



Safety Interlocking Switch GS (Lock) Instruction Manual



Detailed information and use of the GS (Lock) is also described in the "GS (Lock) User's manual". In order to acquire the "GS (Lock) User's manual", download it from the KEYENCE website or call the nearest KEYENCE office. <KEYENCE website> www.keyence.com/global.jsp

This manual explains items such as the handling, operation, and precautions for the Safety Interlocking Switch GS (Lock). Read this manual carefully and thoroughly understand its contents to use the GS (Lock) to the full extent of its capabilities.

Also, keep this manual in a safe place for future reference. Ensure that the end user of this product receives this manual.

This manual is the original instruction manual.

Symbols

	It indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	It indicates a situation which, if not avoided, could result in product damage as well as property damage.
	It indicates cautions and limitations that must be followed during operation.
	It indicates additional information on proper operation.
	It indicates tips for better understanding or useful information.

Safety Precautions

General precautions

	<ul style="list-style-type: none"> KEYENCE does not guarantee the function or performance of the GS (Lock) if it is used in a manner that differs from the GS (Lock) specifications contained in this manual or if the GS (Lock) is modified by the customer. The GS (Lock) can only be used in combination with dedicated actuators. It cannot be used in combination with other actuators or similar devices. Do not bypass the GS (Lock), remove it or change its installation orientation after installation. Do not use a replacement actuator to bypass the GS (Lock). Store replacement actuators strictly to prevent their easy access. When using the GS (Lock) to protect machine operators against a hazard or hazardous zone or when using the GS (Lock) as a safety component for any purpose, always follow the applicable requirements of the laws, rules, regulations and standards in the country or region where the GS (Lock) is used. For such regulations, you should directly contact the regulatory agency responsible for occupational safety and health in your country or region. Depending on the type of machine on which the GS (Lock) is installed, there may be special safety regulations related to the use, installation, maintenance, and operation of the safety component. In such a case, you must fulfill such safety regulations. The responsible personnel must install the GS (Lock) in strict compliance with such safety regulations. The responsible personnel must do the training to the assigned personnel for the correct use, installation, maintenance, and operation of the GS (Lock). The user of the machine must receive specialized training related to the GS (Lock), and must then understand and adhere to the safety restrictions, laws, and regulations in the country or area in which the GS (Lock) is being used. If the GS (Lock) does not operate correctly, the user of the machine must report this information to the party responsible for the use of the GS (Lock) and immediately stop the machine. The GS (Lock) is designed with the assumption that it would be correctly installed in accordance with the installation procedures described in this manual and correctly operated according to the instructions in this manual. You must perform an appropriate installation of the GS (Lock) after performing a sufficient risk assessment for the target machine. Be sure to absolutely confirm that there is nobody in the hazardous zone, before you remove the GS (Lock) from the machine for replacement or disposal. Machine builder must consider the time the machine with inertia takes to stop.
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Important

- When disposing of the GS (Lock), always follow the applicable requirements of the laws, rules, regulations and standards in the country or region where the GS (Lock) is used.
- Dispose of this product as industrial waste.

Environment of use

	<ul style="list-style-type: none"> Do not use the GS (Lock) in an environment (temperature, humidity, interfering light, etc.) that does not conform to the specifications contained in this manual. Do not use a device that emits strong electromagnetic waves near the GS (Lock). This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere. Do not use the GS (Lock) in the presence of substances, such as heavy smoke, particulate matter, or corrosive chemical agents, that may induce deterioration in product quality. Be sure to absolutely confirm that there is nobody in the hazardous zone, before the interlock is released (i.e. the machine system restarts) by the interlock reset mechanism. Indoor use only.
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Target machines for installation

	<ul style="list-style-type: none"> It must be possible to perform an emergency stop on the machine to which the power-to-lock type GS (Lock) is installed at any and all operation points during the operation cycle. Also, do not use the power-to-lock type GS (Lock) on machines that have irregular stop times. Do not use the GS (Lock) to control (stop forward motion, etc.) trains, cars and other transportation vehicles, aircraft, equipment for use in space, medical devices, or nuclear power generation systems.
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Circuit design and wiring

	<ul style="list-style-type: none"> Be sure to turn the power supply off before performing electrical wiring. Perform electrical wiring according to the electrical standards, regulations and laws in the country or area in which the GS (Lock) will be used. Use cables with length less than or equal to the specification in this manual. Usage of cables longer than the specified length may cause the improper operation of safety functions and may cause a dangerous situation.
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Precautions on Regulations and Standards

CE Marking

KEYENCE Corporation has confirmed that this product complies with the essential requirements of the applicable EU Directive(s), based on the following specifications. Be sure to consider the following specifications when using this product in the Member States of European Union.

- Machinery Directive
- RE Directive

The GS (Lock) is a safety component defined in the EU Machinery Directive Annex V and has been certified by TÜV SÜD Product Service GmbH. The GS (Lock) complies with the following EN Standards.

- EN 61508
- EN 62061
- EN ISO 13849-1
- EN ISO 14119
- EN 60947-5-3
- EN 300 330

The full text of the EU declaration of conformity is available at the following internet address: <http://www.keyence.com/cedoc>

- Frequency band of operation 123kHz
- Maximum radio-frequency power 60 dBµV/m

These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of RE and Machinery Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to these Directives.

CSA Certificate and North American Regulations

The GS (Lock) complies with the following UL and CSA standards and regulations, and has received CSA certification.

Applicable standards:

- CAN/CSA C22.2 No. 61010-1
- UL61010-1

Be sure to consider the following specifications when using this product as a product certified by CSA.

- Overvoltage category II
- Pollution degree 3
- Install this product at the altitude of 2000 m or less.
- Indoor use only.
- When using this product, use the following power supply. CSA or UL certified power supply that provides Class 2 output as defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code).

Applicable standard:

- FCC Part15 Subpart B, Class A Digital Device
- FCC Part15 Subpart C
- ICES-003, Class A Digital Apparatus
- RSS-210

This device complies with part 15 of FCC Rules and Innovation, Science and Economic Development Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme à la partie 15 des règles de la FCC et aux normes des CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'appareil doit accepter tout brouillage subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

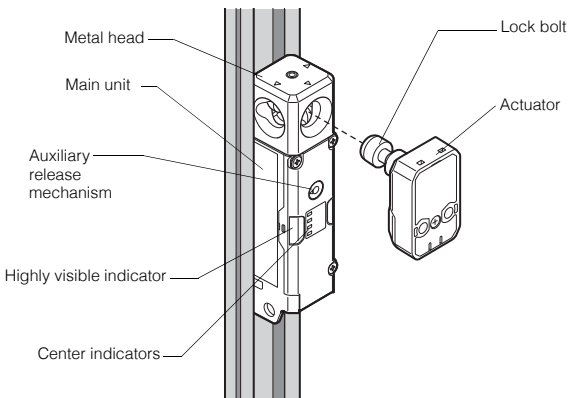
Chapter 1 Before Operation

1-1 Overview and Configuration

The GS (Lock) is a Type4 Interlocking Device with guard lock based on ISO14119.

