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 situation which, if not avoided, could result in product damage as well as property damage.
- It indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- It indicates a situation which, if not avoided, will result in death or serious injury.
- 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**

- **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.

**Environmental use**

- **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.**

**Target machines for installation**

- **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.**

**Circuit design and wiring**

- **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.**

**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 60947-5-3
- EN ISO 13849-1
- EN ISO 14119
- EN 61800-5-5
- 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 dBu/Vm**

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**
Chapter 1 Before Operation

1-1 Overview and Configuration

The GS (Lock) is a Type 4 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.

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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Number of pins</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>GS-P8C5</td>
<td>8</td>
<td>5 m</td>
</tr>
<tr>
<td></td>
<td>GS-P8C10</td>
<td>10 m</td>
<td></td>
</tr>
<tr>
<td>Advanced function</td>
<td>GS-P12C5</td>
<td>12</td>
<td>5 m</td>
</tr>
<tr>
<td></td>
<td>GS-P12C10</td>
<td>10 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GS-P12C20</td>
<td>20 m</td>
<td></td>
</tr>
</tbody>
</table>

- **Extension cables**

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Number of pins</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>GS-P8CC1</td>
<td>8</td>
<td>1 m</td>
</tr>
<tr>
<td></td>
<td>GS-P8CC5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GS-P8CC10</td>
<td>10 m</td>
<td></td>
</tr>
</tbody>
</table>

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

Chapter 2 Installation

2-1 Installation Conditions

Note the following items before installation.

- **The effect of surrounding metal**
  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

- **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.
2-2 Installation Method

Installing the unit on a hinged door

1 Mounting bracket GS-B31

2 M6 screws
   Tightening torque: 3.0 N·m

Installing the unit on a sliding door

1 Mounting bracket GS-B31

2 M6 screws
   Tightening torque: 3.0 N·m

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.

4 M6 screws
   Tightening torque: 3.0 N·m
   Strength class:
   Carbon or alloy steel: Property class 8.8 or higher
   Stainless steel: Property class **-70 or higher

50 mm or more

50 mm or more

50 mm or more

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

- 50 mm or more
- 50 mm or more
- 50 mm or more

M5 screws
Tightening torque: 3.0 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher

M5 screws
Tightening torque: 3.0 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher

M5 screws
Tightening torque: 3.0 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher

M5 screws
Tightening torque: 3.0 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher

M6 screws
Tightening torque: 5.2 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher

M6 screws
Tightening torque: 5.2 N·m
Strength class:
Carbon or alloy steel: Property class 8.8 or higher
Stainless steel: Property class **-70 or higher
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.

---

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”.

---

### 2-3 Cascade Connection Between Units

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.

(a) The rated output voltage is within 24 V DC ±20 % (Ripple P-P 10 % or less, Class2, SELV, Overvoltage category II).

(b) The insulation between the primary and secondary circuits is reinforced or double insulation.

(c) 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.

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)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gray</td>
<td>AUX output</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
<td>+24 V</td>
</tr>
<tr>
<td>3</td>
<td>Light blue</td>
<td>Lock control input</td>
</tr>
<tr>
<td>4</td>
<td>Red/white</td>
<td>Safety input 2</td>
</tr>
<tr>
<td>5</td>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>6</td>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>7</td>
<td>Blue</td>
<td>0 V</td>
</tr>
<tr>
<td>8</td>
<td>Pink</td>
<td>Interlock/EDM selection input</td>
</tr>
</tbody>
</table>

#### Advanced function type (M12 connector, 12 pins)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Wire color</th>
<th>Power-to-release</th>
<th>Power-to-lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>+24 V</td>
<td>+24 V</td>
</tr>
<tr>
<td>2</td>
<td>Red/black</td>
<td>Safety input 1</td>
<td>Safety input 1</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>OSSD1</td>
<td>OSSD1</td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>AUX output 1</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>6</td>
<td>White</td>
<td>OSSD2</td>
<td>OSSD2</td>
</tr>
<tr>
<td>7</td>
<td>Pink</td>
<td>EDM selection input</td>
<td>EDM selection input</td>
</tr>
<tr>
<td>8</td>
<td>Cyan/gray</td>
<td>AUX output 2</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>9</td>
<td>Yellow</td>
<td>Lock control input</td>
<td>Lock control input</td>
</tr>
<tr>
<td>10</td>
<td>Light blue</td>
<td>Reset/EDM input</td>
<td>Reset/EDM input</td>
</tr>
<tr>
<td>11</td>
<td>Pink/black</td>
<td>OSSD operation switching input 1</td>
<td>OSSD operation switching input 1</td>
</tr>
</tbody>
</table>

#### Pin layout (Main unit, M12 connector type)

### DANGER

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.

