Safety Laser Scanner
SZ Series

User’s Manual

Read this manual before using the system in order to achieve maximum performance.
Always keep this manual in a safe place for future reference.
Introduction

This user’s manual describes handling, operation, and precautionary information for the SZ Series Safety Laser Scanner (“SZ”).

Read this user’s manual thoroughly before operating the SZ in order to understand the device features, and keep this user’s manual readily available for reference. Ensure that the end user of this product receives this user’s manual.

Safety headings

This user’s manual uses the following headings to display important safety information. Strict adherence to the instructions next to these heading is required at all times.

⚠️ Danger
Failure to follow the instruction results in significant harm to the machine operators including serious injury or death.

⚠️ Caution
Failure to follow the instruction may result in damage to the SZ or to the machine on which the SZ is installed.

Note
Provides additional information for proper operation.

Reference
Provides advanced and useful information for operation.

Indicates reference pages in this manual.
Safety precautions

General precautions

- SZ is an active opto-electronic protective device responsive to diffuse reflection (AOPDDR). It is a device, whose sensing function is performed by opto-electronic emitting and receiving elements, that detects the diffuse reflection of optical radiations generated within the device by an object present in a protection zone specified in two dimensions.
- You must verify that the SZ is operating correctly in terms of functionality and performance before the start of machine and the operation of the SZ.
- KEYENCE does not guarantee the function or performance of the SZ if it is used in a manner that differs from the SZ specifications contained in this user’s manual or if the SZ is modified by the customer.
- When using the SZ to protect machine operators against a hazard or hazardous zone or when using the SZ 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 SZ 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 SZ is to be 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 SZ 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 SZ.
- "Machine operators" refers to personnel who have received appropriate training from the responsible personnel and are qualified to operate the machine correctly. Machine operators must have specialized training for the SZ, and they must understand and fulfill the safety regulations in the country or region in which they are using the SZ.
- If the SZ fails to operate, machine operators must immediately stop the use of the machine and the SZ and report this fact to the responsible personnel.
- The SZ is designed with the assumption that it would be correctly installed in accordance with the installation procedures described in this user’s manual and correctly operated according to the instructions in this user’s manual. You must perform an appropriate installation of the SZ after performing a sufficient risk assessment for the target machine.
- The SZ should be processed as an industrial waste product when being disposed.
Warning

Operators

- In order to operate the SZ correctly, the responsible personnel and machine operators must fulfill all of the procedures described in this user’s manual.
- No person other than the responsible personnel and machine operators should be allowed to install or test the SZ.
- When performing electrical wiring, always fulfill the electrical standards and regulations for the country or region in which the SZ is used.

Usage environment

- Do not use the SZ in an environment (temperature, humidity, interfering light, etc.) that does not conform to the specifications contained in this user’s manual.
- Do not use wireless devices such as cellular phones or transceivers in the vicinity of the SZ.
- The SZ is not designed to be explosion-proof. Never use it in the presence of flammable or explosive gases or elements.
- Do not use the SZ in the presence of substances, such as heavy smoke, particulate matter, or corrosive chemical agents, that may induce deterioration in product quality.
- Install the SZ in such a way that no direct or indirect light from inverter-type fluorescent lights (rapid-start type lights, high-frequency operation type lights, etc.) enters the optical window.
- 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. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.
- Be sure to confirm that there is nobody in the hazardous zone, before the override is activated. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.

Target machine

- The SZ has not undergone the model certification examination in accordance with Article 44-2 of the Japanese Industrial Safety and Health Law. The SZ, therefore, cannot be used in Japan as a “Safety Device for Press and Shearing machines” as established in Article 42 of that law.
- The machine on which the SZ is to be installed must be susceptible to an emergency stop at all operating points during its operation cycle. Do not use the SZ for machines with irregular stop times.
- Do not use the SZ for power presses equipped with full-revolution clutches.
- The SZ cannot be used as a PSDI because it does not fulfill the requirements of OSHA 1910.217(h). Refer to OSHA 1910.217 for the PSDI mode.
- Do not use the SZ 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.
- The SZ is designed to protect the people or objects approaching into the specified protection zone against a machine’s hazard or hazardous zone. It cannot provide a protection against objects or materials that are expelled from the machine’s hazard or hazardous zone, so you must establish additional safety measures such as installing safeguards when there is the possibility of such projectiles.
## Installation

**Danger**

- The installation of the SZ must ensure the required safety distance in compliance with the requirements of laws, rules, regulations and standards in the country or region in which the SZ is installed.
- When changing the minimum detectable object size and response time for SZ, the minimum safety distance must be recalculated, and the SZ must be reinstalled based on the result of recalculation to keep the required minimum safety distance.
- The SZ must be installed so that the machine operator is able to go into or approach the hazardous zone or hazards only by passing through the protection zone of the SZ. Strictly avoid installation that allows the machine operator or a part of the machine operator’s body to go into or approach the hazardous zone or hazards without passing through the protection zone of the SZ or to remain in a position between the protection zone of the SZ and the hazardous zone or hazard.
- You must always perform the pre-check tests after installing the SZ in accordance with the pre-check test procedures, such as the item specified in this user’s manual, in order to verify that the test pieces can be detected in all of the protection zones.
- The interlock reset mechanisms (such as switches) must be installed so that the whole hazardous zone can be checked by the responsible personnel and that operations of the interlock reset mechanisms are not possible within the hazardous zone.
- Reference points monitoring function must be applied when the SZ is used for the access protection specified in IEC61496-3:2008 Annex A.12 and A.13 (the application where the angle of the approach exceeds ±30° to the detection plane). The SZ-16V cannot be used for this application because the SZ-16V does not have the reference points monitoring function.
- The muting is a function to allow a temporary automatic suspension of the safety function while the SZ receives a signal from one or more muting devices (such as sensors or switches). Therefore, additional safety measures are required for the whole machine on which the SZ is installed in order to ensure safety while the muting is activated.
- The muting devices, the installation of those devices and the procedure to activate the muting must fulfill the conditions specified in this user’s manual and the requirements of the laws, rules, regulations, and standards in the country or region in which the SZ and those devices are used. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.
- When you install the muting devices (such as sensors or switches), the following conditions must be fulfilled:
  1. Muting devices must be installed so that the muting cannot be activated if the hazard is still existing during machine cycle.
  2. Muting devices must be installed so that the muting cannot be activated if someone approaches into the protection zone of the SZ.
- The muting device must be installed such that only responsible personnel have access to that device to change its installation or orientation. Special tools must be required to ensure that only responsible personnel are capable of installation, orientation or change of muting device.
- Only the responsible personnel may be allowed to install or wire the devices to activate the muting function, suspension in teaching mode, or override function.
- The installation of muting lamp may be required by the laws, rules, regulations, and standards in the country or region in which the SZ is used. It depends on the machine application or the result of your risk assessment. If it is necessary for you to provide the muting lamp, you must fulfill the requirements because you are fully responsible for installing the muting lamp.
- **(Precautions on the suspension in teaching mode)**
  - The suspension in teaching mode is a function to allow a temporary manual suspension of the safety function. Therefore, additional safety measures are required for the whole machine system on which the SZ is installed in order to ensure safety while the suspension in teaching mode is activated.

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**SZ-M-NO0-E**
The installation of the indication for the suspension in teaching mode may be required by the laws, rules, regulations, and standards in the country or region in which the SZ is used. It depends on the machine application or the result of your risk assessment. If it is necessary for you to provide such an indication, you must fulfill the requirements because you are fully responsible for installing such an indication.

The override is a function to allow a temporary manual suspension of the SZ safety functions. Therefore, additional safety measures are required for the whole machine system on which the SZ is installed in order to ensure safety while the override is activated.

The override devices, the installation of those devices, and the procedures to activate the override must fulfill the conditions specified in this user’s manual as well as the requirements of the laws, rules, regulations, and standards in the country or region in which the SZ and those devices are used. Failure to follow this warning may result in significant harm to the machine operators, including serious injury or death.

The override devices, which are used for activation of override, must be manual operating devices. When installing the devices to activate the override (override device), those devices must be installed so that the whole hazardous zone can be checked by responsible personnel and so that it is not possible for the device operators to operate those device in the hazardous zone.

The installation of the indication for override may be required by the laws, rules, regulations and standards in the country or region where the SZ is used. It depends on the machine application or the result of your risk assessment. If it is necessary for you to provide the indication for override, you must fulfill the requirements because you are fully responsible for installing the indication for override.

The customer is fully responsible for complying with the requirements for the muting, suspension in teaching mode, and the override. KEYENCE accepts NO responsibility or NO liability for any damage or any injury due to the unauthorized installation, usage, or maintenance, which are not specified in this user’s manual, and/or due to noncompliance with the laws, rules, regulations and standards in the country or region in which the SZ is used.

Securely tighten mounting brackets and cable connectors used for the installation of the SZ in accordance with the torque values specified in this user’s manual.

Do not put the additional housing, such as glass covers or clear polymeric covers, in front of the window of the SZ. This may lead to the loss of the detection capability of the SZ.

Do not put the SZ into additional housing for any purpose. This may lead to the loss of the detection capability of the SZ.
Circuit design and wiring

- Always turn off the power to the SZ when performing electrical wiring.
- You must fulfill the electrical standards and regulations in the country or region in which the SZ is being used when you perform the electrical wiring.
- To avoid the risk of electric shock, do not connect any of the SZ inputs to DC power sources outside of the range of 24 V DC +20% or to any AC power source.
- To avoid the risk of electric shock, the hazardous voltage must be isolated from all wiring of the SZ with the reinforced insulation or double insulation.
- If the power supply for the SZ is the converting type, the power supply for the SZ must meet the conditions listed below in order to meet the requirements specified in IEC61496-1, UL61496-1, and EN61496-1.
  a) A rated output voltage of 24 V DC (SELV circuit, Overvoltage Category II) within ±10%.
  b) Double insulation or reinforced insulation between the primary and secondary circuits.
  c) Output holding time of 20 ms or more.
  d) A power supply must meet the requirements of the electrical safety and electromagnetic compatibility (EMC) regulations or standards in all countries and/or regions where the SZ is used.
- Do not install the electric wiring of the SZ together with or in parallel with the high-voltage electrical or power lines.
- For the wiring between SZ and a safety-related machine control system, both OSSD 1 and OSSD 2 must be always wired to a safety-related machine control system in order to ensure the safety. Similarly, both OSSD 3 and OSSD 4 must be always wired to a safety-related control system if you assign a function for OSSD 3/4. If one OSSD is only wired to a safety-related machine control system, it results in a significant harm to the machine operators, including serious injury or death, due to OSSD malfunction.
- When using PNP output type cable, do not cause short-circuit between the OSSD and +24 V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- When using PNP output type cable, be sure to connect the load between the OSSD and 0 V to avoid a dangerous situation. If the load is incorrectly connected between the OSSD and +24 V, the logic of OSSD operation will be reversed, and then OSSD will turn to the ON-state when the SZ detects an object in the specified protection zone. This is a dangerous situation.
- When using NPN output type cable, do not cause short-circuit between the OSSD and 0 V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- When using NPN output type cable, be sure to connect the load between the OSSD and +24 V to avoid dangerous situation. If the load is incorrectly connected between the OSSD and 0 V, the logic of OSSD operation will be reversed, and then OSSD will turn to the ON-state when the SZ detects an object in the specified protection zone. This is a dangerous situation.
- In case of wiring, regardless of PNP output type cable and NPN output type cable, you must fulfill the requirements of Clause 9.4.3 in IEC60204-1:2005 in order for the protection against maloperation due to earth fault.
- The AUX output is not allowed to be used as a safety output for safety-related control systems. Usage of these functions as safety output may result in a significant harm to the machine operators, including serious injury or death.
- The check input is not allowed to be connected to the safety output provided from the safety-related control system. If the check input is connected to the safety output, it may result in significant harm to the machine operators, including serious injury or death.
- The connector cable must have a length less than or equal to the specification in this user’s manual. Usage of connector cables longer than the specified length may cause the improper operation of safety functions and may cause a dangerous situation.
Testing and maintenance

- You must always perform the pre-check test in accordance with the pre-check test procedures, after maintenance, adjustment or alignment of the target machine or the SZ and before the machine startup.
- If the SZ does not operate properly when you perform pre-check test in accordance with the pre-check test procedures specified in this user’s manual, do not operate the machine.
- You must periodically examine the machine to verify that all brakes, other stop mechanisms, and control devices operate reliably and correctly in addition to checking the SZ.
- The responsible personnel must perform maintenance procedures as specified in this user’s manual at least once every six months to ensure safety to the machine and SZ.

Standards and regulations

1 SZ is a "safety component" defined in the EU Machinery Directive (2006/42/EC) Annex V. SZ complies with the following EU Directives and EN Standards, and has been certified by TÜV SÜD Product Service GmbH.

EU Directives
- Machinery Directive (2006/42/EC)

EN Standards
- EN61496-1 Type 3 ESPE
- EN61496-3 Type 3 AOPDDR
- EN61508 SIL2
- EN62061 SIL2
- EN ISO13849-1 Category 3, PLe
- EN55011 Class A
- EN60204-1
- EN60825-1 Class 1 Laser Product

2 SZ complies with the following North American standards and regulations, and has received UL certification and C-UL certification (CCN: NIPM/NIPM7).