- Coding level: Low or high (switchable)
- "4-7 Coding Level" (page 7)

By combining the GS (Lock) with a door or similar movable safety guard and with a safety-related control system, it is possible to prevent the door or similar part from opening during hazardous machine operations.



Reference The GS (Lock) can also be used for other purposes such as protecting manufacturing processes.

1-2 Product List

Main unit

For details on the main unit models, see "5-1 Model Number Description" (page 7).

M12 connector type cables

Standard cables

Use this cable in combination with a main unit (connector type) or extension cable.

Type	Model	Number of pins	Length
Standard	GS-P8C5	8	5 m
	GS-P8C10		10 m
Advanced function	GS-P12C5	12	5 m
	GS-P12C10		10 m
	GS-P12C20		20 m

Extension cables

Type	Model	Number of pins	Length
Standard	GS-P8CC1	8	1 m
	GS-P8CC5		5 m
	GS-P8CC10		10 m

Mounting brackets

- For main unit and actuator set**
GS-B21
- For actuator**
GS-B31, GS-B33, GS-B41, GS-B43

Optional parts

- Replacement actuator**
GS-A21

1-3 Package Contents

Main unit

- Sensor (main unit)
- Actuator
- Instruction Manual

Chapter 2 Installation

2-1 Installation Conditions

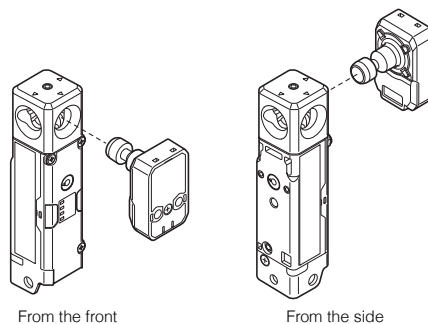
Note the following items before installation.

The effect of surrounding metal

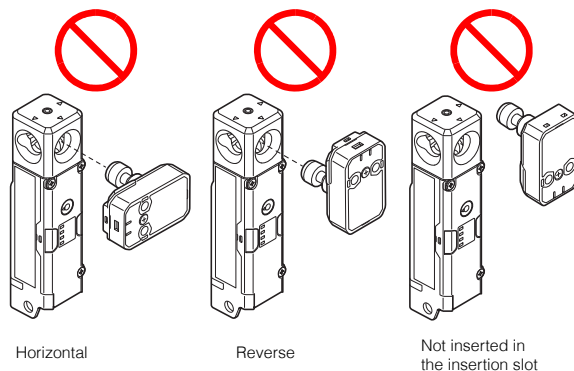
DANGER The sensor's operating distance may be affected by the presence of metal in the surrounding area. After installation, determine the minimum safety distance based on the actual operating distance and check if it is provided appropriately.

Sensor and actuator orientation

Correct installation orientations



Incorrect installation orientations



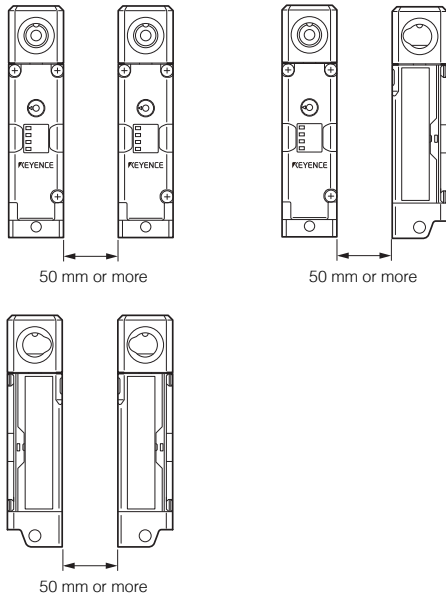
DANGER

- Install the GS (lock) so that the lock bolt inserts securely into the sensor's insertion slot when the door or similar object to which the actuator is installed is closed.
- Do not use the GS (Lock) as a mechanical stopper.

■ Mutual interference

When using multiple GS (Lock) units in close proximity, they may malfunction due to mutual interference. To prevent mutual interference, install the GS (Lock) units as shown below.

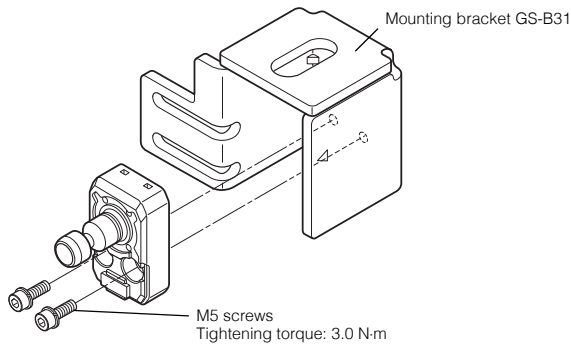
Distance between sensors



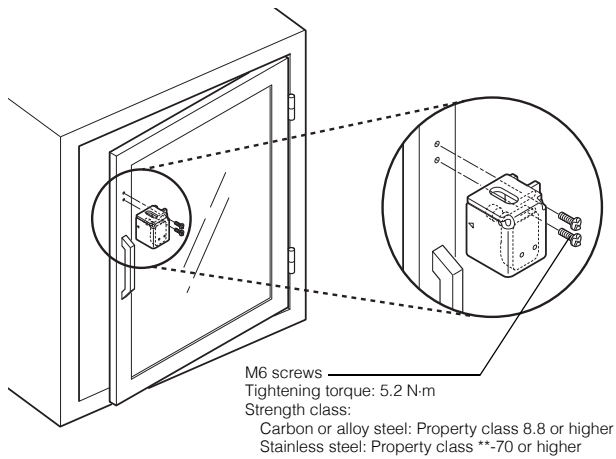
2-2 Installation Method

■ Installing the unit on a hinged door

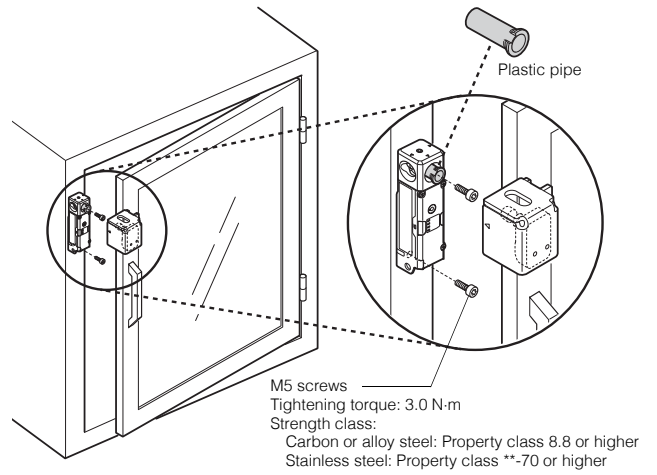
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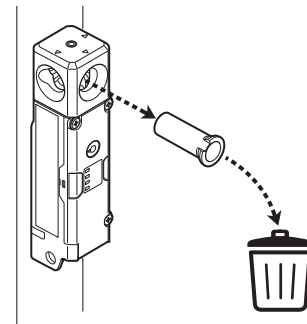
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3 To support the installation of screw, a plastic pipe is pre-inserted to the insertion slot in the metal head. Insert a screw into this pipe to smoothly set the screw in appropriate position.

