally valuable for the operator.

### Photometric measurement using the Zeeman effect

The MERCEM300Z measures the Hg concentration in flue gas photometrically by means of Zeeman atomic absorption spectroscopy (Zeeman AAS): An Hg discharge lamp emits light in the element-specific wavelength. A strong magnetic field generated around the lamp splits the spectral line into several components which form the measuring and reference wavelengths simultaneously (Zeeman effect). The advantage here is that there are no moving parts and that cross sensitivities, lamp deterioration, and contamination are compensated for directly.

# MERCEM300Z – PREDESTINED FOR FLUE GAS MEASURING

Mercury is attracting more and more attention globally when it comes to monitoring emissions. Plant operators are faced with increasingly large challenges thanks to new annual limits in Europe and new legislation on measuring mercury in cement plants and coal-fired power plants in the USA.

In many cases, the permitted limits for flue gases are already below  $10 \mu\text{g}/\text{Nm}^3$ . Power plants, incineration plants, or cement kilns, which use fossil fuels or household goods as a fuel must all take responsibility.

The fuel used, e.g., lignite or bituminous coal in power plants or waste materials in waste incineration plants, is almost solely responsible for mercury entering the process. While in power plants, the level of mercury emissions is almost constant, these emissions fluctuate greatly at waste incineration plants due to the non-uniform distribution of mercury in the fuel.

However, the same requirement applies to all types of plants: In order to comply with the new limits, it is vital to invest in an optimized gas cleaning system and in even more accurate emission measuring technology. The flue gas cleaning units in the majority of existing plants do not have a cleaning stage designed specifically for mercury. As a result, an increasing number of other options are used to discharge mercury from the process, e.g., adding doped activated carbon upstream of the electrostatic precipitator or adding precipitating agents in the washer. Measuring the mercury in the raw gas, upstream of the washer or the electrostatic precipitator, offers significant benefits.



## Plant safety

If high concentrations of mercury are present in the process over an extended period of time, this can cause the flue gas washer to become overloaded with mercury and can ultimately lead to the entire plant becoming contaminated. In the worst case scenario, this could bring the whole plant to a standstill. This can be avoided if high concentrations of mercury are detected in the raw gas using an accurate measurement at an early stage and the appropriate countermeasures are implemented.

## Cost optimization

Using activated carbon and precipitating agents to remove mercury from the process is expensive. Excessive amounts of both of these are often added to the process for safety reasons. By measuring the amount of mercury in the raw gas, it is possible to accurately determine the required quantity of activated carbon and precipitating agents and therefore save money.

## Complying with the Hg limits in clean gas

To be compliant with the new, lower emissions limits, it is vital to respond at process level. Measuring mercury in the raw gas and implementing the appropriate countermeasures in the process can ensure that the emissions limits are not exceeded.

## Higher requirements in raw gas

The requirements for continuous mercury measuring systems in raw gas are significantly higher in comparison to measuring emissions:

- Higher dust loads up in flue gas
- Higher concentrations of interference components (such as SO<sub>2</sub> or HCl)
- Accurate detection of mercury concentration peaks (Hg peaks) up to the mg range
- Fast response times to be able to react to Hg peaks.
- No carry-over effects

In the gas conditioning process, the mercury must be converted into metallic mercury safely and reliably as, if this conversion is not done correctly, this leads to results which are too low and therefore a less accurate measurement of the total mercury. At the same time, suitable processes must be implemented in order to compensate for the increased gas concentration of the cross sensitivity components. This is where an almost continuous measurement with an additional amalgamation process step is also not enough as it does not respond to possible Hg peaks quickly enough. The MERCEM300Z mercury gas analyzer from SICK offers considerable benefits thanks to its use of Zeeman absorption spectroscopy (Zeeman AAS). It is even possible to compensate for high concentrations of contaminants continuously and immediately by using this technology. The patented direct measurement enables immediate detection of Hg raw gas concentrations in the thermal converter, meaning that you can respond to fluctuating concentrations at an early stage.

