

Safe Door Monitoring PLe

Safety system

SDM-PLe

SICK
Sensor Intelligence.

Described product

Safe Door Monitoring PLe

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for SICK AG. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, abridgment or translation of this document is prohibited without the express written permission of SICK AG.

The trademarks stated in this document are the property of their respective owner.

© SICK AG. All rights reserved.

Original document

This document is an original document of SICK AG.

Contents

1	Ordering information.....	5
1.1	Scope of delivery.....	5
1.2	Safe Door Monitoring PLe ordering information.....	5
2	About this document.....	6
2.1	Purpose of this document.....	6
2.2	Scope.....	6
2.3	Target groups and structure of these operating instructions.....	6
2.4	Symbols and document conventions.....	6
2.5	Further information.....	7
3	Safety information.....	8
3.1	Intended use.....	8
3.2	Requirements for the qualification of personnel.....	8
3.3	Safe state.....	8
4	Product description.....	9
4.1	Product identification.....	9
4.2	Application description.....	9
4.3	Additional components required.....	9
4.4	Components of the safety system.....	9
4.5	Limits of the safety system.....	9
4.6	Structure and function.....	10
4.7	Product characteristics.....	10
5	Project planning.....	11
5.1	Manufacturer of the machine.....	11
5.2	Operating entity of the machine.....	11
5.3	Calculating the stopping time.....	11
5.4	Reference standards.....	12
5.5	Safety Functions.....	12
5.6	Integrating the equipment into the electrical control.....	13
5.7	Testing plan.....	14
6	Mounting.....	15
7	Electrical installation.....	16
7.1	SDM-PLe electrical installation.....	16
8	Commissioning.....	17
8.1	Safety.....	17
8.2	Thorough check.....	17
9	Maintenance.....	18

10	Troubleshooting.....	19
11	Operation.....	20
12	Technical data.....	21
	12.1 Data sheet.....	21
13	Annex.....	22
	13.1 Checklist for initial commissioning and commissioning.....	22

1 Ordering information

1.1 Scope of delivery

Table 1: Safe Door Monitoring PLe scope of delivery

Component	Quantity
DM-RE1 safety switch	1
DM-I10 safety locking device	1
Operating instructions for download	www.sick.com

1.2 Safe Door Monitoring PLe ordering information

Table 2: Safe Door Monitoring PLe ordering information

	Type	Part number
Safe Door Monitoring PLe	SDM-PLe	1097225

2 About this document

2.1 Purpose of this document

These operating instructions contain the information required during the life cycle of the safety system. This document describes:

- The individual components
- The project planning
- The mounting and electrical installation, insofar as special measures are necessary for the safety system
- The necessary thorough checks
- The commissioning
- The maintenance
- The troubleshooting

2.2 Scope

These operating instructions contain information regarding the Safe Door Monitoring PLe safety system.



NOTICE

The operating instructions of the components also apply. In the event of contradictions between the operating instructions, the information specified in the operating instructions for the safety system applies.

The relevant information must be made available to the employees for all work performed on the safety system.

The following documents contain information regarding the Safe Door Monitoring PLe safety system:

Table 3: Documents available for Safe Door Monitoring PLe

Document type	Title	Part number
Operating instructions	RE1 DM-RE1	8022123
Operating instructions	i10 Lock DM-I10	8022124

This document is included with the following SICK part numbers (this document in all available language versions):

8023303

2.3 Target groups and structure of these operating instructions

These operating instructions are intended for the following target groups: project developers (planners, developers, designers), installers, electricians, operators, and maintenance personnel.

These operating instructions are organized by the life phases of the safety system: project planning, mounting, electrical installation, commissioning, operation and maintenance.

2.4 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes and other notes

**DANGER**

Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

**WARNING**

Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

**CAUTION**

Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

**NOTICE**

Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

**NOTE**

Indicates useful tips and recommendations.

Instructions to action

- ▶ The arrow denotes instructions to action.
- 1. The sequence of instructions for action is numbered.
- 2. Follow the order in which the numbered instructions are given.
- ✓ The check mark denotes the result of an instruction.