- 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.
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)

<table>
<thead>
<tr>
<th>1st unit</th>
<th>2nd unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS (Lock)</td>
<td>GS (Lock)</td>
</tr>
<tr>
<td>Advanced function type</td>
<td>Advanced function type</td>
</tr>
<tr>
<td>Power-to-release type</td>
<td>Power-to-release type</td>
</tr>
<tr>
<td>Interlock Manual</td>
<td>Interlock Automatic</td>
</tr>
<tr>
<td>Interlock Control</td>
<td>Interlock Control</td>
</tr>
<tr>
<td>Cascade connection: Yes</td>
<td>Cascade connection: No</td>
</tr>
</tbody>
</table>

Cable length and number of connected units

<table>
<thead>
<tr>
<th>A: Maximum cable length</th>
<th>B: Maximum number of connected units</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.3 m</td>
<td>25</td>
</tr>
</tbody>
</table>

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

4-1 OSSD
An OSSD output is a safety output for the safety-related part of a machine control system.

<table>
<thead>
<tr>
<th>Standard type</th>
<th>Advanced function type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pins</td>
<td>8 12</td>
</tr>
<tr>
<td>Lock method</td>
<td>Power-to-release type</td>
</tr>
<tr>
<td>OSSU operation switching (OSSD operation switching input)</td>
<td>-</td>
</tr>
<tr>
<td>Safety input</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Number of lock control inputs</td>
<td>1 1 2 1</td>
</tr>
<tr>
<td>Interlock function</td>
<td>- - ✓ ✓</td>
</tr>
<tr>
<td>EDM function</td>
<td>- - ✓ ✓</td>
</tr>
<tr>
<td>Number of AUX outputs</td>
<td>1 1 2 2</td>
</tr>
<tr>
<td>Auxiliary release</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Coding level switching</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

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

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).

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 OSSDsgo 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 OSSDsgo 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 control input wire will connect to the actuator. When the actuator is detected, the lock will activate.
- The OSSD operation varies depending on the model of the GS (Lock) main unit (Power-to-release type, Power-to-lock type).

**OSSD operation switching**

The OSSDs operation can be switched on the advanced function, Power-to-lock type. The OSSD 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
- OSSD operation switching input 2: Connected to 24 V

**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).

**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.

- 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 switches 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.

**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).

**Power-to-release type lock function**

- 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-lock type lock function**

- When using the lock function for a safety-related control system 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.
- 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.
- 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.

On the advanced function, Power-to-release type, lock control input 1 and lock control input 2 operate as a lock control input pair.
**4-4 Interlock Function**

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.

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.

<table>
<thead>
<tr>
<th>Interlock function</th>
<th>EDM function</th>
<th>Reset/EDM input</th>
<th>Interlock function selection input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>Not used</td>
<td>0 V</td>
<td></td>
</tr>
<tr>
<td>Automatic</td>
<td>Used</td>
<td>Connected to 24 V via the NC relay contacts</td>
<td>Open</td>
</tr>
<tr>
<td>Manual</td>
<td>Not used</td>
<td>Connected to 24 V via a NO reset switch</td>
<td>24 V</td>
</tr>
<tr>
<td>Manual</td>
<td>Used</td>
<td>Connected to 24 V via a NO reset switch and the NC relay contacts</td>
<td>24 V</td>
</tr>
</tbody>
</table>

- **Emergency stop function**
  - 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.

**4-5 EDM Function**

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.

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)
  - Only the specific actuator that 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.