- IEC61496-1 Type 3 ESPE
- IEC61496-3 Type 3 AOPDDR
- UL508
- UL1998
- CDRH Part 1040.10 (Laser Notice No. 50: 2007/06/24), Class 1 Laser Product
- CAN/CSA 22.2 No14-05

3 SZ also complies with the following North American regulations.
- FCC Part 15 Subpart B, Class A Digital Device
- ICES-003, Class A Digital Apparatus

4 The SZ has not undergone the model certification examination in accordance with Article 44-2 of the Japanese Industrial Safety and Health Law. Therefore, the SZ cannot be used in Japan as a "Safety Devices for Presses and Shearing Machines" as established in Article 42 of that law.
The SZ has been designed in consideration of the following standards and regulations. For details regarding the following standards, contact the third-party certification organization, such as UL or TÜV.

**Corresponding standards**
- OSHA 29 CFR 1910.212
- OSHA 29 CFR 1910.217
- ANSI B11.1 - B.11.19
- ANSI/RIA R15.06 - 1999
- SEMI S2-0706
- Ministry of Health, Labor and Welfare in Japan "Guidelines for Comprehensive Safety Standards of Machinery" (July 31, 2007, Notice No. 0731001)
Terms of License Agreement on Use of the Software

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This agreement is to be adjudicated according to Japanese law.

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Overview of applications

The applications introduced in this chapter should be considered just references. The customer (user) is fully responsible for performing the risk assessment, taking into account the machine application, and for using the SZ appropriately based on that result.

Application for stationary installation

- Protection against hazardous area (Area protection: Horizontal detection plane) (SZ-01S, SZ-04M, SZ-16V)
  If the SZ detects an object in the specified protection zone, OSSD goes to the OFF-state to stop the machine hazard. If the SZ detects an object in the specified warning zone, the warning information for the person approaching into the protection zone can be provided by the SZ before stopping the hazard.
One SZ can provide the protection against two different hazards
(Area protection: Horizontal detection plane) (SZ-04M)
You can specify two protection zones: protection zone A and protection zone B. Both OSSD1 and OSSD2 go to the OFF-state if the SZ detects an object in the protection zone A, and then only hazard A will be stopped. On the other hand, both OSSD3 and OSSD4 go to the OFF-state if the SZ detects an object in the protection zone B, and then only hazard B will be stopped. For the warning zone, you can also specify two warning zones as well as protection zone.

Protection against the approaching to the hazardous area
(Access protection: Vertical detection plane) (SZ-01S, SZ-04M)
If the SZ detects someone passing through the specified protection zone, OSSD goes to the OFF-state to stop the machine hazard. However, the SZ has no chance to detect the person in hazardous area after passing through that zone. "2-9 Reference points monitoring function" (page 2-17).
Application for movable installation

Mounting on the AGV (automated guided vehicle) (SZ-04M, SZ-16V)
If the SZ detects an object, such as an operator, in the specified protection zone, OSSD goes to the OFF-state to stop the AGV. The SZ can monitor whether there is an object in the specified protection zone through switching between the several protection zones based on the external signal.
Checking the package contents

SZ x 1

Instruction manual (English) x 1
Instruction manual (Japanese) x 1
1-3 Options

Connector cable

There are two types of cables: the connector cable for SZ-01S (8-wire cable) and the connector cable for SZ-04M/SZ-16V (18-wire cable). You can select the connector cable according to the model of the SZ. For more information on the model of SZ, see "Chapter 2 Functions and Features" (page 2-1). For the information about connecting the connector cable, see "4-3 Mounting the connector cable" (page 4-4).

Note
- For PNP output type cable, the shielding wire is connected to blue wire (0V line). Do not connect the shielding wire to +24V.
- For NPN output type cable, the shielding wire is connected to brown wire (+24V line). Do not connect the shielding wire to 0V.

Shape

Nomenclature for connector cable

SZ-P 5 P S

(1) Basic designation for the SZ connector cable
(2) Length 5:5m 10:10m 20:20m
(3) Output type of OSSD P: PNP output  N: NPN output
(4) Corresponded SZ types S: For SZ-01S M: For SZ-04M or SZ-16V

<table>
<thead>
<tr>
<th>Model</th>
<th>Output type of OSSD</th>
<th>Length</th>
<th>No. of internal wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>SZ-P5PS</td>
<td>PNP</td>
<td>5m</td>
<td>8</td>
</tr>
<tr>
<td>SZ-P10PS</td>
<td>PNP</td>
<td>10m</td>
<td></td>
</tr>
<tr>
<td>SZ-P20PS</td>
<td>PNP</td>
<td>20m</td>
<td></td>
</tr>
<tr>
<td>SZ-P5NS</td>
<td>NPN</td>
<td>5m</td>
<td></td>
</tr>
<tr>
<td>SZ-P10NS</td>
<td>NPN</td>
<td>10m</td>
<td></td>
</tr>
<tr>
<td>SZ-P20NS</td>
<td>NPN</td>
<td>20m</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Output type of OSSD</th>
<th>Length</th>
<th>No. of internal wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>SZ-P5PM</td>
<td>PNP</td>
<td>5m</td>
<td>18</td>
</tr>
<tr>
<td>SZ-P10PM</td>
<td>PNP</td>
<td>10m</td>
<td></td>
</tr>
<tr>
<td>SZ-P20PM</td>
<td>PNP</td>
<td>20m</td>
<td></td>
</tr>
<tr>
<td>SZ-P5NM</td>
<td>NPN</td>
<td>5m</td>
<td></td>
</tr>
<tr>
<td>SZ-P10NM</td>
<td>NPN</td>
<td>10m</td>
<td></td>
</tr>
<tr>
<td>SZ-P20NM</td>
<td>NPN</td>
<td>20m</td>
<td></td>
</tr>
</tbody>
</table>

Brown, blue: AWG24 (nominal cross-sectional area 0.22 mm²)
Other colors: AWG26 (nominal cross-sectional area 0.14 mm²)
It is possible to perform the angle alignment up to ±7.5° vertically and ±7.5° horizontally if you use the mounting bracket with angle alignment (For the L-shaped mounting bracket with angle alignment, only the vertical angle alignment is possible). For the information about the dimensions of the mounting bracket, see "9-3 Dimensions" (page 9-5). For the information about assembling the mounting bracket, see "3-4 Mounting for installation" (page 3-13).

■ Horizontal mounting bracket (Model: OP-86935)
Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 4

■ Vertical mounting bracket (Model: OP-86936)
Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 4

■ Horizontal mounting bracket with angle alignment (Model: OP-86937)
Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8
Before Use

1-3 Options

■ Vertical mounting bracket with angle alignment (Model: OP-86938)
Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8
<Front view> <Rear view>

■ L-shaped mounting bracket with angle alignment (Model: OP-86939)
Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8
<Front view> <Rear view>
Before Use

1-3 Options

**Other**

- **SZ Configurator (Model: SZ-H1S)**
  This is the software used to perform the configuration for SZ on the PC. For the information about functions of SZ Configurator, see "Chapter 2 Functions and features" (page 2-2).

- **USB cable (Model: OP-86941)**
  This is the USB cable used for connecting the SZ to the PC. Cable length is 5 m.
Part description

Top view

- Setting cover
- Front panel
- Protection zone origin

Front view

- Detection plane
- Window
- Lower window

Side view

- Connector cable

Details

- USB port
- Mode switch
  - A: RUN/PC Communication
  - B: Configuration on SZ
- Up button
- Down button
- Enter button
- Right button
- Escape button
- Information display
- OSSD indicator
- Interlock indicator
- Warning indicator
- Muting / Suspension indicator
Functions and Features

2-1 Functions and features ........................................ 2-2
2-2 Information display and indicators .......................... 2-4
2-3 Protection zone .................................................. 2-6
2-4 Warning zone ..................................................... 2-8
2-5 OSSD ............................................................. 2-10
2-6 Response time and scan cycle ................................. 2-11
2-7 Interlock ......................................................... 2-12
2-8 External device monitoring function (EDM) ................. 2-16
2-9 Reference points monitoring function ....................... 2-17
2-10 Multi-OSSD function .......................................... 2-18
2-11 Bank switching function .................................... 2-20
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2-13 AUX (auxiliary) output ...................................... 2-35
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2-15 Monitoring function .......................................... 2-45
This chapter shows the functions and features of SZ.
The following functions can be configured on the SZ itself or on the SZ configurator.
There are three different types of models of SZ, which depends on the availability of functions; SZ-01S, SZ-04M, and SZ-16V.
In this chapter, the following three symbols are used for your reference. The definition is as follows.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Function available with SZ-01S</td>
</tr>
<tr>
<td>M</td>
<td>Function available with SZ-04M</td>
</tr>
<tr>
<td>V</td>
<td>Function available with SZ-16V</td>
</tr>
</tbody>
</table>

When the SZ Configurator is used to configure the SZ, you cannot change the setting through the manual configuration on SZ. Initialization (Updating the configuration data) must be performed in order to change the settings through the manual configuration on SZ in this situation.

For the information about initialization with the SZ-01S or SZ-04M, see "Other Function Settings" (page x-x).
For the information about initialization with SZ-16V, see "Other Function Settings (SZ-16V)" (page x-x).

For more information about configuration, see [Chapter 5 Manual Configuration on the SZ] (page 5-1) and [Chapter 6 Configuration through SZ Configurator (SZ-H1S)] (page 6-1).

### Configuration for each function

<table>
<thead>
<tr>
<th>Function</th>
<th>Manual configuration on SZ</th>
<th>SZ configurator</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection zone</td>
<td>X (Configuration is limited.)</td>
<td>X</td>
<td>2-6</td>
</tr>
<tr>
<td>Minimum detectable object size for protection zone</td>
<td>X</td>
<td>X</td>
<td>2-6</td>
</tr>
<tr>
<td>Response time for protection zone</td>
<td>X</td>
<td>X</td>
<td>2-11</td>
</tr>
<tr>
<td>Scan cycle</td>
<td>X</td>
<td>X</td>
<td>2-11</td>
</tr>
<tr>
<td>Interlock</td>
<td>X (Configuration is limited.)</td>
<td>X</td>
<td>2-12</td>
</tr>
<tr>
<td>Restart delay (On-delay)</td>
<td>-</td>
<td>X</td>
<td>2-15</td>
</tr>
<tr>
<td>EDM</td>
<td>X</td>
<td>X</td>
<td>2-16</td>
</tr>
<tr>
<td>Reference points monitoring</td>
<td>-</td>
<td>X</td>
<td>2-17</td>
</tr>
<tr>
<td>Multi-OSSD</td>
<td>-</td>
<td>X</td>
<td>2-18</td>
</tr>
<tr>
<td>Bank switching</td>
<td>-</td>
<td>X</td>
<td>2-20</td>
</tr>
<tr>
<td>Muting</td>
<td>-</td>
<td>X</td>
<td>2-27</td>
</tr>
<tr>
<td>Suspension in teaching mode</td>
<td>-</td>
<td>X</td>
<td>2-30</td>
</tr>
<tr>
<td>Override</td>
<td>-</td>
<td>X</td>
<td>2-32</td>
</tr>
<tr>
<td>Warning zone</td>
<td>X (Configuration is limited.)</td>
<td>X</td>
<td>2-8</td>
</tr>
<tr>
<td>Minimum detectable object size for warning zone</td>
<td>X</td>
<td>X</td>
<td>2-8</td>
</tr>
<tr>
<td>Response time for warning zone</td>
<td>X</td>
<td>X</td>
<td>2-11</td>
</tr>
<tr>
<td>AUX output</td>
<td>X (Configuration is limited.)</td>
<td>X</td>
<td>2-35</td>
</tr>
<tr>
<td>State Information Output</td>
<td>-</td>
<td>X</td>
<td>2-41</td>
</tr>
<tr>
<td>Muting lamp output</td>
<td>-</td>
<td>X</td>
<td>2-40</td>
</tr>
<tr>
<td>Check input</td>
<td>-</td>
<td>X</td>
<td>2-43</td>
</tr>
<tr>
<td>Password change</td>
<td>X</td>
<td>X</td>
<td>5-17, 5-20</td>
</tr>
<tr>
<td>Initialization</td>
<td>X</td>
<td>X</td>
<td>5-17, 5-20</td>
</tr>
<tr>
<td>Turn off backlight</td>
<td>-</td>
<td>X</td>
<td>6-24</td>
</tr>
<tr>
<td>Adjustment of LCD contrast</td>
<td>X</td>
<td>-</td>
<td>5-17, 5-20</td>
</tr>
</tbody>
</table>
### List of functions for each model

<table>
<thead>
<tr>
<th>Function</th>
<th>SZ-01S</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection in protection zone&lt;sup&gt;1&lt;/sup&gt;</td>
<td>X 1 zone</td>
<td>X 2 zones</td>
<td>X 1 zone</td>
</tr>
<tr>
<td>Detection in warning zone&lt;sup&gt;2&lt;/sup&gt;</td>
<td>X 1 zone</td>
<td>X 1 zone</td>
<td>X 2 zones</td>
</tr>
<tr>
<td>Bank switching&lt;sup&gt;1&lt;/sup&gt;</td>
<td>- 4 Banks</td>
<td>X 16 Banks</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size</td>
<td>30 / 40 / 50 / 70 / 150mm</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>X 60 - 480 ms (Scan cycle A)</td>
<td>66 - 528 ms (Scan cycle B)</td>
<td></td>
</tr>
<tr>
<td>Interlock</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDM</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference points monitoring</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Multi-OSSD</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Muting</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Suspension in teaching mode</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Override</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>AUX output</td>
<td>X 2 outputs</td>
<td>6 outputs</td>
<td>4 outputs</td>
</tr>
<tr>
<td>Multi-OSSD Output</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Mutting lamp output</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Check input</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>1</sup>: The number of the selectable zones (protection zone and warning zone) varies depending on the configuration on the Multi-OSSD function.