2.5 Further information

www.sick.com

The following information is available via the Internet:

- This document in other languages
- Operating instructions and installation instructions of SICK components suitable for the safety system
- Example project data for SISTEMA for this safety system
- Guide for Safe Machinery (“Six steps to a safe machine”)

3 Safety information

3.1 Intended use

The Safe Door Monitoring PLe safety system is used in testing/inspection machines for which all the following features apply:

- The separation of man and machine by a physical guard (e.g., machine housing) is the primary safety concept.
- Access to dangerous areas is only possible through a movable physical guard (e.g., sliding door).
- Neither people nor body parts can be situated in the hazardous area when the access opening is closed (presence detection or protection against reaching around).
- The access opening has a maximum size of 600 mm × 1,500 mm.
- Each access opening is secured with its own safety system.
- The stopping time of the machine is short enough to ensure that the dangerous state which is present when the movable physical guard is opened comes to an end before it is possible to reach the hazardous area.

Safe Door Monitoring PLe is used to protect people.

3.2 Requirements for the qualification of personnel

The protective device must be configured, installed, connected, commissioned, and serviced by qualified safety personnel only.

Project planning

For project planning, a person is considered competent when he/she has expertise and experience in the selection and use of protective devices on machines and is familiar with the relevant technical rules and national work safety regulations.

Mechanical mounting, electrical installation, and commissioning

For the task, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine to be able to assess whether it is in an operationally safe state.

Operation and maintenance

For operation and maintenance, a person is considered competent when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine and has been instructed by the machine operator in its operation.

3.3 Safe state

When the machine is in the safe state, the safety contacts are open. The safe state is initiated in the following cases:

- The movable physical guard is opened.

When the safety system initiates the safe state or the logic unit detects an error in the safety system, e.g. cross-circuit between the signals, the machine manufacturer and user must ensure that the safety contacts are evaluated appropriately and that the hazard is rectified.

4 Product description

4.1 Product identification

The part number of the safety system is located on the packaging.

Further topics

- ["Ordering information", page 5](#)

4.2 Application description

The Safe Door Monitoring PLe safety system is used on stationary machines to reduce the risk of someone being injured.

The safety system is used so that people can reach safely through the access opening of the machine.

The Safe Door Monitoring PLe safety system also features a locking function for process protection.

4.3 Additional components required

The following additional components are essential for using the Safe Door Monitoring PLe safety system in an application:

- Safe logic unit, e.g. a safety controller
- Actuator for ending the dangerous state
- M12 male connector, ready to assemble, 8-pin



NOTE

All necessary components influence the parameters of the entire application that relate to safety technology. The components must therefore have an $MTTF_D$ value suitable for the entire application and satisfy the necessary performance level.

4.4 Components of the safety system

- DM-RE1 safety switch
- DM-I10 safety locking device

Implementing all the safety functions for the application requires a complete system consisting of sensors, a controller, actuators, and control switches. This safety system consists of sensors only and is therefore only a subsystem. The user is responsible for the safe design of the complete system and all safety functions.

4.5 Limits of the safety system

The safety system ends at all inputs and outputs that are not used to wire the components of the safety system.

Further topics

- ["SDM-PLe circuit diagram", page 13](#)

4.6 Structure and function



DANGER

Hazard due to lack of effectiveness of the protective device

The Safe Door Monitoring PLe safety system also is only a subsystem for a complete safety function. It cannot be used without additional components.

- ▶ Plan other components, in particular a safe logic unit (e.g. a safety controller) and suitable actuators.
-

If the movable physical guard is opened or closed, this does not automatically cause the safety system signal to change. The signal has to be evaluated from a safe logic unit and the machine must be switched into a safe state as soon as the movable physical guard opens.

As soon as all work in the hazardous area is complete and the movable physical guard is closed, the machine can be restarted.

The movable physical guard can be locked by a signal from the higher-level control. The locking device is not monitored during this process and is used for process protection (not safe).

4.7 Product characteristics

4.7.1 Locking principle

Operating current locking principle

- Locking the locking device: apply voltage to magnet
- Unlocking the locking device: disconnect voltage from magnet

If voltage is disconnected at the magnet, the locking device is unlocked and the protective device can be opened immediately.