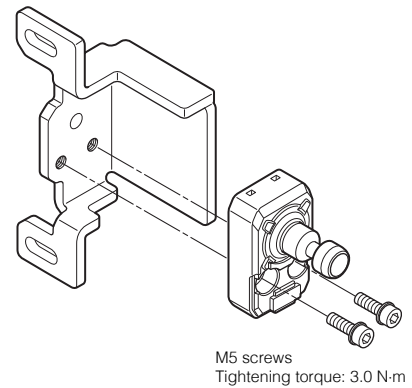


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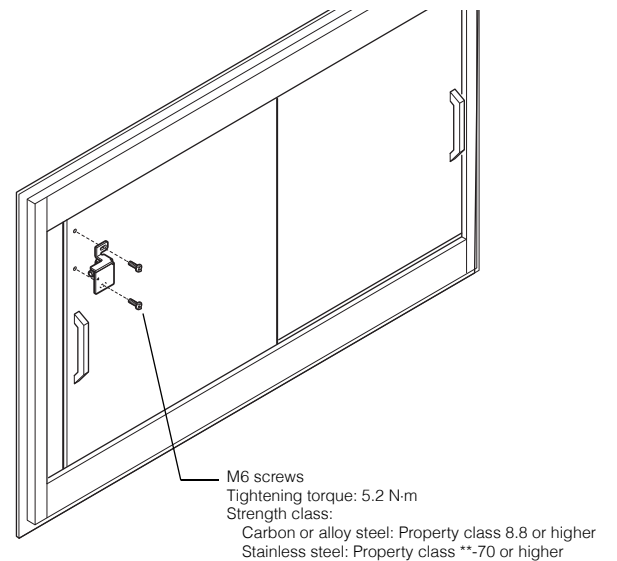


■ Installing the unit on a sliding door

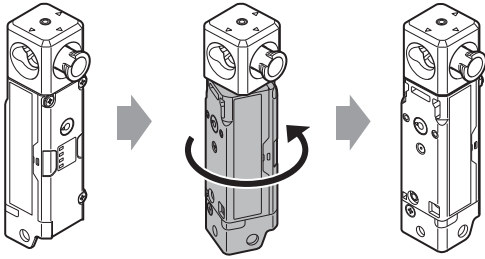
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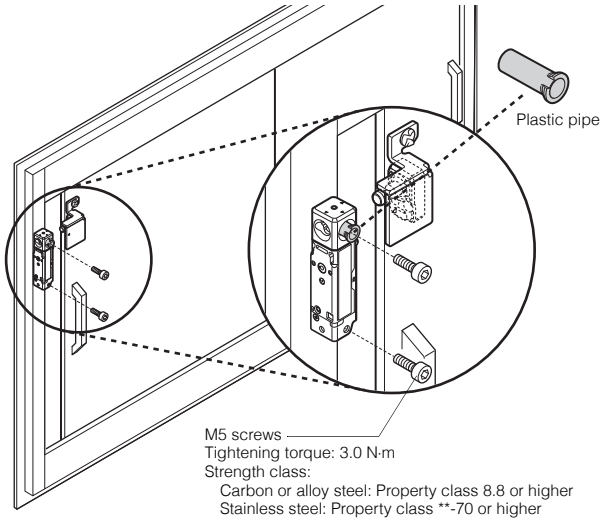
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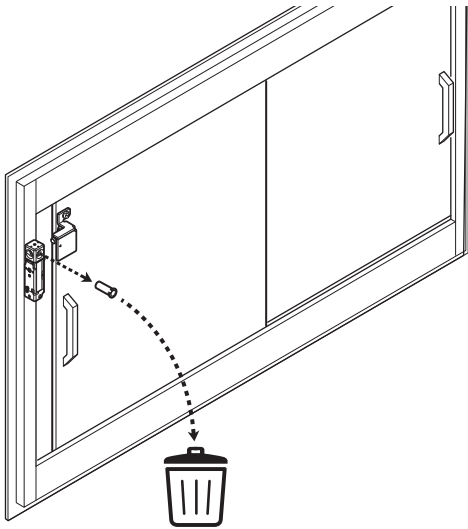
3



4 To support the installation of screw, a plastic pipe is pre-inserted to the insertion slot in the metal head. Insert a screw into this pipe to smoothly set the screw in appropriate position.



5



- To minimize defeat possibilities, GS (Lock) should be installed in a position where the accessibility to GS (Lock) is prevented (e.g. mounting out of reach, physical obstruction or shielding or mounting in hidden position), otherwise use non-detachable fixing to prevent dismantling or de-positioning of GS (Lock) (e.g. Using a flat head screw and plugging the slot on the screw head with a high-strength threadlocker after tightening the screw or other equivalent fixing system). Refer ISO 14119 for more information to minimize defeat possibilities.
- Securely tighten the screws for the sensor, actuator, and mounting brackets according to the specified tightening torques.
- To prevent self-loosening, use screw locker on the screws fixing the GS (Lock).
- If the dedicated bracket is not appropriate, please contact nearest KEYENCE office.

⚠ DANGER

Reference

- When replacing the sensor or actuator, do so by following the same procedure.
- The appropriate screws to mount the main unit and the bracket must be purchased separately.

2-3 Cascade Connection Between Units

Multiple GS (Lock) and GS (Non-contact) units can be connected in series (in a cascade connection). This makes it possible to monitor the opening and closing of multiple doors or similar items on the same machine. For the wiring method, see "Cascade connection wiring example".

Chapter 3 Wiring

3-1 Power Supply

If the power supply for the GS (Lock) is the converting type, the power supply for the GS (Lock) must meet the conditions listed below in order to meet the requirements specified in ISO 14119, IEC 60947-5-3, UL 61010-1, and CAN/CSA-C22.2 No. 61010-1.