<sup>2</sup>: The number of the banks also varies depending on the configuration on the Multi-OSSD function.

<sup>2-10 Multi-OSSD function” (page 2-18)
2-2

Information display and indicators

The information display shows a various text depending on the SZ state.

"Chapter 5 Manual Configuration on the SZ" (page 5-1)
"Indication on information display" (page 8-5)

The information display can be turned off during normal operations. You can do the setting for turning off backlight through the SZ Configurator.

### Information display

The information display shows a various text depending on the SZ state.

"Chapter 5 Manual Configuration on the SZ" (page 5-1)
"Indication on information display" (page 8-5)

The information display can be turned off during normal operations. You can do the setting for turning off backlight through the SZ Configurator.

### Indicator

#### SZ-01S

<table>
<thead>
<tr>
<th>Description on label</th>
<th>Assigned function</th>
<th>Description</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD 1/2</td>
<td>OSSD indicator</td>
<td>Light in green: OSSD1/2 is in the ON-state&lt;br&gt;Light in red: OSSD1/2 is in the OFF-state</td>
<td>&quot;2-5 OSSD&quot; (page 2-10)</td>
</tr>
<tr>
<td>INTERLOCK 1/2</td>
<td>Interlock indicator</td>
<td>Light in yellow: Interlock condition&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-7 Interlock&quot; (page 2-12)</td>
</tr>
<tr>
<td>WARNING</td>
<td>Warning zone indicator</td>
<td>Light in orange: Detected in the warning zone&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-4 Warning zone&quot; (page 2-8)</td>
</tr>
</tbody>
</table>

#### SZ-04M

<table>
<thead>
<tr>
<th>Description on label</th>
<th>Assigned function</th>
<th>Description</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD 1/2</td>
<td>OSSD1/2 indicator</td>
<td>Light in green: OSSD1/2 is in the ON-state&lt;br&gt;Light in red: OSSD1/2 is in the OFF-state</td>
<td>&quot;2-5 OSSD&quot; (page 2-10)</td>
</tr>
<tr>
<td>OSSD 3/4</td>
<td>OSSD3/4 indicator</td>
<td>Light in green: OSSD3/4 is in the ON-state&lt;br&gt;Light in red: OSSD3/4 is in the OFF-state</td>
<td>&quot;Multi-OSSD function&quot; (page 2-18)</td>
</tr>
<tr>
<td>INTERLOCK 1/2</td>
<td>Interlock indicator</td>
<td>Light in yellow: OSSD1/2 is in the Interlock condition&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-7 Interlock&quot; (page 2-12)</td>
</tr>
<tr>
<td>INTERLOCK 3/4</td>
<td>Interlock indicator</td>
<td>Light in yellow: OSSD3/4 is in the Interlock condition&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-7 Interlock&quot; (page 2-12)</td>
</tr>
<tr>
<td>WARNING A</td>
<td>Warning zone A indicator</td>
<td>Light in orange: Detected in warning zone A&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-4 Warning zone&quot; (page 2-8)</td>
</tr>
<tr>
<td>WARNING B</td>
<td>Warning zone B indicator</td>
<td>Light in orange: Detected in warning zone B&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-4 Warning zone&quot; (page 2-8)</td>
</tr>
<tr>
<td>MUTING</td>
<td>Muting indicator</td>
<td>Light in orange: In the state (1) or (2) below:&lt;br&gt;(1) Muting function works.&lt;br&gt;(2) Suspension in teaching mode works.&lt;br&gt;Blinking in orange: Override function works.&lt;br&gt;Light OFF: Other than above</td>
<td>&quot;2-12 Temporary suspension of safety function&quot; (page 2-27)</td>
</tr>
</tbody>
</table>
## Information display and indicators

### SZ-16V

<table>
<thead>
<tr>
<th>Description on label</th>
<th>Assigned function</th>
<th>Description</th>
<th>Reference page</th>
</tr>
</thead>
</table>
| OSSD 1/2             | OSSD indicator    | Light in green: OSSD1/2 is in the ON-state  
                      |                   | Light in red: OSSD1/2 is in the OFF-state   | 2-5 "OSSD" (page 2-10) |
| INTERLOCK            | Interlock indicator | Light in yellow: Interlock condition      | 2-7 "Interlock" (page 2-12) |
| WARNING 1            | Warning zone A indicator | Light in orange: Detected in warning zone 1 
                      |                   | Light OFF: Other than above               | 2-4 "Warning zone" (page 2-8) |
| WARNING 2            | Warning zone B indicator | Light in orange: Detected in warning zone 2 
                      |                   | Light OFF: Other than above               |                           |
When the SZ detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state.

- The protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed. [3-3 Safety distances] (page 3-7)
- When either multi-OSSD function or bank switching function is enabled, every protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed.
- SZ cannot monitor anything behind the object that the SZ detects in the protection zone. (This is a blind area for the SZ.) The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ. If necessary, the additional countermeasure must be taken by the responsible personnel.

Reference: You can configure the protection zone through both the SZ Configurator and the manual configuration on the SZ. But, you can only configure the quadrate and rectangular protection zone through the manual configuration. If the protection zone you want to configure is not quadrate or rectangular, you must use the SZ Configurator for configuration of protection zone. [Chapter 5 Manual Configuration on the SZ] (page 5-1)
- Two protection zones ("protection zone A" and "protection zone B") can be configured when the Mode D is applied as the operation mode for OSSD3/4. See [Multi-OSSD function] (page 2-18)

### Protection zone (top view)

![Protection zone diagram]

### Minimum detectable object size and maximum protection distance

As shown in the following table, the maximum protection distance varies depending on the minimum detectable object size.

<table>
<thead>
<tr>
<th>Minimum detectable object size (mm)</th>
<th>φ30</th>
<th>φ40</th>
<th>φ50</th>
<th>φ70</th>
<th>φ150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum distance (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5° to 185°</td>
<td>1.8</td>
<td>2.4</td>
<td>3.0</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>-45° to -5°</td>
<td>1.2</td>
<td>1.6</td>
<td>2.0</td>
<td>2.8</td>
<td></td>
</tr>
</tbody>
</table>
As shown in the following figure, the detection may not be performed if the whole of minimum detectable object is not included in the protection zone. You must configure the protection zone so as to ensure that the whole of minimum detectable object is included everywhere in that protection zone.

Even if the object is smaller than the minimum detectable object size, it may be detected. But this is not guaranteed.
A warning zone can be configured separately from the protection zone. You can prevent the unnecessary stop of a machine if you configure the warning zone larger than the protection zone, because the SZ can make an alert to the outside, such as indicator, before the object (someone or something) approaches into the protection zone.

You can make sure the state of detection in the warning zone through the AUX output.  

**Danger**

The warning zone is not a safety-related function. Do not use the output for detection in the warning zone as a safety output, which is connected to the safety-related part of a control system. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.

**Note**

OSSD does not go to the OFF-state even if the SZ detects an object in the warning zone.

You can configure the warning zone through both the SZ Configurator and the manual configuration on the SZ. But, you can only configure the square and rectangular warning zone through the manual configuration. If the warning zone you want to configure is not square or rectangular, you must use the SZ Configurator for configuration of warning zone.

**Warning zone (top view)**

**Minimum detectable object size and maximum warning distance**

As shown in the following table, the maximum warning distance varies depending on the minimum detectable object size.

<table>
<thead>
<tr>
<th>Minimum detectable object size (mm)</th>
<th>φ30</th>
<th>φ40</th>
<th>φ50</th>
<th>φ70</th>
<th>φ150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum distance (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5° to 180°</td>
<td>4.5</td>
<td>6.0</td>
<td>7.5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>45° to -5°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.0</td>
</tr>
<tr>
<td>180° to 225°</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>7.0</td>
<td></td>
</tr>
</tbody>
</table>
### Example of warning zone

![Diagram of warning zone and protection zone]

#### Note
- Even if the object is smaller than the minimum detectable object size, it may be detected. But this is not guaranteed.
- The detection may not be performed in the warning zone if the whole of minimum detectable object is not included in that warning zone. You must configure the warning zone so as to ensure that the whole of minimum detectable object is included everywhere in that warning zone.
- The scan cycle for the warning zone cannot be set because the scan cycle for the configured protection zone is always applied. 
  "2-6 Response time and scan cycle" (page 2-11)

#### Reference
- The response time and the minimum detectable object size for the warning zone can be different from those for the protection zone. 
  "2-6 Response time and scan cycle" (page 2-11)
- When the Mode D is applied as the operation mode for OSSD3/4, two warning zones, "warning zone A" and "warning zone B", can be set individually. 
  "Multi-OSSD function" (page 2-18) When the SZ detects an object in either warning zone, you can make sure such detection through the AUX output.
- For the SZ-16V, two warning zones, "warning zone 1" and "warning zone 2", can be set individually. When the SZ detects an object in either warning zone, you can make sure such detection through the AUX output.
  "2-13 AUX (auxiliary) output" (page 2-35)
When the SZ detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state. "2-3 Protection zone" (page 2-6).

The OSSD is a safety output for safety-related part of a machine control system. OSSD 1/2 is a pair of safety outputs that performs the output of same state. Similarly, OSSD 3/4 is also a pair of safety outputs that performs the output of same state.

The SZ 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 (when the SZ detects no object in the protection zone.).

The internal control circuit receives a feed-back signal (OFF-signal) based on the self-diagnosis, the SZ determines that its OSSD is in the normal operation. If the OFF-signal is not returned to the internal control circuit, the SZ determines that there is a problem in its OSSD or wiring and goes to the error state.

**Danger**

For the wiring between SZ and a safety-related part of a machine control system, both OSSD 1 and OSSD 2 must be always wired to a safety-related part of a machine control system in order to ensure the safety. Similarly, both OSSD 3 and OSSD 4 must be always wired to a safety-related part of a machine control system if you assign a function for OSSD 3/4. If one OSSD is only wired to a safety-related part of a machine control system, it results in a significant harm to the machine operators, including serious injury or death, due to OSSD malfunction.

### Reference

- For theSZ-01S andSZ-16V, they have OSSD1 and OSSD2, which are a pair of safety outputs that perform the output of same state.
- For theSZ-04M, it has OSSD1/2 and OSSD3/4. OSSD 1/2 are a pair of safety outputs that perform the output of same state. Similarly, OSSD 3/4 are also a pair of safety outputs that perform the output of same state. For more information about the OSSD3/4, see "Multi-OSSD function" (page 2-18).
- The SZ has a function to monitor the state of external devices (EDM function) that are connected to the OSSD. The OSSD can go to the OFF-state due to the error state of external devices if the SZ detects the error on external devices in case of the enabling the EDM function. For more information about the external device monitoring function, see "Chapter 8 Troubleshooting" (page 8-1).

#### Time chart for self-diagnosis pulse

<table>
<thead>
<tr>
<th>OSSD1</th>
<th>OSSD2</th>
<th>OSSD3</th>
<th>OSSD4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A : approx. 20 μs (if a capacitive load is connected, max. 200 μs can apply.)</td>
<td>B : approx. 30 ms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The devices connected to the OSSD, such as safety relay or contactor, should not respond to these temporary, self-diagnostic OFF-signals.

**Reference**

OSSD 3/4 is only available for SZ-04M.
Response time and scan cycle

The response time of SZ is the time from when an object (someone or something) goes into the protection zone to when the OSSD goes to the OFF-state due to the detection of object. There are several options for response time. (The response time is selectable for user.)

Advantage of a fast response time: The safety distance can be shortened.
Advantage of a slow response time: You can reduce problems that the OSSD goes to the OFF-state due to light interference or instantaneous detection of dust passing through the protection zone, because of the increasing the number of scans.

Danger

- The necessary safety distance varies depending on the response time you specify. The protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed. ▶ "3-3 Safety distances" (page 3-7)
- The response time must be 90 ms or less when the SZ is used for the detection for access protection (trip device using whole-body detection with normal approach). The SZ may not detect the person in the protection zone if the specified response time is more than 90 ms.

SZ has two different scan cycles. You can select either one. You can reduce the possibility of mutual interference between the SZs if you set the different scan cycle individually, even if two SZs are installed facing each other.

The selectable response time varies depending on the scan cycle you specify.

### Scan cycle and available response time

<table>
<thead>
<tr>
<th>Scan cycle</th>
<th>Response time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan cycle A</td>
<td>60 90 120 150 180 210 240 270 300 330 360 390 420 450 480</td>
</tr>
<tr>
<td>Scan cycle B</td>
<td>66 99 132 165 198 231 264 297 330 363 396 429 462 495 528</td>
</tr>
</tbody>
</table>

Reference:
- Scan cycle A is 30 ms, while scan cycle B is 33 ms. (Response time = Scan cycle x the number of scan)
- You can select the response time from a pull-down menu through the SZ Configurator, or from a selectable menu through manual configuration on SZ.
- See ▶ "Safety 1" (page 6-12) or ▶ "Configuration and confirmation of safety-related functions" (page 5-5)

Note:
- For more information about preventing mutual interference, also see ▶ "3-2 Hint on installation" (page 3-3).
- The response time and scan cycle is always the same for all banks when 2 or more banks are set with the bank switching function.
- When the Mode C or D is applied as the operation mode for OSSD3/4, the response time for OSSD1/2 can be different from that for OSSD 3/4. However, the can cycle for OSSD3/4 is always the same as that for OSSD1/2.
- Scan cycle A can only be set in case of the manual configuration on the SZ.
- See ▶ "Chapter 5 Manual Configuration on the SZ" (page 5-1)
Interlock is a function to prevent that the OSSD automatically goes to the ON-state from the OFF-state. You can prevent the unintended start-up and/or the unintended restart of the machine if the interlock is applied to the SZ.