DANGER

Hazard due to lack of effectiveness of the protective device

In the event of a voltage drop, the safety locking device unlocks regardless of whether the dangerous state of the machine has ended.

- ▶ Do not use the locking device for personal protection. It is designed solely for process protection.
-

5 Project planning

5.1 Manufacturer of the machine



DANGER

Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ▶ Use of the safety system requires a risk assessment. Check whether additional protective measures are required.
- ▶ Comply with the applicable national regulations derived from the application (e.g., work safety regulations, safety rules, or other relevant safety guidelines).

The safety system was developed under consideration of typical application cases. A partial safety function can be implemented with the safety system in these application cases. The manufacturer must check whether the safety system is suitable for its specific application case (risk assessment).

If the thorough check shows that the safety system is not suitable for the specific application case, the safety system can be used as a basis for an individualized development suitable for the specific application case. This case will not be considered further in this document.

In any event, additional work is necessary for the safety system to be used, e.g. subsequent configuration of the safety controller.

The manufacturer has the following duties:

- ▶ Executing a risk assessment.
- ▶ Verifying and validating the safety functions.
- ▶ Integrating the individual components in accordance with the appropriate standards.
- ▶ Please note that C standards have priority compared to statements about this safety system.

5.2 Operating entity of the machine



DANGER

Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ▶ Changes to the electrical integration of the safety system in the machine control and changes to the mechanical mounting of the safety system necessitate a new risk assessment. The results of this risk assessment may require the entity operating the machine to meet the obligations of a manufacturer.
- ▶ Changes to the safety system's configuration may impair the protective function. The effectiveness of the safety system must be checked after any change to the configuration. The person carrying out the change is also responsible for maintaining the protective function of the safety system.

5.3 Calculating the stopping time

Stopping time $T_{\text{stop time}}$ is calculated based on total safety application response time T_{response} and machine delay time $T_{\text{deceleration}}$.

$$T_{\text{stop time}} = T_{\text{response}} + T_{\text{deceleration}}$$

Total safety application response time T_{response} is based on the sum of the response times of the individual subsystems of the safety application.

$$T_{\text{response}} = T_{\text{sensor}} + T_{\text{safety controller}} + T_{\text{relay/contactors}}$$

The response time of the Safe Door Monitoring PLe safety system corresponds to response time T_{sensor} . The T-connector does not affect the response time.

Formula	Meaning
T_{sensor}	Safe Door Monitoring PLe response time 0 ms
$T_{\text{safety controller}}$	Depending on components selected
$T_{\text{relay/contactors}}$	Depending on components selected
$T_{\text{deceleration}}$	Time period between the safety relay or the safe digital output signal switching devices dropping out and the dangerous state coming to an end (application-dependent).

5.4 Reference standards

- ISO 13849-1 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- ISO 13849-2 Safety of machinery – Safety-related parts of control systems – Part 2: Validation
- IEC 60204-1 Safety of machinery – Electrical equipment of machines – Part 1: General requirements
- ISO 13857 Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs
- ISO 13855 Safety of machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body
- ISO 14119 Safety of machinery – Interlocking devices associated with guards – Principles for design and selection

5.5 Safety Functions

5.5.1 Initiating a stop

Important information



DANGER

The safety function is only effective if the Safe Door Monitoring PLe is combined with additional components!

Description of the safety function

A safety-related stop function places the machine in a safe state on demand (e.g., opening of the movable physical guard).

This safety function consists of the following sub-functions:

- The state of the movable physical guard is monitored.
- The state of the external devices connected via external device monitoring (EDM) is monitored

Table 4: Initiating a stop

Trigger	Movable physical guard opens
---------	------------------------------

Reaction	The safety contacts of the Safe Door Monitoring PLe are open. The safe logic unit processes the signal from the Safe Door Monitoring PLe so that the actuators switch the machine to the safe state.
Safe state	No dangerous movement

Table 5: Expected frequency for requests of the safety function

2,160 times per day (every 40 s)	Replacement of the test material
Total	
788,400 times per year	Request for the safety function



NOTE

The expected frequency of the safety function request influences the SISTEMA calculation. If other frequencies are to be expected – more frequent requests in particular – the SISTEMA calculation must then be adjusted accordingly.