- The rated output voltage is within 24 V DC $\pm 20\%$ (Ripple P-P 10 % or less, Class2, SELV, Overvoltage category II).
- The insulation between the primary and secondary circuits is reinforced or double insulation.
- The power supply complies with the laws, regulations, and standards related to items such as electrical safety and electromagnetic compatibility (EMC) in the country or area in which the GS (Lock) will be used.

▶ Important

When the power supply used with the GS (Lock) is shared with other machines or electrical products, the voltage supplied to the GS (Lock) may drop due to temporary increases in the current consumption of these other machines and the GS (Lock) may also be affected by the noise generated by these other machines. Errors or other such problems may occur with the GS (Lock) in this situation, so it is strongly recommended to avoid sharing the power supply of the GS (Lock) with other machines or electrical products.

3-2 Cable Wire Colors and Functions

Standard type (loose wires or M12 connector, 8 pins)

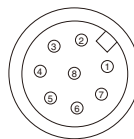
Pin number	Wire color	Function
1	Gray	AUX output
2	Brown	+24 V
3	Light blue	Lock control input
4	Red/white	Safety input 2
5	Black	OSSD1
6	White	OSSD2
7	Blue	0 V
8	Red/black	Safety input 1

Advanced function type (M12 connector, 12 pins)

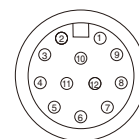
Pin number	Wire color	Function		
		Power-to-release	Power-to-lock	Open/close link mode
1	Brown	+24 V	+24 V	+24 V
2	Red/black	Safety input 1	Safety input 1	Safety input 1
3	Blue	0 V	0 V	0 V
4	Black	OSSD1	OSSD1	OSSD1
5	Gray	AUX output 1	AUX output 1	OSSD operation switching input 2
6	Red/white	Safety input 2	Safety input 2	Safety input 2
7	White	OSSD2	OSSD2	OSSD2
8	Pink	Interlock/ EDM selection input	Interlock/ EDM selection input	Interlock/ EDM selection input
9	Gray/black	AUX output 2	AUX output 2	AUX output 2
10	Light blue	Lock control input 1	Lock control input 1	Lock control input 1
11	Yellow	Reset/EDM input	Reset/EDM input	Reset/EDM input
12	Light blue/black	Lock control input 2	OSSD operation switching input 1	OSSD operation switching input 1

Pin layout (Main unit, M12 connector type)

Standard type (M12, 8 pins, male)



Advanced function type (M12, 12 pins, male)



3-3 Wiring Example

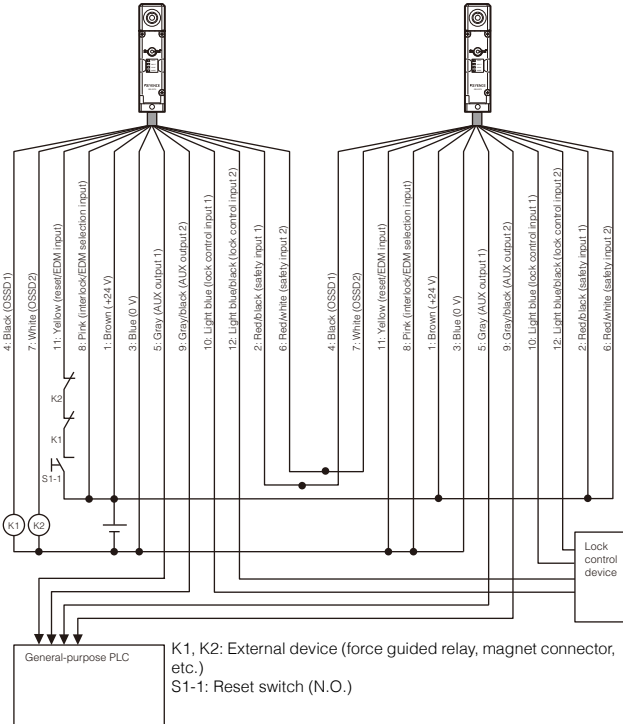
■ Cascade connection wiring example

Wire the safety inputs of a GS (Lock) to the OSSDs of the next GS (Lock) or GS (Non-contact) to implement a cascade connection.

- "4-1 OSSD" (page 5)
- "4-2 Safety Input" (page 6)

1st unit
GS (Lock)
PNP output
Advanced function type
Power-to-release type
Interlock: Manual
EDM: Use
Cascade connection: Yes

2nd unit
GS (Lock)
PNP output
Advanced function type
Power-to-release type
Interlock: Automatic
EDM: Do not use
Cascade connection: No



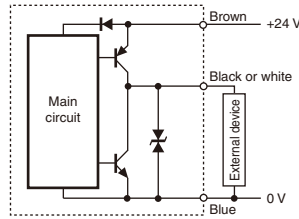
■ Cable length and number of connected units

A: Maximum cable length	30.3 m
B: Maximum number of connected units	25

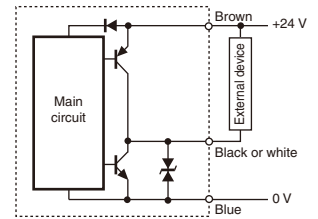
Contact KEYENCE for the maximum number of connected units when using a cascade connection that also includes GS (Non-contact) units.

3-4 I/O Circuit Diagrams

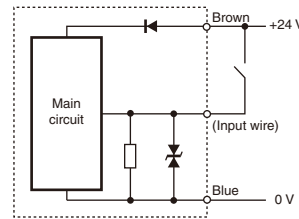
Output circuit (PNP type)



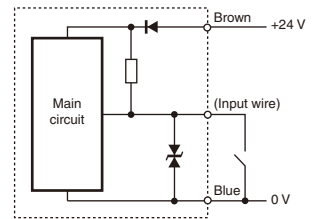
Output circuit (NPN type)



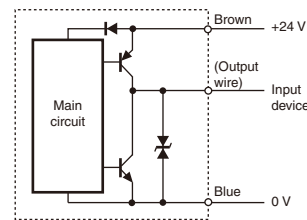
Input circuit (PNP type)



Input circuit (NPN type)



AUX output circuit (PNP/NPN common)



Chapter 4 Functions

The functions that can be used with the GS (Lock) vary depending on the model of the main unit (standard type/advanced function type, Power-to-release type/Power-to-lock type).

	Standard type		Advanced function type	
	8	12	8	12
Number of pins	8	12	8	12
Lock method	Power-to-release type	Power-to-lock type	Power-to-release type	Power-to-lock type
OSSD	✓	✓	✓	✓
OSSD operation switching (OSSD operation switching input)	-	-	-	✓
Safety input	✓	✓	✓	✓
Number of lock control inputs	1	1	2	1
Interlock function	-	-	✓	✓
EDM function	-	-	✓	✓
Number of AUX outputs	1	1	2	2*
Auxiliary release	✓	✓	✓	✓
Coding level switching	✓	✓	✓	✓

* When the OSSD operation is set to open/close link mode, the number of AUX outputs is one.