- **Coding level: High (unique operation)**
  - Only the specific actuator that 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.
### Safety-related parameters

#### Interlocking function

**Interlocking function**

- **Guard locking function (GS-51)**
  - **Mission time**: 20 years
  - **Hardware fault tolerance**: 1
  - **Type of element**: 3
  - **Performance level**: 4
  - **Category**: 2
  - **SIL**: 5

#### Guard locking function (GS-53')

- **Mission time**: 20 years
- **Hardware fault tolerance**: 1
- **Type of element**: 3
- **Performance level**: 4
- **Category**: 4
- **SIL**: 5

### PFH (IEC 61508)

**Interlocking function**: $4.78 \times 10^{-10}$

**Guard locking function**: $1.74 \times 10^{-10}$

---

### 6-1 Indicator Descriptions

#### (1) Highly visible indicator

<table>
<thead>
<tr>
<th>Light color</th>
<th>Status</th>
<th>Details</th>
<th>OSSD status</th>
<th>Lock status</th>
<th>Actuator detection status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ON</td>
<td>During normal operation</td>
<td>ON</td>
<td>Locked</td>
<td>Detected</td>
</tr>
<tr>
<td>Green</td>
<td>Blinking</td>
<td>Door, etc. is closed but lock is not active</td>
<td>OFF</td>
<td>Lock released</td>
<td>Detected</td>
</tr>
<tr>
<td>Orange</td>
<td>Blinking (fast)</td>
<td>During operation with the &quot;High&quot; coding level, an actuator different from the one that was taught was detected.</td>
<td>OFF</td>
<td>Lock released</td>
<td>Incorrect actuator detected</td>
</tr>
<tr>
<td>Red</td>
<td>Blinking</td>
<td>Error state. The GS (Lock) has detected an error.</td>
<td>OFF</td>
<td>*2</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

#### (2) OSSD indicator

<table>
<thead>
<tr>
<th>Light color</th>
<th>Status</th>
<th>Details</th>
<th>OSSD status</th>
<th>Lock status</th>
<th>Actuator detection status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ON</td>
<td>The OSSD is ON</td>
<td>ON</td>
<td>Locked</td>
<td>Detected</td>
</tr>
<tr>
<td>Red</td>
<td>ON</td>
<td>The OSSD is OFF</td>
<td>OFF</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
<tr>
<td>OFF</td>
<td>–</td>
<td>Power OFF</td>
<td>OFF</td>
<td>*2</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

#### (3) INPUT READY indicator

<table>
<thead>
<tr>
<th>Light color</th>
<th>Status</th>
<th>Details</th>
<th>OSSD status</th>
<th>Lock status</th>
<th>Actuator detection status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>ON</td>
<td>Interlock release wait state (waiting for reset input)</td>
<td>OFF</td>
<td>Locked</td>
<td>Detected</td>
</tr>
<tr>
<td>Blinking</td>
<td>Safety input is OFF</td>
<td>OFF</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td></td>
</tr>
<tr>
<td>OFF</td>
<td>–</td>
<td>Other state</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

#### (4) LOCK indicator

<table>
<thead>
<tr>
<th>Light color</th>
<th>Status</th>
<th>Details</th>
<th>OSSD status</th>
<th>Lock status</th>
<th>Actuator detection status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ON</td>
<td>The power is ON and the lock is active</td>
<td>Locked</td>
<td>Locked</td>
<td>Detected</td>
</tr>
<tr>
<td>Blinking</td>
<td>State at which an attempt was made to activate the lock, but the lock has not activated.</td>
<td>OFF</td>
<td>Lock released</td>
<td>Uncertain</td>
<td></td>
</tr>
<tr>
<td>OFF</td>
<td>–</td>
<td>Other state</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

#### (5) MODE indicator

<table>
<thead>
<tr>
<th>Light color</th>
<th>Status</th>
<th>Details</th>
<th>OSSD status</th>
<th>Lock status</th>
<th>Actuator detection status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ON</td>
<td>OSSD operation is set to open/close link mode</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
<tr>
<td>OFF</td>
<td>–</td>
<td>Other state</td>
<td>Uncertain</td>
<td>Uncertain</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

---

*1 ON in open/close link mode for the Power-to-lock type.
*2 Depends on lock control input(s).
If the operation of the GS (Lock) is abnormal, identify the cause of the error and carry out the countermeasures according to the following tables.