5.6 Integrating the equipment into the electrical control



NOTE

Several safety functions are generally necessary in order to ensure a safe design for the entire application. This requires additional components that are not part of the safety system, such as switches, fuses, and contactors.

5.6.1 SDM-PLe circuit diagram

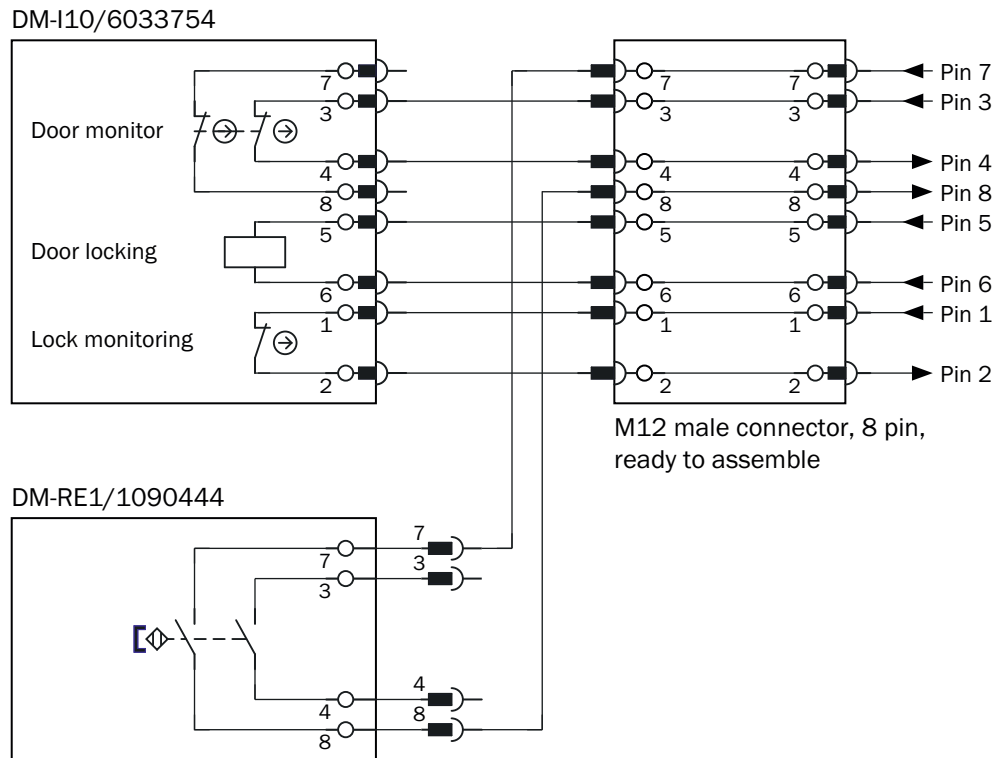


Figure 1: SDM-I10 circuit diagram

Table 6: System connection pin assignment

Pin	Marking	Description
1	+24 V DC	Voltage supply 24 V DC
2	“Door locked” signal	Output. HIGH signal level (24 V) indicates that the reset pushbutton has been activated.
3	X1 test pulse	Test pulse input 1
4	Input channel 1	Safety contact 1 (tested with test pulse input 1)
5	“Activate locking” signal	Input This signal can be used to control the lock of the DM-I10. Lock is activated at signal level HIGH (24 V).
6	0 V DC	Voltage supply 0 V DC
7	X2 test pulse	Test pulse input 2
8	Input channel 2	Safety contact 2 (tested with test pulse input 2)

X1 and X2 are 2 isolated 24-V test pulse canals. The test pulses must come from the same safety controller which also evaluates the input channel 1 and input channel 2 signals. The current on channels X1 and X2 must be limited by the safety controller or other measures (e.g. fuse).

5.7 Testing plan

The safety system must be thoroughly checked by appropriately qualified safety personnel during commissioning, after changes at regular intervals.