4-1 OSSD

An OSSD output is a safety output for the safety-related part of a machine control system.

OSSD 1/2 is a pair of safety outputs that are redundant.

The GS (Lock) generates self-diagnosis signals on its internal control circuit to perform diagnostics on the OSSD. These signals periodically force the OSSD into a temporary OFF-state when the OSSD is in the ON-state.

If the internal control circuit receives a feed-back signal (OFF-signal) based on the self-diagnosis, the GS (Lock) determines that its OSSD is operating normally. If the OFF-signal is not returned to the internal control circuit, the GS (Lock) determines that there is a problem with the OSSD or wiring and goes to an error state.

■ OSSD operation

The OSSDs go to OFF state:

- During startup, in the error state, when switching the coding level

When all the conditions shown below are met during normal operation, the OSSDs go to ON state. (*1)

● Power-to-release type

- The sensor has detected an actuator.
- Lock control input(s) is(are) OFF.
- Safety inputs are ON.
- The lock bolt is inserted in the insertion slot of the main unit correctly.

● Power-to-lock type

In lock link mode (initial setting):

- The sensor has detected an actuator.
- Lock control input is ON.
- Safety inputs are ON.
- The lock bolt is inserted in the insertion slot of the main unit correctly.

In open/close link mode:

- The sensor has detected an actuator.
- Safety inputs are ON.

*1: The OSSDs keep OFF state in the interlock reset ready state.

■ OSSD operation switching

Advanced function type

The OSSDs operation can be switched on the advanced function, Power-to-lock type. The OSSDs operation is determined by the wiring of the OSSD operation switching input during startup.

- Lock link mode: Links the OSSDs with the lock operation.
- OSSD operation switching input 1: Open
- Open/close link mode: Links the OSSDs with the open/close operation of the door or similar object.

OSSD operation switching input 1: Connected to 0 V
 OSSD operation switching input 2: Connected to 24 V

DANGER

- For the wiring to a safety-related machine control system, the output of both OSSD 1 and OSSD 2 must be used by the safety-related machine control system in order to create a safety system.
- If only one OSSD output is used to construct the machine's control system, an OSSD malfunction will make it impossible to stop the machine, which may lead to extremely dangerous situations including serious injury to or death of the machine's user.
- When using a PNP type, do not cause a short-circuit between the OSSD and +24V. Otherwise, the OSSDs will stay in the ON-state and it will cause a dangerous situation.
- When using a PNP type, be sure to connect the load between the OSSD and 0 V. Connecting this between the OSSD and +24 V by mistake will invert the OSSD operation from its normal behavior, which is extremely dangerous.
- When using an NPN type, do not cause a short-circuit between the OSSDs and 0V. Otherwise, the OSSDs stay in the ON-state and it will cause a dangerous situation.
- When using an NPN type, be sure to connect the load between the OSSD and +24 V. Connecting this between the OSSD and 0 V by mistake will invert the OSSD operation from its normal behavior, which is extremely dangerous.
- To prevent malfunctions caused by ground faults on the OSSD output wire, perform wiring in a manner such that the requirements specified in paragraph 9.4.3 of IEC 60204-1 are met.

4-2 Safety Input

This function controls the OSSDs of the GS (Lock) with input signals from sensors or similar devices connected to the safety inputs.

Safety input 1 and safety input 2 form a safety input pair. If safety input 1 or safety input 2 goes to OFF state, the OSSDs go to OFF state.

Multiple GS units can be connected and used in an expanded system (with a cascade connection) by connecting the OSSDs of a different GS (Lock) or GS (Non-contact) to the safety inputs. The system can be expanded to include up to twenty five units in the case of the GS (Lock). For details, see "Cable length and number of connected units" (page 5).

- Reference
- Wire the safety inputs as shown below when they are not in use.
 PNP type: Short circuit to 24 V.
 NPN type: Short circuit to 0 V.
 - If safety input 1 and safety input 2 are mismatched for 3 seconds or more a Safety Input Error will occur.

■ Emergency stop switch/button wiring

Wiring an emergency stop switch/button to the safety inputs makes it possible to perform an emergency stop on the machine by pressing the emergency stop switch/button.

DANGER

- Use an emergency stop switch/button that has two or more independent, NC (normally closed) contacts. For the requirements related to emergency stop switches/buttons, see IEC 60204-1, ISO 13850, and all other requirements, regulations, standards, and laws related to occupational safety and health in the country or area where the GS (Lock) will be used. For such regulations, you should directly contact the regulatory agency responsible for occupational safety and health in your country or region.
- Ensure that the device does not start or restart automatically when the emergency stop switch/button is reset.
- Only the devices shown below can be connected to the safety inputs. Do not connect any other devices.
 - GS (Lock) OSSDs, GS (Non-contact) OSSDs, and emergency stop switch/button
- When using a PNP sensor, please connect the OSSDs of the PNP type GS (Lock) or GS (Non-contact) to the safety inputs.
- When using a NPN sensor, please connect the OSSDs of the NPN type GS (Lock) or GS (Non-contact) to the safety inputs.

4-3 Lock Function

The lock function makes it possible to keep closed the door or similar item to which the GS (Lock) actuator is installed by maintaining a physical connection between the type and actuator.

The operation of the lock function varies depending on the model of the GS (Lock) main unit (Power-to-release type, Power-to-lock type).

Type		Power-to-release type		Power-to-lock type	
Actuator detection status		Not detected	Detected	Not detected	Detected
Power ON	Lock Control Input ON	Lock released	Lock released	Lock on close	Locked
	Lock Control Input OFF	Lock on close	Locked	Lock released	Lock released
Power OFF		Lock on close	Locked	Lock released	Lock released

On the advanced function, Power-to-release type, lock control input 1 and lock control input 2 operate as a lock control input pair.

DANGER

- When using the lock function for a safety-related control system to achieve PLe, be sure to wire both lock control inputs (lock control input 1 and lock control input 2) to the machine's control system in order to construct a safety system.
- The GS (Lock) does not monitor between lock control inputs for short circuits. When using the two lock control inputs to achieve PLe, use a safety PLC or some other such device that can detect short circuits on outputs.
- When using only one lock control input for the machine's control system, the lock control input malfunctioning will make it impossible to perform locking.
- When using a PNP type, do not cause a short-circuit between the lock control input and +24 V. Doing so will make the lock control input ON at all times, which may be dangerous.
- When using an NPN type, do not cause a short-circuit between the lock control input and 0 V. Doing so will make the lock control input ON at all times, which may be dangerous.
- To prevent malfunctions caused by ground faults on the lock control input wire, perform wiring in a manner such that the requirements specified in paragraph 9.4.3 of IEC 60204-1 are met.