For some operators, it is currently sufficient to measure the trends for Hg concentrations in the raw gas. A key factor here is the simultaneous monitoring of several plants. SICK also provides the ideal solution for this: With the optional measuring point switchover, up to two measuring points can be operated with one gas analyzer. It is possible to switch between the measuring points manually or in parametrized cycles if this is requested by the customer.

# INNOVATIVE MEASUREMENT OF MERCURY IN FLUE GASES



## Product description

The MERCEM300Z mercury measuring system monitors Hg emissions in flue gases with high reliability within the smallest measuring ranges. Due to its rugged housing, MERCEM300Z is suit-

able for use in harsh industrial environments. The complete extractive system is designed to meet national and international regulations and directives.

## At a glance

- Accurate measurement of “total mercury” directly in a thermal converter (patented)
- Measuring operation without using consumables
- Very low maintenance gas sampling using an ejector pump – no moving parts
- Integrated adjustment cell for automatic drift correction
- Automatic adjustment of the entire measuring system with a built-in test gas generator (optional)
- Modular design with the entire system

## Your benefits

- Reliable results of the actual measuring values of elemental Hg and Hg compounds in gases
- Very low operating expenses
- Minimum maintenance expenditure
- Long-term stability minimizes technician time requirements due to self-adjusting measuring system
- Measuring certainty using the fully automated adjustment with test gas
- Convenient and fast access for easy service and user-friendly remote diagnosis



## Additional information

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→ [www.mysick.com/en/MERCEM300Z](http://www.mysick.com/en/MERCEM300Z)

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.



## Fields of application

- Emission monitoring in incineration of domestic and hazardous waste
- Emission monitoring in combustion of sewage sludge or hospital waste
- Emission monitoring in cement plants
- Emission monitoring in power stations

## 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.

### System

<b>Measured values</b>	Hg
<b>Performance tested measurands</b>	Hg
<b>Measurement principles</b>	Zeeman atomic absorption spectroscopy
<b>Gas flow rate</b>	150 l/h ... 400 l/h
<b>Measuring ranges</b>	
	Hg 0 ... 1 ppb / 0 ... 100 ppb
<b>Certified measuring ranges</b>	
	Hg 0 ... 10 µg/m <sup>3</sup> / 0 ... 45 µg/m <sup>3</sup> / 0 ... 100 µg/m <sup>3</sup> / 0 ... 1,000 µg/m <sup>3</sup>
<b>Sensitivity drift</b>	< 3 % within the maintenance interval, relative to measuring range full scale
<b>Zero point drift</b>	< 3 % within the maintenance interval, relative to measuring range full scale
<b>Detection limit</b>	< 2 % relative to measuring range end value
<b>Process temperature</b>	≤ +1,300 °C
<b>Process pressure</b>	850 hPa ... 1,100 hPa
<b>Ambient temperature</b>	MERCEM300Z: -20 °C ... +50 °C MERCEM300Z Indoor: +5 °C ... +35 °C
<b>Storage temperature</b>	-20 °C ... +40 °C
<b>Ambient pressure</b>	850 hPa ... 1,100 hPa
<b>Ambient humidity</b>	≤ 80 % Relative humidity; non-condensing
<b>Conformities</b>	EN 14181 EN 15267 2001/80/EC 2000/76/EC
<b>Electrical safety</b>	CE
<b>Enclosure rating</b>	MERCEM300Z: IP 55 MERCEM300Z Indoor: IP 43
<b>Analog outputs</b>	2 outputs: 0/4 ... 20 mA, 500 Ω Electrically isolated; additional outputs if using I/O modules (option)
<b>Digital outputs</b>	4 relay contacts: 50 V, 4 A Electrically isolated; additional outputs if using I/O modules (option)
<b>Digital inputs</b>	4 inputs: 24 V, 0.3 A Electrically isolated; additional outputs if using I/O modules (option)
<b>Interfaces</b>	CAN (internal system bus) Ethernet
<b>Bus protocol</b>	Modbus TCP
<b>Indication</b>	LC display
<b>Input</b>	Functional keys
<b>Operation</b>	Via LC-display or software SOPAS ET
<b>Model</b>	Aluminium cabinet