### [A] The OSSD does not turn ON (or turns OFF unexpectedly).

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Confirmation method</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The GS (Lock) is in the error state.</td>
<td>Identify the cause of the error and implement countermeasures according to “Display details when an error occurs.”</td>
<td></td>
</tr>
<tr>
<td>The actuator is not detected.</td>
<td>The highly visible indicator is ON in red. Replace the actuator.</td>
<td></td>
</tr>
<tr>
<td>The actuator is broken.</td>
<td>The highly visible indicator is ON in red. Bring the actuator within the detection range.</td>
<td></td>
</tr>
<tr>
<td>During operation with the “High” coding level, an actuator different from the one that was taught was detected.</td>
<td>The highly visible indicator is blinking in orange. Use the actuator that was taught to the unit.</td>
<td></td>
</tr>
<tr>
<td>Safety inputs are not ON.</td>
<td>The INPUT READY indicator is blinking in yellow. Turn ON the safety inputs.</td>
<td></td>
</tr>
<tr>
<td>The unit is in the interlock reset ready state.</td>
<td>The INPUT READY indicator is ON in yellow. Release the interlock state by turning the RESET/EDM input ON.</td>
<td></td>
</tr>
<tr>
<td>The type has not activated properly.</td>
<td>—</td>
<td>See [E]. The unit does not switch to the lock state.</td>
</tr>
<tr>
<td>The type and actuator are at a shorter distance than the specified operating distance Sar (OFF—ON).</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
<tr>
<td>The unit is affected by the surrounding metal.</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
<tr>
<td>The unit is affected by interference from other types.</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
<tr>
<td>The cascade connection wiring is incorrect.</td>
<td>The INPUT READY indicator is OFF. Check the safety input wiring.</td>
<td></td>
</tr>
<tr>
<td>The mode is open/close link mode.</td>
<td>The MODE indicator is ON in green. Change to lock link mode if necessary.</td>
<td></td>
</tr>
</tbody>
</table>

### [B] The OSSD does not turn OFF (or turns ON unexpectedly).

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Confirmation method</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The OSSD's periodic OFF signal for diagnosis function, but the connected device may be recognizing this short OFF signal.</td>
<td>—</td>
<td>Select a device that does not detect the OSSD's periodic OFF signal for the connected device.</td>
</tr>
</tbody>
</table>

### [C] The OSSD sometimes turns ON and OFF.

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Confirmation method</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The type is subject to noise.</td>
<td>—</td>
<td>Check the noise environment around the wiring.</td>
</tr>
<tr>
<td>The unit is affected by the surrounding metal.</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
<tr>
<td>The unit is affected by interference from other types.</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
<tr>
<td>The sensor and actuator are at a distance between the specified operating distance Saco (OFF—ON) and Sar (ON—OFF).</td>
<td>—</td>
<td>Check the installation.</td>
</tr>
</tbody>
</table>

### [D] The connected device repeatedly turns the OSSD ON/OFF at high speed (chattering).

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Confirmation method</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The type and actuator do not fit together well.</td>
<td>The highly visible indicator is blinking in green and orange alternately.</td>
<td></td>
</tr>
</tbody>
</table>

### [E] The unit does not switch to the lock state.

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Confirmation method</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Power-to-lock type or Power-to-release type is being used by mistake.</td>
<td>Main unit model display.</td>
<td>Check the model, and then replace the unit with the correct model.</td>
</tr>
<tr>
<td>The lock control input logic is incorrect.</td>
<td>The LOCK indicator is OFF.</td>
<td></td>
</tr>
<tr>
<td>If the highly visible indicator blinks in green and orange alternately, it may be the case that the lock control input logic is correct but the lock has not activated well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Check the fit of the type and actuator.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Check that the auxiliary release is in the normal state.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unit: mm
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.

- **Initial inspection**
  - The type and actuator are installed on the basis of the installation conditions, installation methods, and wiring specifications indicated in this manual.
  - The safety functions used are (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) as indicated.

- **Periodic inspection**
  - **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 in 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.

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