■ Power-to-release type lock function

<Lock operation>

On the Power-to-release type, the lock activates immediately when the actuator is detected.

<Lock release operation>

On the Power-to-release type, setting the lock control input(s) to ON releases the lock.

The lock can also be released manually by using the auxiliary release on the front or back of the unit. For details, see "Auxiliary release" (page 6).

DANGER

- If the power supply of the GS (Lock) main unit is interrupted, the door will be locked, so it is possible for people to be trapped within the chamber.
- Check that the machine has stopped, and then release the lock.

■ Power-to-lock type lock function

<Lock operation>

On the Power-to-lock type, the lock activates when the lock control input turns ON with the actuator already detected.

<Lock release operation>

On the Power-to-lock type, setting the lock control input to OFF or interrupting the power supply of the GS (Lock) releases the lock.

The lock can also be released manually by using the auxiliary release on the front or back of the unit. For details, see "Auxiliary release" (page 6).

DANGER

Do not use the Power-to-lock type lock function with a safety-related control system. The lock is released when the power supply of the GS (Lock) is interrupted, so operators may be exposed to dangerous situations depending on the operating status of the machine.

■ Auxiliary release

This is a mechanism for manually releasing the lock of the GS (Lock). Use it to manually release the lock in situations where the type malfunctions.

The auxiliary release mechanism has two states.

Normal state: The lock can be applied by way of lock control input(s).

Released state: The lock cannot be applied regardless of the state of the lock control input(s).

The lock operation will not be executed even in states in which it is possible.

Important

- A separate auxiliary release key is required in order to switch between the normal and released states. A hex key with an across-flats size of 3 mm (M4 size) can be used as the auxiliary release key.
- Provide the protection on the auxiliary release mechanism to prevent unintended actuation (e.g. protected by seal with security screw paint).
- With the auxiliary release mechanism set to the released state, the lock will not be applied even when the door is closed. After using the auxiliary release, return the auxiliary release mechanism to the normal state and seal it again prior to normal use.

4-4 Interlock Function

Advanced function type

Interlock is a function that prevents the OSSDs from automatically going into the ON-state from the OFF-state. This prevents the unintended start-up and/or the unintended restart of the machine if the interlock is applied to the GS (Lock). It is necessary to perform the reset operation in order for the GS (Lock) to go back to normal operation from the interlock condition.

On the advanced function type, the interlock function setting can be selected from two types: Automatic and Manual.

Point The interlock function cannot be set on the standard type. The interlock function is fixed to Automatic.

Automatic and Manual indicate the following operations.

Automatic:

The OSSDs immediately switches to the ON state when the conditions for doing so—such as the unit being in the lock state with the door closed—are met.

Manual:

Even if the condition for switching the OSSDs to the ON state are met, the OSSDs maintain the OFF state (interlock state).

<Terminating the interlock state>

To set the OSSDs to the ON state and to start the machine, close the door to which the GS (Lock) has been installed and perform the reset operation after the preparations for starting the machine are complete. This sets the OSSDs to the ON state and terminates the interlock state.

Interlock function settings

Use the wiring to configure the settings. The wiring method varies depending on whether the "4-5 EDM Function" (page 7) is used.

Interlock function	EDM function	Reset/EDM input	Interlock/EDM function selection input
Automatic	Not used	0 V	0 V
Automatic	Used	Connected to 24 V via the NC relay contacts	Open
Manual	Not used	Connected to 24 V via a NO reset switch	24 V
Manual	Used	Connected to 24 V via a NO reset switch and the NC relay contacts	24 V

⚠ DANGER	<ul style="list-style-type: none"> Be sure to absolutely confirm that there is nobody in the hazardous zone before the interlock condition is terminated (i.e. the machine system restarts) by the interlock reset mechanism. Install the switch, etc. for releasing the interlock state in a position where it is possible to check the entirety of the hazardous zone and where the switch, etc. cannot be operated from within the hazardous zone. When the interlock function is set to Automatic, it is necessary to ensure the safety of the entire control system in order to prevent unexpected starts from occurring. Exercise caution to prevent the reset/EDM input from forming a short circuit with other inputs or outputs.
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4-5 EDM Function

Advanced function type

The GS (Lock) can monitor the state of external devices, such as a safety relay or contactors that are connected to the OSSDs, in order to detect the failure of the external device. This monitoring function is called the EDM function.

EDM function settings

Use the wiring to configure the settings. The wiring varies depending on whether the interlock function is used. For details, see "4-4 Interlock Function" (page 7).

4-6 AUX Output

This is an informational output used to check the operating status of the GS (Lock). The operation of the AUX output varies depending on the type of the main unit.

⚠ DANGER The AUX outputs cannot be used as the safety outputs to a safety-related control system.

4-7 Coding Level

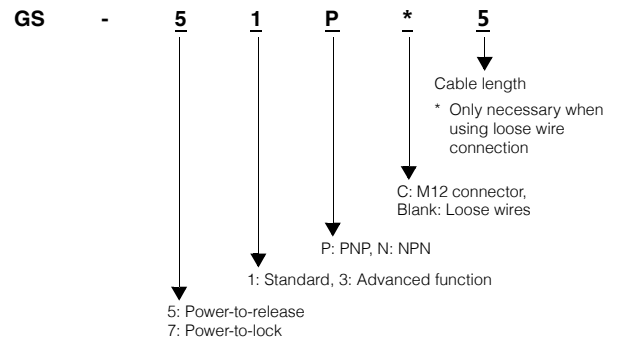
The GS (Lock) has two coding levels.

Coding level: Low (multi operation)	Any actuator is detected when it enters the range of the operating distance from the type. (Initial setting)
Coding level: High (unique operation)	Only the specific actuator that the type has been taught to detect is detected when it enters the range of the operating distance from the type. The type does not respond if an actuator other than the actuator that it has been taught to detect is within the range of the operating distance.