It is necessary for to perform the reset operation in order that the SZ goes back to the normal operation from the interlock condition. The configuration for interlock is necessary through the manual configuration on the SZ or SZ Configurator. Furthermore, the reset switch must be connected to the reset input terminal on the SZ.

For more information about the configuration, see "Chapter 5 Manual Configuration on the SZ" (page 5-1) and "Chapter 6 Configuration through SZ Configurator (SZ-H1S)" (page 6-1).

For more information about the wiring, see "Chapter 4 Wiring" (page 4-1).

Reference: When the Mode D is applied as the operation mode for OSSD 3/4, you can configure the interlock function to both OSSD 1/2 and OSSD 3/4.

### Start/restart mode

You can determine whether the interlock function is enabled at start-up or at restart based on the setting of start/restart mode.

In this manual, start-up and restart refer to the following.

Start-up:
1) when the power is supplied (after SZ loading),
2) when the SZ is restored from error state thorough reset input,
3) when the configuration is completed through the SZ Configurator or the manual configuration on the SZ.

Restart:
1) When the OSSD goes back to the ON-state from OFF-state, except for the start-up

### Start mode

**Automatic:**
Interlock function does not work. The SZ starts operation automatically without the reset operation.
The OSSD goes to the ON-state automatically if the SZ detects no object in the protection zone at start-up.
This mode can be used for machines where nobody can go into or approach the hazardous area by only passing through the protection zone, or if the safety-related part of a control system other than the SZ, such as a safety relay unit, can ensure the safety with other means.

**Manual:**
Interlock function works. The SZ starts operation if the SZ receive the reset operation.
The OSSD keeps the OFF-state at start-up (Interlock condition). It is necessary to perform the reset operation when the SZ detects no object in the protection zone, in order that the machine starts operation. Because of reset operation, the OSSD goes to the ON-state, and then interlock condition is terminated. Unexpected/Unintended start-up of the machine or machinery can be prevented.
### Restart mode

**Automatic:**
Interlock function does not work. The SZ starts operation automatically without the reset operation. The OSSD goes to the ON-state automatically at restart if the object detected by the SZ is removed from the protection zone.

This mode can be used for machines where nobody can go into or approach the hazardous area by only passing through the protection zone, or if the safety-related part of a control system other than the SZ, such as a safety relay unit, can ensure the safety with other means.

**Manual:**
Interlock function works. The SZ starts operation if the SZ receive the reset operation. The OSSD keeps the OFF-state even if the object detected by the SZ is removed from the protection zone. (Interlock condition).

It is necessary to perform the reset operation when the SZ detects no object in the protection zone, in order that the machine starts operation. Because of reset operation, the OSSD goes to the ON-state, and then interlock condition is terminated.

<table>
<thead>
<tr>
<th>Reference</th>
<th>There are three options on the configuration of start/restart through the SZ Configurator: Automatic/Automatic, Manual/Automatic, Manual/Manual. &quot;Chapter 6 Configuration through SZ Configurator (SZ-H1S)&quot; (page 6-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>There are two options on the configuration of start/restart through the manual configuration on the SZ: Automatic/Automatic and Manual/Manual. &quot;Chapter 5 Manual Configuration on the SZ&quot; (page 5-1)</td>
</tr>
</tbody>
</table>

### Input circuit and wiring

**For PNP output type cable**

**For NPN output type cable**

*1 When the Mode D is applied as the operation mode for OSSD3/4, the reset input wire for OSSD 1/2 is yellow and the reset input wire for OSSD 3/4 is yellow/black.

* In case of "Manual/Manual" on the configuration of start/restart, the switch with N.O. type should be used for reset operation.

* In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type should be used for reset operation.

* In case of "Automatic/Automatic" on the configuration of start/restart, the switch for reset operation is not necessary. However, the switch with N.C. type should be used for reset operation if you want to restore the SZ to normal operation from error state with external switch. Switch is not necessary unless you restore the SZ to normal operation from error state with external switch.

When using PNP output type cable, reset input wire must be short-circuited to +24 V. When using NPN output type cable, it must be short-circuited to 0 V.
### Time chart (Restart from interlock condition)

- **Power supply**: ON
- **SZ**: Detect no object
  - **Detected object**: OFF
  - **Reset input**: OFF
- **OSSD**: OFF

---

**Danger**

- 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. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.
- In case of “Automatic/Automatic” on the configuration of start/restart, the SZ cannot go to the interlock condition. You must prevent the unintended start-up/restart and ensure the safety with machine control system except for the SZ.

---

**Note**

- It is necessary to provide 20 ms or more between the timing of reset input and the timing of other inputs.
- The OSSD keeps the OFF-state during error state regardless of the configuration of interlock function. ["8-2 Troubleshooting" (page 8-5)]
- In case of “Manual/Automatic" or “Manual/Manual” on the configuration of start/restart, you have no chance to apply the check input function. ["2-14 Check input function" (page 2-43)]
Restart Delay (ON-delay)

In case of "Automatic" on the configuration of restart mode, restart delay (ON-delay) can be applied to the SZ. You can change the time from when the object detected by the SZ is removed from the protection zone to when the OSSD goes back to the ON-state. This is a delay time, which can be set from 2 seconds to 60 seconds on the second time scale. On the other hand, the OSSD goes back to the ON-state after passing the response time (ON to OFF) if the restart delay (ON-delay) is not applied. [2-6 Response time and scan cycle] (page 2-11)

■ Time chart (Restarted from interlock condition)

Note
- The restart delay does not work even if the OSSD goes back to the ON-state due to the termination of check input. [2-14 Check input function] (page 2-43)
- The restart delay does not work even if the OSSD goes back to the ON-state due to the override function. [Override function] (page 2-32)
The SZ can monitor the state of external device, such as safety relay or contactor, that is connected to the OSSD in order to detect the failure on that external device. This function is the external device monitoring function (EDM function).

Wiring between the SZ and external device (N.C. contact) must be performed according to the following figures.

EDM input must be open-circuit if the EDM is not applied to the SZ.

### Input circuit and wiring

**For PNP output type cable**

**For NPN output type cable**

*1 The EDM input wire for OSSD1/2 is red, and the EDM input wire for OSSD3/4 is red/black.

### Time chart

1. The SZ continues normal operation because the SZ detects the operation of external device within the specified period of time (0.3 s) after the operation of OSSD 1/2 (ON to OFF).
2. The SZ detects the error on the external device and generates the error state of "EDM error" because the SZ does not detect the operation of external device within the specified period of time (0.3 s).

**Troubleshooting** (page 8-5)

- When the OSSD3/4 are enabled, EDM can also be applied to the OSSD 3/4.
- For more details about the EDM error, see "Error state" (page 8-2).
Reference points monitoring function

Reference points monitoring is a safety-related function where the SZ monitors the position change of the structure (such as protective guarding or door) located at the specified reference point. As well as the SZ detects an object in the protection zone, the OSSD goes to the OFF-state if the position of the structure (such as protective guarding or door) varies exceeding the specified tolerance.

• SZ configurator must be used to apply the reference points monitoring to the SZ.
• Maximum 30 reference points can be set.

Examples of applications for detection for area protection

When the reference point is set on the position of movable part, such as a door, the OSSD goes to the OFF-state if the SZ detects the position change of the movable part.

Examples of applications for detection for access protection

When the SZ is used in combination with other protective structures as safety measures, the configured protection zone may not ensure the safety because the unintended area possible to approach would be generated due to the displacement of protective structures or the SZ itself. Because of reference points monitoring function, the SZ can monitor the position of the protective structure. Therefore, you can ensure the safety because the OSSD goes to the OFF-state in case of position change of the protective structure.

Example of reference points

2 or more reference points must be set on one structure so as to ensure the detection of its position change. As shown in the above "Example of reference point", two reference points are set on three structures (protective structure 1, protective structure 2 and the floor) for a total of six points (A to F).

Danger

Reference points monitoring function must be applied when the SZ is used for the access protection specified in IEC61496-3:2008 Annex A.12 and A.13 (the application where the angle of the approach exceeds ±30º to the detection plane). In this case, the tolerance for reference points must be ±100 mm or less and the response time must be 90 ms or less. Additional countermeasures for protection must be provided if there is the unprotected space between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ.
The SZ-04M has an OSSD 3/4.
The following functions (four modes: mode A to mode D) can be assigned to the OSSD 3/4.

- **Note**
  - When the Mode D is applied as the operation mode for OSSD 3/4, you have no chance to apply the temporary suspension of the safety function to the SZ.
    - "2-12 Temporary suspension of safety function" (page 2-27)
  - Bank switching function can be applied to the SZ if you apply the multi-OSSD function, but the number of settable banks varies depending on the mode of OSSD 3/4.
    - For Mode A: 3 banks
    - For Mode B: 3 banks
    - For Mode C: 3 banks
    - For Mode D: 2 banks

---

**Danger**

If you realize the safety-related control to the two hazards independently under the Mode D, you must take into full account the positioning and orientation of SZ in case of installation. If there is unprotected space where the operator can approach into the hazardous area, you must take additional countermeasure against the hazard.

---

**Reference**

SZ configurator must be used to assign the function to OSSD 3/4.

- **Mode A:**
  OSSD 3/4 performs completely the same operation for the detection as OSSD 1/2. You can establish the same control to the two machines through one SZ if you use the OSSD 1/2 and OSSD 3/4.

- **Mode B:**
  OSSD 3/4 performs the same operation for the detection as OSSD 1/2. As well as mode A, you can establish the same control to the two machines through one SZ if you use the OSSD 1/2 and OSSD 3/4. But, the interlock and temporary suspension of safety function does not work for the OSSD 3/4 under mode B.
    - "2-7 Interlock" (page 2-12)
    - "2-12 Temporary suspension of safety function" (page 2-27)
  More specifically, the following functions are not enabled for the OSSD 3/4.
    - Start interlock
    - Restart interlock
    - Restart delay (ON-delay)
    - Muting
    - Suspension in teaching mode
    - Override
Mode C:
OSSD 3/4 performs different operation for the detection from OSSD 1/2, especially the minimum detectable object size and response time, but the protection zone is completely the same as OSSD 1/2. The minimum detectable object size and response time for OSSD 3/4 are to be less than or equal to those for OSSD 1/2. In this mode, OSSD 3/4 always goes to the OFF-state if the OSSD 1/2 goes to the OFF-state. If you assign a faster response time to the OSSD 3/4 than OSSD 1/2, it becomes possible that only OSSD 3/4 goes to the OFF-state even if the OSSD 1/2 does not go to the OFF-state.
When you use the OSSD 3/4 for the purpose of reducing speed of machine and use the OSSD 1/2 for the purpose of stopping the machine, the machine can stop only if the SZ detects a person in the protection zone (in case of hazardous situation), while the machine just reduces the speed if the SZ detects a dust or spatter in the protection zone. Mode C is useful for such an application because you can prevent the unnecessary stop of machine.

Mode D:
OSSD 3/4 performs the non-related (independent) operation from OSSD 1/2. Therefore, all of parameters related to OSSDs, including the protection zone, can be different from OSSD 1/2. Additionally, two warning zones can also be set.
It is possible to configure two protection zones, such as protection zone A and protection zone B. Furthermore, it is also possible to configure two warning zones, such as warning zone A and warning zone B.
The OSSD 1/2 goes to the OFF-state if the SZ detects an object in the protection zone A. On the other hand, the OSSD 3/4 goes to the OFF-state if the SZ detects an object in the protection zone B.
Example of protection zones A and B
You can configure two protection zones, such as protection zone A and protection zone B.
The OSSD 1/2 goes to the OFF-state if the SZ detects an object in the protection zone A. Then, hazard A just stops the operation.
On the other hand, the OSSD 3/4 goes to the OFF-state if the SZ detects an object in the protection zone B. Then, hazard B just stops the operation.
Furthermore, it is also possible to configure two warning zones, such as warning zone A and warning zone B.

Not used
OSSD3/4 are always in the OFF-state.
**Bank switching function**

You can set the number of zones in the SZ.

Bank switching function is the function to switch a number of zones (Bank) according to the external input (bank input).

The bank refers to the combination with protection zone, warning zone and reference points.

The maximum number of banks and the number of warning zones per one bank varies depending on the model.

<table>
<thead>
<tr>
<th>SZ-01S</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of banks</td>
<td>1</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Number of protection zones per one bank</td>
<td>1</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Number of warning zones per one bank</td>
<td>1</td>
<td>1 (2)</td>
</tr>
</tbody>
</table>

*1. The numbers are as indicated in the parentheses if mode D is applied as the operation mode for OSSD3/4.

You can switch the banks according to the signal combination of bank inputs (ON/OFF state combination). Appropriate protection zone can be selected if you configure the SZ to switch the banks corresponding to the hazard and/or hazardous area.

**Note**

For the SZ-04M, the maximum number of the selectable banks varies depending on the configuration assigned to OSSD 3/4.