The regular thorough checks serve to assess the effectiveness of the safety system and to identify defects as a result of changes or other influences (e.g., damage or manipulation).

The manufacturer and user must define the type and frequency of the thorough checks on the basis of the application conditions and the risk assessment. Determination of the thorough checks must be documented in a traceable manner.

- A thorough check must be carried out during commissioning and following modifications.
- The regular thorough checks of the safety system must fulfill certain minimum requirements. The minimum requirements for the thorough check of the safety system comply at least with the sum of the minimum requirements for the thorough check of the components of the safety system (see operating instructions of the components).
- In many cases, depending on the application conditions, the risk assessment can determine that further thorough checks are required.

Further chapters

- Thorough check, [see "Commissioning", page 17](#)
- Checklist for initial commissioning and commissioning, [see "Annex", page 22](#)

6 Mounting

Important information



NOTICE

Incorrect mounting and unsuitable ambient conditions may damage the safety switch.

- ▶ Arrange the sensor and actuator in a way that prevents damage from foreseeable external influences.
 - ▶ Do not use the sensor and actuator as a stop.
 - ▶ The holder and mounting method for the sensor and actuator must be stable enough to ensure that correct operation can take place.
 - ▶ Always use reliable mounting elements that can only be removed using tools.
 - ▶ If misalignment results in an opening on the physical guard, this must not impair the protection that is provided.
-

Approach



NOTE

Information is included in the operating instructions for the components.

7 Electrical installation

7.1 SDM-PLe electrical installation

Prerequisites

For the electrical installation, observe the following:

- All connections must comply with the requirements of the selected category according to ISO 13849 (e.g., protected cable laying or shielded cable sheaths).
- OSSDs and external device monitoring (EDM) must be wired inside the control cabinet.
- The control cabinet and the wiring it contains must meet the requirements of IEC 60204.

Approach

1. Interconnect the components as follows:

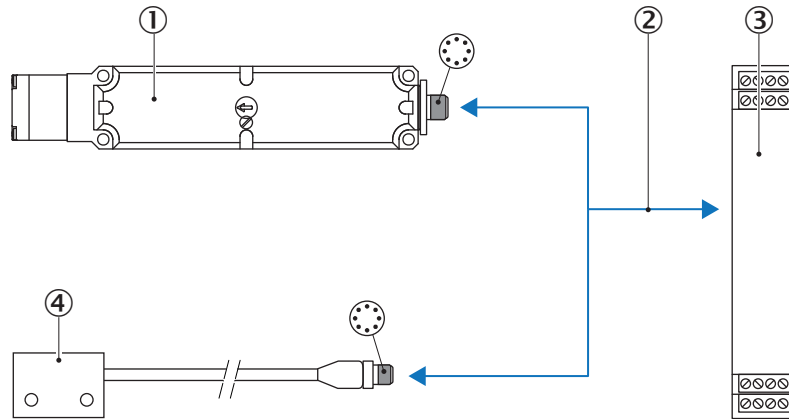


Figure 2: Safe Door Monitoring PLe electrical installation

- ① DM-I10
- ② Connection to the safe logic unit must be done by the customer.
- ③ Safe logic unit
- ④ DM-RE1

Complementary information



NOTE

Additional information is included in the operating instructions for the components.

Further topics

- ["SDM-PLe circuit diagram", page 13](#)

8 Commissioning

8.1 Safety



DANGER

Hazard due to lack of effectiveness of the protective device

- ▶ Before commissioning the machine, make sure that the machine is first checked and released by qualified safety personnel.
- ▶ Only operate the machine with a perfectly functioning protective device.



DANGER

Dangerous state of the machine

During commissioning, the machine or the protective device may not yet behave as you have planned.

- ▶ Make sure that there is no-one in the hazardous area during commissioning.

Before commissioning can be performed, project planning, mounting, electrical installation and configuration must be completed in accordance with this document.