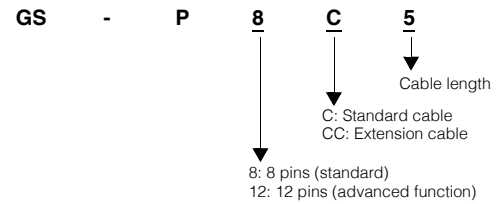
Chapter 5 Specifications

5-1 Model Number Description

Main unit



Cable



5-2 Specifications

Specifications

Model	GS-51P5	GS-51N5	GS-51P10	GS-51N10	GS-51PC	GS-53PC	GS-71P5	GS-71N5	GS-71P10	GS-71N10	GS-71PC	GS-73PC	
Lock type	Power-to-release type						Power-to-lock type						
Type	Standard type						Advanced function type		Standard type				Advanced function type
Output type	PNP	NPN	PNP	NPN	PNP	PNP	PNP	NPN	PNP	NPN	PNP	PNP	
Response time (ms) *1,2	Lock → Unlock Unlock → Lock						220 ms			320 ms			220 ms *3
Lock	Locking force (Fzh)						Min. 2,000 N						
	Alignment tolerance of lock						±2 mm						
	Mechanical life-span						1 million cycles or more (with door operation speed of 1m/s)						
	Acceptable operation frequency *4						1 Hz						
	Door radius						Min. 250 mm						
Cascading	Auxiliary release						Front, back						
	Max. 25 units												
	Output						Transistor outputs × 2						
	Max. load current						PNP: Max. 150 mA, NPN: Max. 100 mA						
Control output (OSSD output)	Residual voltage (during ON)						Max 2.5 V (with a cable length of 5 m)						
	OFF state voltage						Max 2.0 V (with a cable length of 5 m)						
	Leakage current						Max. 0.5 mA						
	Max. capacitive load						2.2 μF						
	Load wiring resistance						Max. 2.5 Ω						
AUX (Non-safety-related output)	Output						Transistor output						
	Number of output						1		2		1		2 *5
	Max. load current						50 mA						
	Residual voltage (during ON)						Max 2.5 V (with a cable length of 5 m)						
External input (Short-circuit current)	Safety input						Approx. 1.5 mA × 2						
	Reset/EDM input						-		Approx. 10 mA × 1		-		Approx. 10 mA × 1
	Lock control input						Approx. 2.5 mA × 1		Approx. 2.5 mA × 2		Approx. 2.5 mA × 1		
	OSSD operation switching input						-						Approx. 2.5 mA × 2 *6
Power supply	Power voltage						24 V DC ±20 % (Ripple P-P 10 % or less, Class2)						
	Power consumption						3.4 W *7						
Protection circuit						Reverse current protection, short-circuit protection and surge protection for each output							
Environmental resistance	Enclosure rating						IP65/67(IEC60529), IP69K(ISO 20653) (TÜV SÜD certified), Enclosure Type 3/4X/12/13 (NEMA250)						
	Operating ambient temperature						-20°C to +55°C (No freezing)						
	Storage temperature						-25°C to +70°C (No freezing) *8						
	Operating relative humidity						5% to 95%RH						
	Storage relative humidity						5% to 95%RH						
	Vibration resistance						10 to 55 Hz, Double amplitude 2.0 mm, 5 minutes in each of the X, Y, and Z directions (IEC 60947-5-3)						
Shock resistance						30 G in X, Y, Z directions 6 times each axis (IEC 60947-5-3)							

Chapter 6 Appendix

6-1 Indicator Descriptions

Model	GS-51P5	GS-51N5	GS-51P10	GS-51N10	GS-51PC	GS-53PC	GS-71P5	GS-71N5	GS-71P10	GS-71N10	GS-71PC	GS-73PC
Material	SUS304, PPS, PBT, PAR, PA66, NBR											
Main unit	Case	Aluminum alloy, Zinc die cast (Nickel chrome plating)										
	Lock	Aluminum alloy, Zinc die cast (Nickel chrome plating)										
Actuator	Cable	PVC										
	Case	PPS, PBT, NBR										
Lock	Case	Aluminum alloy, SUS303										
	Lock	Aluminum alloy, SUS303										
Weight	Approx. 560 g	Approx. 770 g	Approx. 380 g	Approx. 560 g	Approx. 770 g	Approx. 380 g	Approx. 560 g	Approx. 770 g	Approx. 380 g	Approx. 560 g	Approx. 770 g	Approx. 380 g

- *1 Risk time according to IEC60947-5-3 is 150 ms + 2 ms × (number of cascaded units - 1).
- *2 In case OSSD operation is open/close link mode, Detect → Not detect: 20 ms + 2 ms × (number of cascaded units - 1), Not detect → Detect: 30 ms + 25 ms × (number of cascaded units - 1)
- *3 430 ms when locked at the same time with actuator detection.
- *4 Acceptable door operation frequency is 3 Hz in case OSSD operation is open/close link mode. In that case, operation distance is Sao(OFF→ON) = 3mm, Sar(OFF→ON) = 10.5mm.
- *5 The number of AUX outputs is 1 when the OSSD operation is open/close link mode.
- *6 The number of OSSD operation switching inputs is 1 when the OSSD operation is lock link mode.
- *7 Power consumption temporarily increases (Max. 10.5 W, Approx. 0.2 s) when the lock control input(s) is(are) turned ON. After that, current consumption will be within the specification.
- *8 When stored for a long period of time, please store it at temperature of 55°C or lower.

■ Safety-related parameters

Interlocking function

Mission time	20 years
Hardware fault tolerance	1
Type of element	B
Performance level	e
Category	4
SIL	3

Guard locking function (GS-51*)

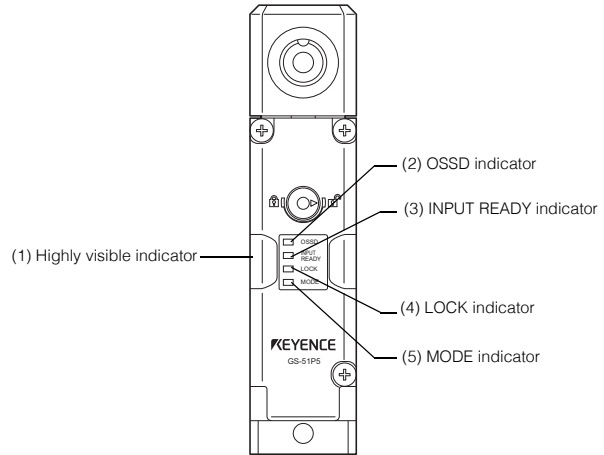
Mission time	20 years
Hardware fault tolerance	0
Type of element	B
Performance level	d
Category	2
SIL	2

Guard locking function (GS-53*)

Mission time	20 years
Hardware fault tolerance	1
Type of element	B
Performance level	e
Category	4
SIL	3

■ PFH (IEC 61508)

Interlocking function	4.78×10^{-10}
Guard locking function	1.74×10^{-10}



(1) Highly visible indicator

Light color	Status	Details	OSSD status	Lock status	Actuator detection status
Green	ON	During normal operation.	ON	Locked	Detected
	Blinking	Door, etc. is closed but lock is not active.	OFF ^{*1}	Lock released	Detected
Green and orange	Blinking alternately	Door, etc. is closed and an attempt was made to activate the lock, but the lock has not activated properly.	OFF ^{*1}	Lock released	Detected
Orange	Blinking (fast)	During operation with the "High" coding level, an actuator different from the one that was taught was detected.	OFF	Lock released	Incorrect actuator detected
		Error during coding level switching.		Uncertain	Uncertain
	Blinking (fast)	Switching coding level or teaching for an actuator.	OFF	*2	Uncertain
Red	ON	Door, etc. is open.	OFF	Lock released	Not detected
	Blinking	Error state. The GS (Lock) has detected an error.	OFF	Uncertain	Uncertain
OFF	-	Power if OFF	OFF	Uncertain	Uncertain

*1 ON in open/close link mode for the Power-to-lock type.