For the information of reference points monitoring, see "2-9 Reference points monitoring function" (page 2-17)

**In case of SZ-04M**

For the SZ-04M, you can set the four banks at maximum. As shown in the following table, bank 1 to bank 4 can be switched according to the signal combination of bank inputs (bank input 1 to 4). In other words, SZ-04M switches the banks based on the signal state (ON/OFF) of four bank inputs.

<table>
<thead>
<tr>
<th>Bank input 1</th>
<th>Bank input 2</th>
<th>Bank input 3</th>
<th>Bank input 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank 1</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Bank 2</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Bank 3</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 4</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Table 2-11 (A)

Bank switching works only if a certain bank input is in the ON-state and the other bank inputs are in the OFF-state. Bank No. is the same as the bank input No. that is in the ON-state.

**Note**

- The SZ does not start operation if the signal combination of bank inputs is different from the combination as shown in Table 2-11 (A) at start-up, because the SZ goes to the state of "Waiting for bank input". The SZ starts operation if the signal combination of bank inputs becomes the same as the combination as shown in Table 2-11 (A). "Start-up" means 1) when the power is supplied, 2) when the SZ is restored from error state thorough reset input, and 3) when the configuration is completed through the SZ Configurator or the manual configuration on the SZ.
- The SZ goes to the error state of "Bank error" if the signal combination of bank inputs becomes different from the combination as shown in Table 2-11 (A) after start-up. (Example: All bank inputs go to the OFF-state, or two or more bank inputs go to the ON-state simultaneously.)
- Bank switching must be performed according to the bank transition time you specified through the SZ Configurator. The SZ goes to the error state of "Bank error" if the time does not meet the specified bank transition time. (Example: When the signal combination of bank inputs is different from the combination as shown in Table 2-11 (A) when the specified bank transition time has been passed.)
- For more information about the error state, see "2-9 Error state" (page 8-2).
### Application example in a robot cell

One SZ has 2 protection zones because the machine operator works in 2 area. You can activate only one protection zone and one warning zone in which the robot (hazard) exists, because of bank switching.

### Wiring for SZ-04M

- **Brown**
  - Input resistance for bank input1/2/3: 4.4 kΩ, for bank input4: 2.2 kΩ
- **Light blue**
  - (Bank input 1)
  - (Bank input 2)
  - (Bank input 3)
  - (Bank input 4)
- **Light blue/Black**
  - (Bank input 1)
  - (Bank input 2)
  - (Bank input 3)
  - (Bank input 4)
- **Yellow/Black**
  - (Bank input 1)
  - (Bank input 2)
  - (Bank input 3)
  - (Bank input 4)
- **Red/Black**
  - (Bank input 1)
  - (Bank input 2)
  - (Bank input 3)
  - (Bank input 4)
- **Blue**
  - (Bank input 1)
  - (Bank input 2)
  - (Bank input 3)
  - (Bank input 4)
### Time chart for SZ-04M

(1) Since the bank input 2 and bank input 4 go to the ON-state after T1 is passed, SZ goes to the error state (Bank error).

(2) Since all bank inputs go to the OFF-state after T1 is passed, SZ goes to the error state (Bank error).

You can select the delay time for bank inputs (T1). Option is "0.1", "0.25", "0.5", "1.0", "2.5" and "5.0." (Unit: second, Default: 0.1)

#### Note
- It is necessary to provide 20 ms or more between the timing for bank switching and the timing of reset input.
- If the bank switching function is applied to the SZ, you have no chance to apply the temporary suspension of safety function to the SZ.
- For the SZ-04M, the maximum number of banks varies depending on the function assigned to OSSD3/4.

#### Danger
Someone may be able to approach the hazard and/or hazardous area without passing through the SZ protection zone if the bank switching is performed at unintended timing. Therefore, you must perform the risk assessment on your own responsibility, taking into account the delay time of bank input, in order to establish the appropriate control system for bank switching.
For the SZ-16V, you can set sixteen banks at maximum. As shown in the following table, bank 0 to bank 15 can be switched according to the signal combination of bank inputs (bank input A to D / bank input a to d). In other word, SZ-16V switches the banks based on the signal state (ON/OFF) of eight bank inputs.

### Table 2-11 (B)

<table>
<thead>
<tr>
<th>Bank No.</th>
<th>Bank input A</th>
<th>Bank input B</th>
<th>Bank input C</th>
<th>Bank input D</th>
<th>Bank input a</th>
<th>Bank input b</th>
<th>Bank input c</th>
<th>Bank input d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank 0</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 1</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 2</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 3</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 4</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 5</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 6</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 7</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 8</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 9</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 10</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 11</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 12</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 13</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 14</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Bank 15</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

The logic for bank input a is the opposite of bank input A. The same goes for bank input b to d and bank input B to D. Bank No. is represented with binary code consisting of the signal combination of bank input A, B, C and D. For the bank input a, b, c and d, these are inverted signals from bank input A, B, C and D.

### Note

- The SZ does not start operation if the signal combination of bank inputs is different from the combination as shown in Table 2-11 (B) at start-up, because the SZ goes to the state of "Waiting for bank input". The SZ starts operation if the signal combination of bank inputs becomes the same as the combination as shown in Table 2-11 (B). "Start-up" means 1) when the power is supplied, 2) when the SZ is restored from error state thorough reset input, and 3) when the configuration is completed through the SZ Configurator or the manual configuration on the SZ.
- The SZ goes to the error state of "Bank error" if the signal combination of bank inputs becomes different from the combination as shown in Table 2-11 (B) after start-up. (Example: All bank inputs go to the OFF-state. All bank inputs go to the ON-state.)
- Bank switching must be performed according to the bank transition time you specified through the SZ Configurator. The SZ goes to the error state of "Bank error" if the time does not meet the specified bank transition time. (Example: When the signal combination of bank inputs is different from the combination as shown in Table 2-11 (B) when the specified bank transition time has been passed.)
- If the total number of banks is eight or less (ie. When bank 0 to bank 7 are enabled), the SZ does not check the state of bank input D and bank input d because they are not related to the bank switching.
- If the total number of banks is four or less (ie. When bank 0 to bank 3 are enabled), the SZ does not check the state of bank input C/D and bank input c/d because they are not related to the bank switching.
- If the total number of banks is two or less (ie. When bank 0 to bank 1 are enabled), the SZ does not check the state of bank input B/C/D and bank input b/c/d because they are not related to the bank switching.
Application example for AGV (automated guided vehicle)

If the SZ detects an object (someone or something) in the protection zone, the AGV stops because the OSSD goes to the OFF-state. The SZ monitors whether there is an object in the protection zone with bank switching corresponding to the surrounding situation of the SZ.

Wiring for SZ-16V

For PNP output type cable

Input resistance: 4.4 kΩ

For NPN output type cable
Time chart for SZ-16V

(1) Since the bank input C and bank input c go to the OFF-state after T1 is passed, SZ goes to the error state (Bank error).

You can select the delay time for bank inputs (T1).

Option is "0.1", "0.25", "0.5", "1.0", "2.5" and "5.0". (Unit: second, Default: 0.1)

Note

It is necessary to have 20 ms or more between the timing for bank switching and the timing of reset input.

Danger

Someone may be able to approach the hazard and/or hazardous area without passing through the SZ protection zone if the bank switching is performed at unintended timing. Therefore, you must perform the risk assessment on your own responsibility, taking into account the delay time of bank input, in order to establish the appropriate control system for bank switching.
The SZ can monitor the sequence of bank switching so that the OSSD may go to the OFF-state due to the error state if the SZ detects the signal combination of bank inputs in the unexpected sequence. You can prevent the machine operation with an unintended protection zone selected because of the bank sequence monitoring.

For each bank, you can assign 3 bank numbers to be followed. The SZ goes to the error state of “Bank error” if the bank number indicated by the signal combination of bank inputs is different from the specified bank number that is to be followed under the bank sequence monitoring function.

Keyence Corporation strongly recommends enabling the bank sequence monitoring function if you can specify the bank sequence in your machine application.

**Application example**

When the AGV on which mounts the SZ moves a certain path as shown in the following figure, the SZ can switch the bank in the following sequence, bank 1 ⇒ bank 2 ⇒ bank 3 ⇒ bank 1.

The AGV can stop because the SZ goes to the error state of “Bank error” if the bank number indicated by the signal combination of bank inputs is different from the specified bank number that is to be followed under the bank sequence monitoring function.

---

**Laser Shutdown**

For the SZ-16V, the OSSD can go to the OFF-state because of the laser shutdown due to the signal combination of bank inputs. This is “laser shutdown” function for the SZ. You can assign the laser shutdown function to a certain bank among bank 0 to bank 15.

For example, if you assign this function to the bank number 0, the OSSD goes to the OFF-state because of the laser shutdown when the bank number 0 is selected based on the signal combination of bank inputs. The SZ goes back to the normal operation if the other bank number is selected.

The SZ goes to the temporary standby state due to this function, and then AGV can stop.

If you want to carry out the laser shutdown for SZ-01S and SZ-04M, you can apply the “2-14 Check input function” (page 2-43).
SZ-04M has a function that can temporarily suspend the safety function when the specific conditions are fulfilled. While the specific signals, which fulfill that condition, are activated, the OSSD keeps the ON-state even if the SZ detects something or someone in the protection zone, or if the SZ detects the change of position monitored through the reference points monitoring function.

The following 2 functions are temporary suspension of safety function in the SZ.

• Muting
• Suspension in teaching mode

**Danger**
The customer is fully responsible for complying with the requirements for the temporary suspension of safety function. KEYENCE accepts NO responsibility or NO liability for any damage or any injury due to the unauthorized installation, usage, or maintenance, which are not specified in this user’s manual, and/or due to noncompliance with the laws, rules, regulations and standards in the country or region in which the SZ is used.

**Note**
- SZ configurator must be used to apply the temporary suspension of safety function.
- You can make sure the state of suspension of safety function through the muting indicator and AUX output signal. The configuration of AUX output is necessary if you want to make sure the state of suspension through AUX output signal. [2-13 AUX (auxiliary) output] (page 2-35)
- The AUX output on the SZ can control the muting indicator if you want to make sure the state of suspension of safety function through the muting indicator. AUX 6 must be configured for the muting lamp output and the indicator as shown in below must also be connected to AUX 6.
  - In case of incandescent lamp: DC24 V, 1.0-5.5 W
  - In case of LED indicator: current consumption 10-230 mA
- The temporary suspension of safety function does not work when the bank switching function is applied to the SZ. [2-11 Bank switching function] (page 2-20)
- Mode D as the operation mode for OSSD 3/4 cannot be applied if the temporary suspension of safety function is applied. [2-10 Multi-OSSD function] (page 2-18)

**Muting function**
You can configure any muting zone in the protection zone. The SZ goes to the muted condition when the conditions for initiation of muting are fulfilled. The OSSD keeps the ON-state even if the SZ detects an object in the muting zone.

(Even if the conditions for initiation of muting are fulfilled, the OSSD goes to the OFF-state when the SZ detects an object in the protection zone that the muting zone is not configured.)

For example, it is not necessary to stop the machine when the AGV goes into the hazardous area if you configure the muting zone in the protection zone where the AGV would pass through.

The muting input terminals on the SZ must be connected to the muting devices if you want to use the muting function.
■ Input circuit and wiring

For PNP output type cable

For NPN output type cable

The input circuit for muting input 1 and 2 is as follows.

For PNP output type cable

For NPN output type cable

■ Limitation

- **Muting device**
  - The muting device output must be N.O. (normally open).
  - The muting device is required to be PNP output when using the PNP output type cable, while the muting device is required to be NPN output when using the NPN output type cable.
  - Do not use one muting device with multiple outputs in place of two or more muting devices. (One muting device may only provide one output.)
  - If the muting device has a timer function that can adjust the output timing, do not use that function.

■ Conditions for initiation of muting

Muted condition is initiated if all of the following conditions are met.

- Muting inputs go to the ON-state with the specified sequence and within the specified time between them.
- The SZ detects no object in the protection zone.
- The OSSD is in the ON-state.

**Configuration to the conditions for initiation of muting**

For the sequence of muting inputs (muting input 1 and muting input 2) and the time between muting inputs, you can change them as shown in the following.

**For the sequence of muting inputs**

- Muting input 1 to Muting input 2 (default)
- Muting input 2 to Muting input 1
- Not specified

**For the time between muting inputs (Unit: second)**

- 0.04 to 3.0 (default)
- 0.04 to 5.0
- 0.04 to 10.0
- 0.04 to (not specified)
### Conditions for termination of muting

The muted condition is terminated if one of the following conditions is met.

- Either of muting inputs goes to the OFF-state at least for more than 0.03 sec.
- The SZ goes to the error state.
- Check input goes to the ON-state. [2-14 Check input function](#)
- The power supply is interrupted or restored.
- Maximum muting period of time has been passed.

### Configuration to the conditions for termination of muting

For the maximum muting period of time, you can change it as shown in the following.

- Approx. 1 minute
- Approx. 5 minutes (Default)
- Approx. 10 minutes
- Not specified

---

**Danger**

The responsible personnel must perform the risk assessment based on the machine application in order to appropriately determine the risk if “Not specified” is selected for the maximum muting period of time. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.

---

**Note**

Muted condition is terminated approx. 5 minutes later when the time between muting inputs exceeds 3 seconds, even if “Not specified” is selected for both maximum muting period of time and time between muting inputs.