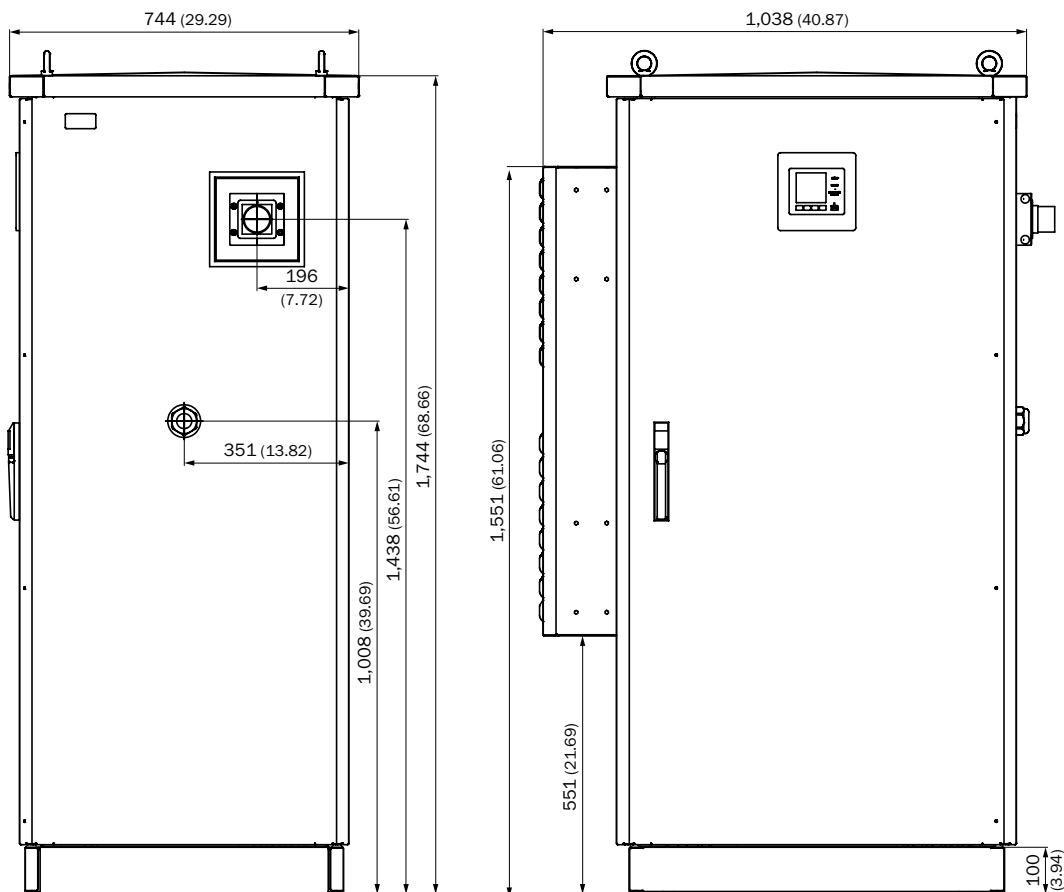
<b>Dimensions (W x H x D)</b>	1,038 mm x 1,744 mm x 744 mm (MERC300Z with cooling device) 806 mm x 2,156.5 mm x 605 mm (MERC300Z Indoor)
<b>Weight</b>	≤ ± 250 kg
<b>Power supply</b>	
Power consumption	Without integrated test gas generator ≤ 2,100 W With integrated test gas generator ≤ 3,100 W
<b>Auxiliaries</b>	
Instrument air:	≤ 2,500 l/h 6 ... 7 bar; particle size max. 1 µm; oil content max. 0.1 mg/m³; pressure dew point max. -30 °C
Test gas:	≤ 500 l/h Max. 0.5 bar; accuracy ±2%; water content 5 ... 30 vol.-%
<b>Sample connections</b>	Sample gas inlet: Swagelok 6 mm
<b>Auxiliary connections</b>	Test gas: Swagelok 6 mm Instrument air: Swagelok 10 mm Exhaust gas outlet: Swagelok 10 mm
<b>Corrective functions</b>	Internal adjustment cuvette Integrated test gas generator (option) Drift correction (QAL3) and check of the complete system
<b>Integrated components</b>	Integrated instrument air conditioning (option) Integrated test gas generator (option)