8.2 Thorough check

Requirements for the thorough check during commissioning and in certain situations

The safety system and its application must be thoroughly checked in the following situations:

- Before commissioning
- After changes to the configuration or the safety function
- After changes to the mounting or the electrical connection
- After exceptional events, such as after a manipulation has been detected, after modification of the machine, or after replacing components

The thorough check ensures the following:

- All relevant regulations are complied with and the safety system is effective in all of the machine's operating modes
- The documentation corresponds to the state of the machine, including the protective device

The thorough checks must be carried out by qualified safety personnel or specially qualified and authorized personnel and must be documented in a traceable manner.

1. Effectiveness of the protective device for all operating modes selectable on the machine in accordance with the checklist for initial commissioning and commissioning (see "Annex", page 22).
2. Make sure that the operating personnel has been instructed in the function of the protective device before starting work on the machine. The instruction is the responsibility of the machine operator and must be carried out by qualified personnel.

9 Maintenance

Service life of safety locking device

Based on a cycle time of 40 s (788,400 actuations per year), the DM-I10 safety locking device has a T_{10D} value of 3.8 years. The safety locking device must therefore be replaced after no more than 3.8 years.



NOTE

Information is included in the operating instructions for the components.

Further topics

- ["Initiating a stop", page 12](#)

10 Troubleshooting

**NOTE**

Information is included in the operating instructions for the components.

11 Operation

Operation is dependent on integration of the safety system into the application.

12 **Technical data**

12.1 **Data sheet**

**NOTE**

Information is included in the operating instructions for the components.

13 Annex

13.1 Checklist for initial commissioning and commissioning

This checklist should be retained and kept with the machine documentation to serve as reference during recurring thorough checks.

This checklist is not a substitute for initial commissioning or periodic thorough checks by qualified safety personnel.

Test for “Initiating a stop” safety function

Table 7: Test for “Initiating a stop standstill” safety function

Test sequence	Expected result	Result OK?
1. Open movable physical guard.	The safety outputs of the evaluating safe logic unit switch to the OFF state. The machine stops.	Yes <input type="checkbox"/> No <input type="checkbox"/>
Comments:		

Test for restarting the machine

Table 8: Test for restarting the machine

Test sequence	Expected result	Result OK?
1. Close movable physical guard.	The machine starts or can be started.	Yes <input type="checkbox"/> No <input type="checkbox"/>
Comments:		

Test for locking function

Table 9: Test for locking function

Test sequence	Expected result	Result OK?
1. Set the signal level of the “activate locking” signal to HIGH.	The movable physical guard is locked by the DM-I10 safety locking device and can no longer be opened.	Yes <input type="checkbox"/> No <input type="checkbox"/>
Comments: This test is not safety-relevant. The test checks for the following: <ul style="list-style-type: none"> • Safety system is connected properly. • Lock function for process protection is working. 		

Australia

Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria

Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg

Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil

Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada

Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic

Phone +420 2 57 91 18 50
E-Mail sick@sick.cz

Chile

Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China

Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark

Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland

Phone +358-9-25 15 800
E-Mail sick@sick.fi

France

Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany

Phone +49 (0) 2 11 53 01
E-Mail info@sick.de

Hong Kong

Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary

Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India

Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel

Phone +972-4-6881000
E-Mail info@sick-sensors.com

Italy

Phone +39 02 27 43 41
E-Mail info@sick.it

Japan

Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia

Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico

Phone +52 (472) 748 9451
E-Mail mario.garcia@sick.com

Netherlands

Phone +31 (0) 30 229 25 44
E-Mail info@sick.nl

New Zealand

Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway

Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland

Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania

Phone +40 356-17 11 20
E-Mail office@sick.ro

Russia

Phone +7 495 283 09 90
E-Mail info@sick.ru

Singapore

Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia

Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia

Phone +386 591 78849
E-Mail office@sick.si

South Africa

Phone +27 (0)11 472 3733
E-Mail info@sickautomation.co.za

South Korea

Phone +82 2 786 6321
E-Mail info@sickkorea.net

Spain

Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden

Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland

Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan

Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand

Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey

Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates

Phone +971 (0) 4 88 65 878
E-Mail info@sick.ae

United Kingdom

Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA

Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam

Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Further locations at www.sick.com