---

### Time chart (Default)

![Time chart diagram]
Suspension in teaching mode

Suspension in teaching mode is a temporary suspension of safety function while the industrial robot (hereinafter called as "robot") is in the teaching mode. Generally, the operation mode of the robot would be switched to the teaching mode in order to configure the robot. After that, the operator or responsible personnel can go into the hazardous area (ie. inside of safety guarding).

The SZ is connected to both the signal from switch to change the operation mode to teaching mode and the signal from the robot indicating that the robot is in the teaching mode. The safety function is suspended only if the SZ recognizes that the robot is in the teaching mode (manual operation mode for a robot that has sufficiently reduced speed).

The whole of protection zone goes to the suspended condition during the suspension in teaching mode. (It is not possible to suspend the safety function to a part of the protection zone.)

**Input circuit and wiring**

**For PNP output type cable**

- **Teach mode input**
  - Brown
  - Light blue
- **Teach ready input**
  - Light blue/Black
  - Blue

**For NPN output type cable**

- **Teach mode input**
  - Light blue
- **Teach ready input**
  - Blue

The input circuit for teach mode input and teach ready input is as follows.

**Conditions for initiation of suspension in teaching mode**

Suspended condition (Temporary suspension of safety function) is initiated if all of the following conditions are met.

- Teach ready input goes to the ON-state within the specified time after the teach mode goes to the ON-state.
- The SZ detects no object in the protection zone.
- The OSSD is in the ON-state.

**Configuration to the conditions for initiation of suspension in teaching mode**

For the time between teach mode input and teach ready input, you can change it as shown in the following.

- 0.04 to 3.0 (default)
- 0.04 to 5.0
- 0.04 to 10.0
### Conditions for termination of suspension in teaching mode

Suspended condition (Temporary suspension of safety function) is terminated if one of the following conditions is met.

- Either of teach mode input or teach ready input goes to the OFF-state at least for more than 0.03 sec.
- The SZ goes to the error state.
- Check input goes to the ON-state.
- The power supply is interrupted or restored.

There is no specification for maximum suspended period of time in case of suspension in teaching mode.

### Time chart

- **Teach mode input**: ON, OFF
- **Teach ready input**: ON, OFF
- **Suspended**: Yes/No
- **Not suspended**: Yes/No
- **Muting lamp**: Light ON, Light OFF
- **SZ**
  - Detect no object: ON, OFF
  - Detect object: ON, OFF
- **OSSD**: ON, OFF

**T1**: Within 0.04 to 3 seconds
Override function

Under the temporary suspension of safety function activated, such as muting or suspension in teaching mode, the OSSD goes to the OFF-state if that suspension is interrupted for any reason while an object is still in the protection zone.

In this case, the machine continues to stop because the muting or suspension in teaching mode never works again for the reason that the SZ detects an object in the protection zone.

The override is a helpful function suitable for such a situation.

The SZ goes to the override condition when the conditions for initiation of override are met. Under the override activated, you can easily remove an object in the protection zone.

The whole of protection zone goes to the override condition during override activated. (It is not possible to suspend the safety function to a part of the protection zone.)

Input circuit and wiring

For PNP output type cable

- Brown: +24 V
- Yellow: (Reset input)
- Yellow/Black: (Override input)
- Blue: 0 V

For NPN output type cable

- Brown: +24 V
- Yellow: (Reset input)
- Yellow/Black: (Override input)
- Blue: 0 V

The input circuit for reset input and override input is as follows.

For PNP output type cable

- Main circuit: Brown, Yellow, Yellow/Black, Blue
- Input resistance: 4.4kΩ

For NPN output type cable

- Main circuit: Brown, Yellow, Yellow/Black, Blue
- Input resistance: 4.4kΩ

*1 In case of "Manual/Automatic" or "Automatic/Automatic" on the configuration of start/restart, the switch with N.C. type should be used for reset operation.

"Start/restart mode" (page 2-12)
● Under the muting function activated

Conditions for initiation of override
Override condition is initiated when the reset input goes to the ON-state (*2) within 0.04 to 1 sec. after the override input goes to the ON-state, if all of the following conditions are met.

- Either of muting inputs or both muting inputs go to the ON-state.
- The SZ is not in the error state.
- The SZ detects an object in the protection zone.
- The OSSD is in the OFF-state. (Including interlock condition)

*2 In case of "Manual/Automatic" or "Automatic/Automatic" on the configuration of start/restart, the reset input must be the OFF-state for initiation of override. Additionally, in case of applying the check input function, check input must be the ON-state for initiation of override.

Conditions for termination of override
The override condition is terminated if one of the following conditions is met.

- All muting inputs go to the OFF-state.
- Either override input or reset input goes to the OFF-state.
- The SZ goes to the error state.
- Maximum override period of time has been passed.

You can select the maximum override period of time. Option is "1 minute", "5 minutes" and "10 minutes". (Default: 1 minute)

● Under the suspension in teaching mode activated

Conditions for initiation of override
Override condition is initiated when the reset input goes to the ON-state (*3) within 0.04 to 1 sec. after the override input goes to the ON-state, if all of the following conditions are met.

- Both teach mode input and teach ready input go to the ON-state.
- The SZ is not in the error state.
- The SZ detects an object in the protection zone.
- The OSSD is in the OFF-state. (Including interlock condition)

*3 In case of "Manual/Automatic" or "Automatic/Automatic" on the configuration of start/restart, the reset input must be the OFF-state for initiation of override. Additionally, in case of applying the check input function, check input must be the ON-state for initiation of override.

Conditions for termination of override
The override condition is terminated if one of the following conditions is met.

- Either of teach mode input or teach ready input, or both of them go to the OFF-state.
- Either override input or reset input goes to the OFF-state.
- The SZ goes to the error state.
- Maximum override period of time has been passed.

You can select the maximum override period of time. Option is "1 minute", "5 minutes" and "10 minutes". (Default: 1 minute)
Time chart (Initial settings when the Muting Function is used)

<table>
<thead>
<tr>
<th>Muting input 1</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muting input 2</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>SZ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Override input</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Reset input 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Override condition</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Muting lamp</td>
<td>Blinking</td>
<td>Light OFF</td>
</tr>
<tr>
<td>OSSD</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

*4 If the start/restart mode setting is Auto/Auto, then the reset input logic is reversed.
AUX output is informative output to inform the user of the SZ operations. The number of outputs and applicable information varies depending on the model.

<table>
<thead>
<tr>
<th></th>
<th>SZ-01S</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUX output</td>
<td>2 outputs</td>
<td>6 outputs</td>
<td>4 outputs</td>
</tr>
</tbody>
</table>

SZ-01S: Two outputs (AUX1, 2)
SZ-04M: Six outputs (AUX1 to 6)
SZ-16V: Four outputs (AUX1 to 4)

X: Available    -: Not available

<table>
<thead>
<tr>
<th>Condition</th>
<th>SZ-01S</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Alert</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Error or alert</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>OSSD state</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Detection in protection zone</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Detection in warning zone</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Interlock-reset-ready output</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>State information</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Muted or override condition</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Muting lamp</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

The AUX output is not allowed to be used as a safety output for safety-related part of a control system. Usage of this function as safety output could result in the significant harm to the machine operators, including serious injury or death.

### Output circuit and wiring

For connecting a PNP input device

- Blue: 0 V
- Brown: +24 V
- Output rating: 50 mA or less

For connecting an NPN input device

- Blue: 0 V
- Brown: +24 V
- Output rating: 50 mA or less

**Note**

Regardless of selection between PNP output type cable and NPN output type cable, AUX output can be connected to 0 V common or +24 V common. But, the operation of load connected to the AUX output varies depending on the cable type and common to be connected.

The following description is based on the below assumption.

1) The AUX output is used as PNP output because the connector cable is PNP output type cable.
2) The AUX output is used as NPN output because the connector cable is NPN output type cable.

If the AUX output is used as NPN output even though the connector cable is PNP output type cable, the explanation related to the operation of load (ON/OFF state) must be completely inverted. Similarly, if the AUX output is used as PNP output even though the connector cable is NPN output type cable, the explanation related to the operation of load (ON/OFF state) must be also completely inverted.
When muting lamp output is assigned to AUX 6

If you assign the AUX 6 to the muting lamp output, the AUX 6 is always NPN output regardless of selection between PNP output type cable and NPN output type cable.

The configuration for the AUX output through the manual configuration on the SZ is limited. For information about the available information, see "Non-safety Function Settings" (page 5-12).

Error output

You can make sure whether there is an error in the SZ or not.
Error output goes to the ON-state during normal operation, while it goes to the OFF-state in case of error state.

<table>
<thead>
<tr>
<th>Error output</th>
<th>( S )</th>
<th>( M )</th>
<th>( V )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>OSSD</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Error output</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device. For more information, see "Overview of the AUX output" (page 2-35).

Alert output

You can make sure whether there is an alert in the SZ or not.
The alert output goes to the OFF-state if the SZ detects any of the following condition.
- Light pollution on the window
- Light interference
- High-reflective background
- Overcurrent on AUX
- Muting lamp failure (disconnection or overcurrent)

"Alert state" (page 8-4)

You can prevent the unnecessary machine stop because you can find the countermeasure before the OSSD goes to the OFF-state during the normal operation, if you use this output.
The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device. For more information, see "Overview of the AUX output" (page 2-35).

**Note**

The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device. For more information, see "Overview of the AUX output" (page 2-35).

**Error or alert output**

You can make sure whether there is an error or alert in the SZ or not. The error/alert output goes to the OFF-state if the SZ detects an error or alert.

For the timing chart in case of error state, see "Error output" (page 2-36). For the timing chart in case of the alert state, see "Alert state" (page 8-4).

**OSSD state output**

OSSD state output operates corresponding to the operation of OSSD. You can make sure the OSSD operation through the external device, such as PLC.

When the Mode B, C or D is applied as the operation mode for OSSD 3/4, you can select either the OSSD 1/2 state output corresponding to the OSSD 1/2 operation or the OSSD 3/4 state output corresponding to the OSSD 3/4.

"Multi-OSSD function" (page 2-18)

**Time chart**

The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device. For more information, see "Overview of the AUX output" (page 2-35).
You can make sure the operation for detection in the protection zone and at the reference points. The AUX output assigned for detection in protection zone goes to the OFF-state if the SZ is in any of the following situation.

- In case where the SZ detects an object (someone or something) in the protection zone
- In case where the SZ detects nothing at the reference point
- In case where the check input goes to the ON-state
- In case where the SZ is in the error state

### Note
When the Mode C is applied as the operation mode for OSSD3/4 and muting or suspension in teaching mode is also applied to the SZ, you cannot assign the output for detection in protection zone to the AUX output.

### Reference
- You can define that the SZ is in the interlock condition if this output indicates "Nothing detected in the protection zone" with the OFF-state of OSSD.
- You can also define that the SZ detects an object (someone or something) in the protection zone under the temporary suspension of safety function activated if this output indicates "Something detected in the protection zone" with the ON-state of OSSD.
- See "2-7 Interlock" (page 2-12) and "2-12 Temporary suspension of safety function" (page 2-27).

### Time chart

![Time chart](image)

### Note
The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device.

For more information, see "Overview of the AUX output" (page 2-35).

---

You can make sure the operation for detection in the warning zone. The AUX output assigned for detection in warning zone goes to the OFF-state if the SZ is in any of the following situation.

- In case where the SZ detects an object (someone or something) in the warning zone
- In case where the check input goes to the ON-state
- In case where the SZ is in the error state

### Reference
- When the Mode D is applied as the operation mode for OSSD3/4, two outputs for detection in warning zone, "detection in warning zone A" and "detection in warning zone B", can be set individually.
- "Multi-OSSD function" (page 2-18)

### Output for detection in the warning zone

![Output chart](image)

The time chart is the same for "Output for detection in the protection zone".
You can make sure whether the SZ is ready for start/restart during interlock condition or not. The interlock-reset-ready output goes to the ON-state if the SZ is ready for the start/restart during interlock condition. At this moment, the SZ can starts/restarts the operation due to the termination of interlock condition if the reset operation is performed. The SZ is ready for the start/restart if the following conditions are fulfilled.

- The SZ detects no object (someone or something) in the protection zone
- The SZ detects something at the reference point (in case of reference points monitoring activated)
- The check input is in the OFF-state
- The SZ is not in the error state

### Time chart

<table>
<thead>
<tr>
<th>Time chart</th>
<th>S</th>
<th>M</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detect no object</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detect object</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interlock-reset-ready output ON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interlock-reset-ready output OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset input ON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset input OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSSD ON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSSD OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device.

For more information, see "Overview of the AUX output" (page 2-35).

---

You can make sure whether the SZ is under the temporary suspension of safety function or not. The muted or override condition output goes to the ON-state if the SZ is under the temporary suspension of safety function, such as muting, suspension in teaching mode and override.

### Time chart

<table>
<thead>
<tr>
<th>Time chart</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD ON</td>
<td></td>
</tr>
<tr>
<td>OSSD OFF</td>
<td></td>
</tr>
<tr>
<td>Muted or override condition output ON</td>
<td></td>
</tr>
<tr>
<td>Muted or override condition output OFF</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device.

For more information, see "Overview of the AUX output" (page 2-35).
The SZ can inform that it is under temporary suspension of safety function through an external indicator, which is called the muting lamp.

Since the SZ can assign the AUX 6 to the output for muting lamp, the SZ itself can control the muting lamp.