### Ordering information

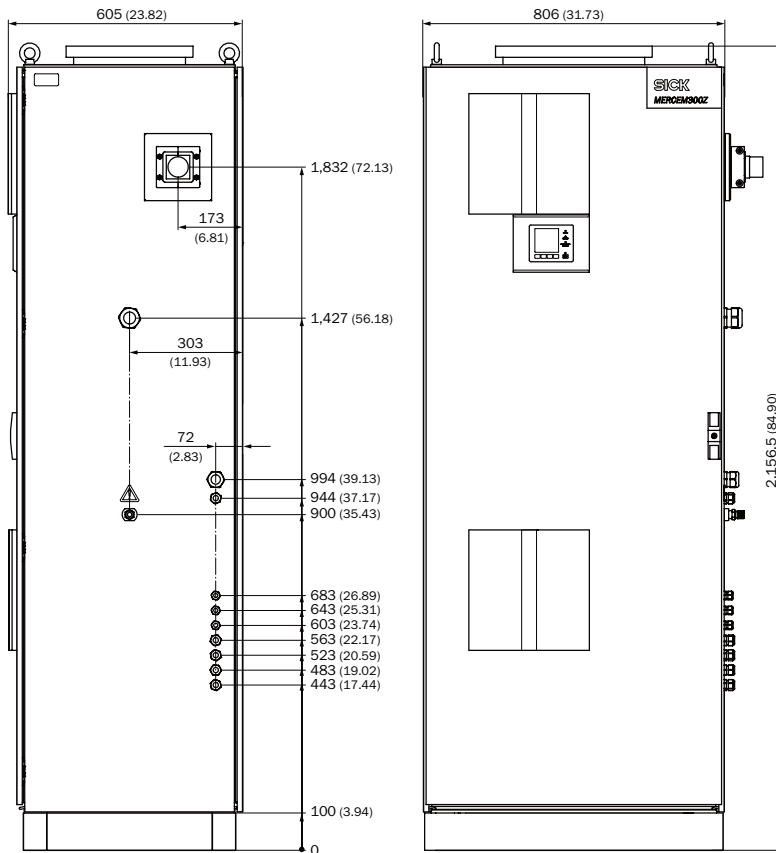
Our regional sales organization will help you to select the optimum device configuration.

### Dimensional drawings (Dimensions in mm (inch))

MERC300Z system

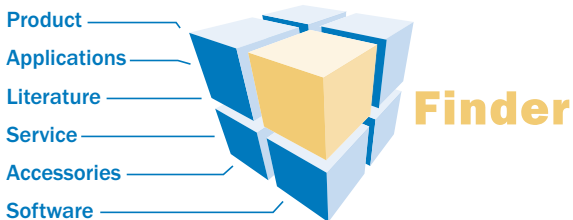


MERCEM300Z Indoor system



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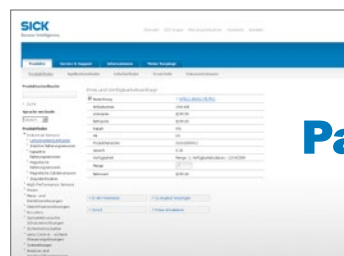
**Product Finder:** We can help you to quickly target the product that best matches your application.

**Applications Finder:** Select the application description on the basis of the challenge posed, industrial sector, or product group.

**Literature Finder:** Go directly to the operating instructions, technical information, and other literature on all aspects of products from SICK.

These and other “Finders” at → [www.mysick.com](http://www.mysick.com)

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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 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](http://www.sick.com)