*2 Depends on lock control input(s).

(2) OSSD indicator

Light color	Status	Details	OSSD status	Lock status	Actuator detection status
Green	ON	The OSSD is ON.	ON	Locked ^{*1}	Detected
Red	ON	The OSSD is OFF.	OFF	Uncertain	Uncertain
OFF	—	Power OFF.	OFF	*2	Not detected

*1 Uncertain for the Power-to-lock type and in open/close link mode for the Power-to-release type.

*2 Uncertain for the Power-to-release type and lock released for the Power-to-lock type.

(3) INPUT READY indicator

Light color	Status	Details	OSSD status	Lock status	Actuator detection status
Yellow	ON	Interlock release wait state (waiting for reset input).	OFF	Locked ^{*1}	Detected
	Blinking	Safety input is OFF.	OFF	Uncertain	Uncertain
OFF	—	Other state.	Uncertain	Uncertain	Uncertain

*1 Uncertain in open/close link mode for the Power-to-lock type type.

(4) LOCK indicator

Light color	Status	Details	OSSD status	Lock status	Actuator detection status
Green	ON	The power is ON and the lock is active.	Uncertain	Locked	Detected
	Blinking	State in which an attempt was made to activate the lock, but the lock has not activated.	OFF ^{*1}	Lock released	Uncertain
OFF	—	Other state.	Uncertain	Uncertain	Uncertain

*1 Uncertain in open/close link mode for the Power-to-lock type.

(5) MODE indicator

Light color	Status	Details	OSSD status	Lock status	Actuator detection status
Green	ON	OSSD operation is set to open/close link mode.	Uncertain	Uncertain	Uncertain
OFF	—	Other state.	Uncertain	Uncertain	Uncertain

■ [F] No indicators light.

Possible cause	Confirmation method	Countermeasure
The power is OFF or the power supply voltage is insufficient.	Power supply voltage or power supply wiring	Ensure that the power supply voltage is within the range in the specifications. Wire the power supply correctly.
An extension cable or other such connector cable is not connected correctly.	Connection status of connector cables	If necessary, connect the parts again.

WARRANTIES AND DISCLAIMERS

6-4 Inspection and Maintenance

Inspect the safety function of the GS (Lock) on the basis of the results of a risk assessment of the target machine. It is strongly recommended that, at minimum, the following items and periods be met.

	<ul style="list-style-type: none"> To prevent danger due to the machine starting, thoroughly ensure that no one is present in the hazardous zone during inspection. If some error is found on the GS (Lock) as a result of the inspection, do not operate the machine.
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• **Initial inspection**

Items

- The type and actuator are installed on the basis of the installation conditions, installation methods, and wiring specifications specified in this manual.
- The safety functions being used ("4-1 OSSD" (page 5), "4-2 Safety Input" (page 6), "4-3 Lock Function" (page 6), "4-4 Interlock Function" (page 7) or "4-5 EDM Function" (page 7)) operate as intended.

• **Periodic inspection**

Periods

SIL3/PLe: Once/month or more, SIL2/PLd: Once/year or more (ISO 14119)

Items

- If an emergency stop switch is connected to the safety input, the safety function acts correctly when the emergency stop switch is pressed.
- There are no changes in the mounting conditions of the type and actuator or in the doors, etc. to which these devices are installed.
- The door, etc. is not deformed.
- There are no changes to the installation status that will affect the results of the risk assessment carried out at the start of the installation.
- The mounting screws and seals (in the case that seals have been applied to the auxiliary release) have been applied correctly.
- No excessive damage or dirt is present.

Especially in the following cases, check the same details as the initial inspection.

- When a change is made to the installation, wiring, or functions
- When the sensor or actuator is replaced
- When the equipment is not used for a long period of time
- When a defect occurs

Store the inspection results together with the machine's records.

Errors found on the sensor or actuator cannot be repaired by the customer. Replace the product with a new one or contact the nearest KEYENCE office.

6-5 Cleaning

If it is unavoidable that metal powder or a similar substance will accumulate near the lock pin of the sensor main unit, clean the product periodically.

- (1) KEYENCE warrants the Products to be free of defects in materials and workmanship for a period of one (1) year from the date of shipment. If any models or samples were shown to Buyer, such models or samples were used merely to illustrate the general type and quality of the Products and not to represent that the Products would necessarily conform to said models or samples. Any Products found to be defective must be shipped to KEYENCE with all shipping costs paid by Buyer or offered to KEYENCE for inspection and examination. Upon examination by KEYENCE, KEYENCE, at its sole option, will refund the purchase price of, or repair or replace at no charge any Products found to be defective. This warranty does not apply to any defects resulting from any action of Buyer, including but not limited to improper installation, improper interfacing, improper repair, unauthorized modification, misapplication and mishandling, such as exposure to excessive current, heat, coldness, moisture, vibration or outdoors air. Components which wear are not warranted.
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KEYENCE CORPORATION

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku,
Osaka, 533-8555, Japan
PHONE: +81-6-6379-2211

www.keyence.com

AUSTRIA Ph: +43-2236-378266-0	HONG KONG Ph: +852-3104-1010	NETHERLANDS Ph: +31-40-20-66-100	TAIWAN Ph: +886-2-2721-8080
BELGIUM Ph: +32-15-281-222	HUNGARY Ph: +36-1-802-73-60	PHILIPPINES Ph: +63-2-981-5000	THAILAND Ph: +66-2-369-2777
BRAZIL Ph: +55-11-3045-4011	INDIA Ph: +91-44-4963-0900	POLAND Ph: +48-71-36861-60	UK & IRELAND Ph: +44 1908-696-900
CANADA Ph: +1-905-366-7655	INDONESIA Ph: +62-21-2966-0120	ROMANIA Ph: +40-269-232-808	USA Ph: +1-201-930-0100
CHINA Ph: +86-21-3357-1001	ITALY Ph: +39-02-6688220	SINGAPORE Ph: +65-6392-1011	VIETNAM Ph: +84-24-3772-5555
CZECH REPUBLIC Ph: +420-220-1847-00	KOREA Ph: +82-31-789-4300	SLOVAKIA Ph: +421-25939-6461	
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GERMANY Ph: +49-6102-3689-0	MEXICO Ph: +52-55-8850-0100	SWITZERLAND Ph: +41-43-455-77-30	

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