The following conditions must be fulfilled if the muting lamp is connected to the AUX 6 assigned to the muting lamp output.

- In case of incandescent lamp: DC 24V, 1.0-5.5 W
- In case of LED indicator: Current consumption 10-230 mA

You can receive alerts about muting lamp failure, such as the blowout of the lamp, disconnection or overcurrent, through the alert output, error output or state information output. "State Information Output" (page 2-41).

You can define the performance of SZ under the muting lamp failure as either error (muting lamp error) or alert. The SZ goes to the error state in case of muting lamp failure in accordance with the default configuration.

You can assign the muting lamp output only to the AUX6.

If you assign the AUX 6 to the muting lamp output, the AUX 6 is always NPN output regardless of selection between PNP output type cable and NPN output type cable.

For information about output circuit and the wiring method, see "Overview of the AUX output" (page 2-35).
The state information output is a function to inform the external device of the current state of the SZ through the two AUX outputs. The state information output 1 is assigned to the AUX output 1, while the state information output 2 is assigned to the AUX output 2. The state information output 1 is the strobe signal for information output. The state information output 2 is the informative pulse signal for exact state of the SZ.

The state information output 1 goes to the ON-state if the SZ has a change on its state. While the state information output 1 is in the ON-state, the SZ generates the pulse signals on the state information output 2. If you count the pulses on the state information outputs, you can get the current state of the SZ. (The state information output 1 goes back to the OFF-state when the SZ is completed to generate the pulses on the state information output 2.)

The following table shows the relationship between the number of pulse and the state of the SZ. You can use this function for monitoring the SZ operation through the PLC.

<table>
<thead>
<tr>
<th>Number of pulses from the state information output 2</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal operation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Override condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muted condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suspension in teaching mode state</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interlock condition</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Switch to bank1</td>
<td>Bank switching*1</td>
</tr>
<tr>
<td>5</td>
<td>Switch to bank2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Switch to bank3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Switch to bank4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Waiting for bank input</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Alert for window</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Alert for light interference or high-reflective background</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Alert for muting lamp</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>OSSD error</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>EDM error</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Reset error</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Bank error</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Window error</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Check point error</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Muting lamp error</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Window calibration error</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>System error</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>State in configuration</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Configuration data error</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>MI error</td>
<td></td>
</tr>
</tbody>
</table>

*1 For the SZ-16V, pulse number 4 is generated in case of bank switching and start.

"Start-up" means 1) when the power is supplied, 2) when the SZ is restored from error state thorough reset input, and 3) when the configuration is completed through the SZ Configurator or the manual configuration on the SZ.

For more information about the error state, see “Error state” (page 8-2). For more information about the alert state, see “Alert state” (page 8-4).
You can select the pulse width (A).
Option is “20”, “40”, “60”, “80”, “100”, “200” and “300”. (Unit: millisecond, Default: 20 ms)

Note
The operation (ON/OFF state) of the load connected to the AUX output varies depending on the selected connector cable and connection with the external device. For more information, see "Overview of the AUX output" (page 2-35).

Reference
SZ Configurator must be used to assign the state information output to the AUX 1 and AUX 2, and to select the pulse width (A) of state information output 2.
Check input function

You can make sure whether the machine stops as intended or not because the OSSD can go to the OFF-state through the external signal (check input). There are two options, such as laser shutdown and check points monitoring. You must select either if you apply this function to the SZ. The yellow wire is assigned to the check input function.

Note
In case of “Manual/Automatic” or “Manual/Manual” on the configuration of start/restart, you have no chance to apply the check input function to the SZ.

“2-7 Interlock” (page 2-12)

Input circuit and wiring

For PNP output type cable

For NPN output type cable

Reference
SZ configurator must be used to apply the check input function to the SZ.

Laser shutdown

The laser radiation from the SZ stops while the OSSD is in the OFF-state due to the check input function.

Time chart

*“Laser Shutdown” (page 2-26)*
Check point monitoring

The check points monitoring works while the OSSD is in the OFF-state due to the check input function. You can make sure the displacement of the surrounding structure (ex. protective safeguarding), the displacement of the SZ itself and the detection of the SZ.

The check input function has three of following features.
- You can make sure the state of the specified check points while the check input is in the ON-state.
- The SZ goes to the error state of “check point error” unless the SZ detects something at the check point while the check input is in the ON-state.
- The OSSD goes to the OFF-state while the check input is in the ON-state. (Laser radiation continues.)

Check point

The point that the SZ check the positioning of the surrounding structure is named as “Check point”. The following figure is an example that the 2 check points (A and B) is set to the surrounding structure.

Setting example for check points

Note

In case of check point monitoring applied, you have no chance to apply the reference points monitoring function.

“2-9 Reference points monitoring function” (page 2-17)

- SZ configurator must be used to apply the check input function to the SZ.
- Maximum 30 check points can be set.
- For more information about the error state, see “Error state” (page 8-2).

Time chart

In case where the SZ does not go to the error state of “Check point error”

In case where the SZ goes to the error state of “Check point error”

[Diagram of time chart]

[Diagram of time chart]
You can monitor the state of SZ operation through the information display on the SZ or the SZ Configurator.
X: Available    -: Not available

<table>
<thead>
<tr>
<th>Function</th>
<th>SZ</th>
<th>SZ configuration software</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O monitoring</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Wiring check</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Protection zone monitoring</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Warning zone monitoring</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>OSSD OFF History</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Real-time ranging</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>AUX output test</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

You can check the ON/OFF state on each inputs and AUX outputs.
You can check the pin No., color and function on connector cable.
You can check whether the SZ detects an object in the protection zone.
You can check whether the SZ detects an object in the warning zone.
You can check the time and reason for the OSSD OFF. Maximum 20 events can be checked in the history after power-on.
You can check the surrounding structures detected by SZ in real time.
You can check the operation of AUX output through the switching between ON-state and OFF-state with the simulation basis.

**Note**

If both protection zone and warning zone are configured through the SZ Configurator, you cannot perform the protection zone monitoring and warning zone monitoring on the SZ itself.

For more information about use, see "Chapter 5 Manual Configuration on the SZ" (page 5-1) and "Chapter 6 Configuration through SZ Configurator (SZ-H1S)" (page 6-1)
MEMO
## Installation to a Machine

<table>
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<tr>
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<td>3-4 Mounting for installation</td>
<td>3-13</td>
</tr>
</tbody>
</table>
3-1 Precaution at installation

- The protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed.
  ( "3-3 Safety distances" page 3-7)
- When either multi-OSSD function or bank switching function is enabled, every protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed.
- SZ cannot monitor anything behind the object that the SZ detects in the protection zone. (This is a blind area for the SZ) The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ. If necessary, the additional countermeasure must be taken by the responsible personnel.
- The necessary safety distance varies depending on the minimum detectable object size and the response time you specify. The protection zone must be configured so as to set ensure the minimum safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed.
  ( "3-3 Safety distances" page 3-7)
- The SZ must be installed so that the machine operator is able to go into or approach the hazardous zone or hazards only by passing through the protection zone of the SZ. Strictly avoid installation that allows the machine operator or a part of the machine operator’s body to go into or approach the hazardous zone or hazards without passing through the protection zone of the SZ or to remain in a position between the protection zone of the SZ and the hazardous zone or hazard.
- You must prepare the test piece with the intended minimum detectable object size in order to verify the protection zone in accordance with the pre-check test procedures, such as the item specified in this manual, after installing the SZ.
3-2 Hint on installation

**Light interference**

Although there is no object in the protection zone, the OSSD might go to the OFF-state if the ambient light source as shown in below is located at the detection plane, because the SZ performs the false detection.

- Incandescent lamp
- Sunlight
- Fluorescent light
- Strobe light
- Other infrared light sources (infrared photoelectric sensor, infrared laser, etc.)

In order to avoid this situation, the ambient light source should not be located within ±5° of the detection plane.

**Mutual interference**

The OSSD might go to the OFF-state due to mutual interference if you install multiple SZ.

The SZ should be installed according to the following countermeasures in order to avoid mutual interference.

(1) A shielding plate should be installed like below.
(2) The height of installation should be changed like below.

(3) The angle of installation should be changed like below.

The following countermeasures may be taken into account in order to reduce the possibility of the mutual interference.

- The scan cycle can be changed. ( "2-6 Response time and scan cycle" page 2-11)
- The response time can be slower. ( "2-6 Response time and scan cycle" page 2-11)
- The minimum detectable object size can be smaller. ( "2-3 Protection zone" page 2-6)
- The protection zone can be smaller. ( "2-3 Protection zone" page 2-6)

⚠️ Danger

You must calculate the minimum safety distance again in order to reinstall the SZ with appropriate safety distance if you want to apply the above countermeasure.
High reflective background

The SZ performs false detection for the actual distance to the object if there is a high reflective background at the detection plane. In this case, the SZ falsely recognizes that the object is located farther than the actual distance to the object.

Therefore, if there is a high reflective background within 1.5 m from the boundary of the protection zone, you must take a countermeasure, such as reducing the reflectance or removing the background itself. However, if you cannot take the above-mentioned countermeasures, another 200 mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance.

If there is a high reflective background within 1.5 m from the boundary of the protection zone, you must take a countermeasure, such as reducing the reflectance or removing the background itself. If you cannot take the above-mentioned countermeasures, another 200 mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance.

The SZ goes to the alert state (Alert for high-reflective background) if it detects the high reflective background. For more information about the alert state, see "Alert state" (page 8-4).

Examples of high reflective backgrounds
- Metallic glossy surface
- Retro-reflective sheet
- Retro-reflective plate etc…
Zone with limited detection capability

SZ might not detect an object with low reflectance located at the distance of 85mm or less from the protection zone origin. This is the zone with limited detection capability.

Danger

In case of installation of the SZ, the responsible personnel must perform the risk assessment with taking into account the possibility that an object might go into the zone with limited detection capability. If it is possible, the additional countermeasure must be taken by the responsible personnel.
The protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, standards of the country and region in which the SZ is installed as well as the specification specified in this user’s manual.

**Example of area protection (Direction of approach parallel to the protection zone)**

\[ S = K \times T + C + A \quad \text{< According to ISO13855 (2005) and IEC61496-3 (2008) >} \]

- **S**: Safety distance
- **K**: Approach speed of the body or parts of the body in millimeters per second
- **T**: Overall Response time in second (\( t_1 + t_2 \))
  - \( t_1 \): SZ response time in second
  - \( t_2 \): Max. time in second required to stop the machine after receiving the OSSD signal from SZ
- **C**: \( 1200 - 0.4 \times H \) (850 mm or higher)
  - **H**: Height of detection plane (protection zone) above the reference plane in millimeters, for example the floor. \( 1000 \text{mm} \geq H \geq 15 \times (\text{d-50}) \)
- **A**: Supplementary necessary distance for SZ in millimeters
- **P1, P2, P3**: Protection distances to be configured as the protection zones
- **W1, W2**: Width of the hazardous area
- **B**: Distance between the edge of the hazardous area and protection zone origin on the SZ
- **D**: Unprotected space
• The unprotected space (D) between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ is installed, in order to prevent the machine operators from approaching into the hazardous area through this space (D). Additional countermeasures for protection must be provided if there is a space (D) between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ.

• There is a risk of inadvertent undetected access beneath the detection plane (protection zone), if the height “H” of detection plane (protection zone) is greater than 300mm (200mm for non-industrial application, for example in the presence of children). The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ. If necessary, the additional countermeasure must be taken by the responsible personnel.

• If you select the minimum detectable object size of 150 mm, “H” (Height of detection plane) exceeds 1,000 mm. You must select the minimum detectable object size of 70 mm or less if you want to configure the area protection (direction of approach parallel to the protection zone).

Example of safety distance calculation

\[
\begin{align*}
K &= 1600 \text{ mm/s} & \text{Approach speed of the body or parts of the body (Constant)} \\
T &= t_1 + t_2 = 0.59 \text{ s} & \text{Overall response time} \\
 & = 0.09 \text{ seconds} & \text{SZ response time (Changeable)} \\
 & = 0.5 \text{ seconds} & \text{Max. time required to stop the machine after receiving the OSSD signal from SZ} \\
C &= 1200 - 0.4 \times H = 1080 \text{ mm} \\
H &= 300 \text{ mm} & \text{Lowest allowable height of detection plane (protection zone). This must be calculated using the following formula: } H \geq 15 (d - 50 \text{ mm}) \\
d &= 70 \text{ mm} & \text{Minimum detectable object size (Changeable)} \\
A &= 100 \text{ mm} & \text{Supplementary necessary distance for SZ} \\
B &= 59 \text{ mm} & \text{Distance between the edge of the hazardous area and protection zone origin on the SZ} \\
W_1 = W_2 &= 1000 \text{ mm} & \text{Width of the hazardous area} \\
\end{align*}
\]

Safety Distances

\[
S = K \times T + C + A \\
= 1600 \times 0.59 + 1080 + 100 = 2124 \text{ mm}
\]

Protection distances to be configured as the protection zones

\[
\begin{align*}
P_1 &= S - B = 2065 \text{ mm} \\
P_2 &= S + W_1 = 3124 \text{ mm} \\
P_3 &= S + W_2 = 3124 \text{ mm}
\end{align*}
\]

If there is a high reflective background within 1.5 m from the boundary of the protection zone, another 200 mm must be added as supplementary necessary distance to the P1, P2 and P3 respectively.

We recommend you should have a marking on the floor for indicating the specified protection zone.
Example of access protection 1 (Direction of approach normal to the protection zone)

- Reference points monitoring function must be applied when the SZ is used for the access protection specified in IEC61496-3:2008 Annex A.12 and A.13 (the application where the angle of the approach exceeds ±30° to the detection plane.). In this case, the tolerance for reference points must be ±100 mm or less and the response time must be 90 ms or less.

- The unprotected space between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ is installed, in order to prevent the machine operators from approaching into the hazardous area through this space. Additional countermeasures for protection must be provided if there is a space between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ.

\[
S = (K \times T) + C < \text{According to ISO13855 (2005) and IEC61496-3 (2008)}> \\
S: \text{Minimum safety distance in millimeters} \\
K: \text{Approach speed of the body or parts of the body in millimeters per second} \\
T: \text{Overall response time in second (}t_1 + t_2) \\
t_1: \text{SZ response time in second} \\
t_2: \text{Max. time in second required to stop the machine after receiving the OSSD signal from SZ} \\
C: \text{Additional distance in millimeters, taking into accounts the intrusion prior to actuation of protective equipment.}
\]

Example of safety distance calculation

- \( K = 1600 \text{ mm/s} \) Approach speed of the body or parts of the body
- \( T = t_1 + t_2 = 0.59 \text{ s} \) Overall response time
- \( t_1 = 0.09 \text{ seconds} \) SZ response time (Changeable)
- \( t_2 = 0.5 \text{ seconds} \) Max. time required to stop the machine after receiving the OSSD signal from SZ
- \( C = 850\text{mm} \)
- \( d = 70\text{mm} \) Minimum detectable object size

\[
S = K \times T + C = 1600 \times 0.59 + 850 = 1794 \text{ mm}
\]
Example of access protection 2 (In case of approaching of the body or parts of the body to the hazardous area)

- Reference points monitoring function must be applied when the SZ is used for the access protection specified in IEC61496-3:2008 Annex A.12 and A.13 (the application where the angle of the approach exceeds ±30° to the detection plane). In this case, the tolerance for reference points must be ±100 mm or less and the response time must be 90ms or less.

- If you configure the protection zone in order to protect the opening of the machine through which the machine operator can approach the hazardous area (hereinafter called as "opening to the hazard"), you must configure the protection zone with the additional width indicated by "a", "b", and "c" as shown in below figure, which is to be larger than the opening to the hazard.

- In case of the application for detection of hand and arm approaching into the hazardous area, the minimum detectable object size must be 30 mm or 40 mm.

Example of safety distance calculation

\[ S = (K \times T) + C \]  
(According to ISO13855 (2005) and IEC61496-3 (2008))

- \( S \): Minimum safety distance in millimeters
- \( K \): Approach speed of the body or parts of the body in millimeters per second
- \( T \): Overall response time in second \((t_1 + t_2)\)
  - \( t_1 \): SZ response time in second
  - \( t_2 \): Max. time in second required to stop the machine after receiving the OSSD signal from SZ
- \( C \): Additional distance in millimeter, taking into accounts the intrusion prior to actuation of protective equipment. \(8 \times (d-14)\)
- \( d \): SZ minimum detectable object size in millimeters.

- \( a, b, c \): Width of protection zone in millimeters that covers the outside of opening to the hazard. This must be more than \((100-d/2)\) mm.

Example of access protection 2 (In case of approaching of the body or parts of the body to the hazardous area)

Example of safety distance calculation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( K )</td>
<td>2000 mm/s</td>
</tr>
<tr>
<td>( T )</td>
<td>0.18s</td>
</tr>
<tr>
<td>( t_1 )</td>
<td>0.06 seconds</td>
</tr>
<tr>
<td>( t_2 )</td>
<td>0.12 seconds</td>
</tr>
<tr>
<td>( C )</td>
<td>128mm</td>
</tr>
<tr>
<td>( d )</td>
<td>30mm</td>
</tr>
</tbody>
</table>

\[ S = K \times T + C = 2000 \times 0.18 + 128 = 488 \text{ mm} \]

Note

- If \( S \) is found to be greater than 500mm using this formula, you can use \( K=1,600 \text{ mm/s} \). However, the minimum value of \( S \) shall not be less than 500 mm.
Example of installing to an AGV (automated guided vehicle)

\[ S = V \times T + S_{brake} \times L + Z \]

- **S**: Minimum safety distance in millimeters
- **V**: Maximum approach speed of the AGV in millimeters per second
- **T**: Overall response time in second \((t_1 + t_2)\)
  - **t_1**: SZ response time in second
  - **t_2**: Max. time in second that AGV responds after receiving the OSSD signal from SZ.
- **S_{brake}**: Required distance for braking AGV in millimeters
- **L**: Safety coefficient for required distance based on the wear of braking
- **Z**: Additional distance in millimeters, \(Z_{SZ} + Z_{G}\) (mm)
  - **Z_{SZ}**: Supplementary necessary distance for SZ in millimeters
  - **Z_{G}**: Supplementary necessary distance in millimeters, if \(h\) is not enough.
- **h**: Space between the reference plane (floor) and the bottom of AGV.

If the \(h\) is not enough ensured, you must take into account the risk that the toe or toe tip is caught between the ground (floor) and the AGV.

The relationship between \(h\) and \(Z_{G}\) is as follows.

\[ h (\text{mm}) \]

\[ Z_{G} (\text{mm}) \]

- **P1, P2, P3**: Protection distances to be configured as the protection zones
- **W1, W2**: Width of the AGV
- **B**: Distance between the front edge of the SZ and protection zone origin on the SZ
- **D**: Unprotected space
- **H**: Height of detection plane (protection zone) above the reference plane in millimeters, for example the floor. \(H\) must be less than 200 mm.
• The unprotected space (D) between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ is installed, in order to prevent the machine operators from approaching into the hazardous area through this space (D) when the AGV stops. Additional countermeasures for protection must be provided if there is a space (D) between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ.

• There is a risk of inadvertent undetected access beneath the detection plane (protection zone), if the height “H” of detection plane (protection zone) is greater than 200mm. However, the height “H” should be 150 mm or more in order to detect the object with the height of 150 mm. The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ. If necessary, the additional countermeasure must be taken by the responsible personnel.

### Example of safety distance calculation

\[ V = 1500 \text{ mm/s} \]

\[ T = t_1 + t_2 = 0.19 \text{ s} \]

\[ t_1 = 0.09 \text{ seconds} \quad \text{SZ response time (Changeable)} \]

\[ t_2 = 0.1 \text{ seconds} \quad \text{Max. time in second that AGV responds after receiving the OSSD signal from SZ.} \]

\[ S_{\text{brake}} = 1,300 \text{mm} \quad \text{Required distance for braking AGV in millimeters} \]

\[ L = 1.1 \quad \text{Safety coefficient for required distance based on the wear of braking} \]

\[ Z = Z_{\text{SZ}} + Z_G = 100 + 100 = 200 \text{mm} \quad \text{Additional distance in millimeters (mm)}, \]

\[ Z_{\text{SZ}} = 100 \text{mm} \quad \text{Supplementary necessary distance for SZ in millimeters} \]

\[ Z_G = 100 \text{mm} \quad \text{Supplementary necessary distance in millimeters, if “h” is not enough.} \]

\[ h = 60 \text{mm} \quad \text{Space between the reference plane (floor) and the bottom of AGV.} \]

\[ B = 45 \text{mm} \quad \text{Distance between the front edge of the SZ and protection zone origin on the SZ} \]

\[ W_1 = W_2 = 1,000 \text{ mm} \quad \text{Width of AGV} \]

**Safety Distances**

\[ S = V \times T + S_{\text{brake}} \times L + Z = 1,500 \times 0.19 + 1,300 \times 1.1 + 200 = 1,915 \text{mm} \]

Protection distances to be configured as the protection zones

\[ P_1 = S + B = 1,960 \text{mm} \]

\[ P_2 = W_1 + Z = 1,200 \text{mm} \]

\[ P_3 = W_2 + Z = 1,200 \text{mm} \]

If there is a high reflective background within 1.5 m from the boundary of the protection zone, 200 mm must be added as supplementary necessary distance to the P1, P2 and P3 respectively.

“High reflective background” (page 3-5)
Mounting for installation

**Danger**
Losing the screw caused by the vibration or shock to the SZ must be avoided. It may cause the displacement of detection plane of the SZ. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.

For more information about the dimensions of SZ or the mounting bracket, see "9-3 Dimensions" (page 9-5)

### Wall mounting
You can use four screw holes on the backside of the SZ for installation. Purchase the appropriate screws separately.
(Recommended tightening torque: 3 N·m)

**Mounting with horizontal mounting bracket (OP-86935)**
You can install the SZ with horizontal mounting bracket, which is suitable for the place with low height.

1. You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket.) in case where the horizontal mounting bracket is mounted to the SZ as shown in below figure.
(Recommended tightening torque: 3 N·m)

2. You can install the SZ with horizontal mounting bracket to the intended place. The M6 screws (4 screws) are necessary for installation of SZ itself, which can be prepared on your side.
Mounting with vertical mounting bracket (OP-86936)

You can install the SZ with vertical mounting bracket, which is suitable for the place with narrow width. (1) You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket) in case where the vertical mounting bracket is mounted to the SZ as shown in below figure.

(Recommended tightening torque: 3 N·m)

(2) You can install the SZ with vertical mounting bracket to the intended place. The M6 screws (2 screws) are necessary for installation of SZ itself, which can be prepared on your side.

Mounting with horizontal mounting bracket with angle alignment (OP-86937)

You can install the SZ with horizontal mounting bracket with angle alignment, which is suitable for the place with low height. Additionally, you can align the vertical angle of detection plane with ±7.5 degrees and the horizontal angle of detection plane with ±7.5 degrees. (1) You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket) in case where the mounting bracket 1 is mounted to the SZ as shown in below figure.

(Recommended tightening torque: 3 N·m) You should care the mounting direction to the SZ for the mounting bracket 1.

(2) You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket) in case where two mounting bracket 2 are mounted to the mounting bracket 1 as shown in below figure. (Temporary joint)

(3) You can install the SZ with this mounting bracket to the intended place. The M6 screws (4 screws) are necessary for installation of SZ itself, which can be prepared on your side. (Temporary joint)

(4) You can align the vertical and/or horizontal angle of detection plane, and then tighten the all screws according to the specified tightening torque. You must make sure the detection plane keeps the intended height from the reference plane over the whole protection zone. (Recommended tightening torque: 3 N·m)
Mounting with vertical mounting bracket with angle alignment (OP-86938)

You can install the SZ with vertical mounting bracket with angle alignment, which is suitable for the place with narrow width. Additionally, you can align the vertical angle of detection plane with ±7.5 degrees and the horizontal angle of detection plane with ±7.5 degrees.

1. You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket.) in case where the mounting bracket 1 is mounted to the SZ as shown in below figure. (Recommended tightening torque: 3 N·m) You should care the mounting direction to the SZ for the mounting bracket 1.
2. You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket.) in case where the mounting bracket 2 is mounted to the mounting bracket 1 as shown in below figure. (Temporary joint)
3. You can install the SZ with this mounting bracket to the intended place. The M6 screws (4 screws) are necessary for installation of SZ itself, which can be prepared on your side. (Temporary joint)
4. You can align the vertical and/or horizontal angle of detection plane, and then tighten the all screws according to the specified tightening torque. You must make sure the detection plane keeps the intended height from the reference plane over the whole protection zone.

Mounting with L-shaped mounting bracket with angle alignment (OP-86939)

You can install the SZ with L-shaped mounting bracket with angle alignment, which is suitable for the installation on the reference plane, such as a floor. Additionally, you can align the vertical angle of detection plane with ±7.5 degrees.

1. You can use eight hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket.) in case where the mounting bracket 1 is mounted to the SZ as shown in below figure. (Recommended tightening torque: 3 N·m) You should care the mounting direction to the SZ for the mounting bracket 1.
2. You can use four hexagon socket bolts (M5, length: 10 mm, width across flats: 4 mm, attached with the bracket.) in case where two mounting bracket 2 are mounted to the mounting bracket 1 as shown in below figure. (Temporary joint)
3. You can install the SZ with this mounting bracket to the intended place. The M6 screws (4 screws) are necessary for installation of SZ itself, which can be prepared on your side.
4. You can align the vertical angle of detection plane, and then tighten the all screws according to the specified tightening torque. You must make sure the detection plane keeps the intended height from the reference plane over the whole protection zone. (Recommended tightening torque: 3 N·m)
Wiring

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4-1 Precautions on wiring

- Always turn off the power to the SZ when performing electrical wiring.
- You must fulfill the electrical standards and regulations in the country or region in which the SZ is being used when you perform the electrical wiring.
- To avoid the risk of electric shock, do not connect any of the SZ inputs to DC power sources outside of the range of 24 V DC +20% or to any AC power source.
- To avoid the risk of electric shock, be sure that the hazardous voltage must be isolated from all wiring of the SZ with the reinforced insulation or double insulation.
- Do not install the electric wiring of the SZ together with or in parallel with the high-voltage electrical or power lines.
- For the wiring between SZ and a safety-related machine control system, both OSSD 1 and OSSD 2 must be always wired to a safety-related machine control system in order to ensure the safety. Similarly, both OSSD 3 and OSSD 4 must be always wired to a safety-related control system if you assign a function for OSSD 3/4. If one OSSD is only wired to a safety-related machine control system, it results in a significant harm to the machine operators, including serious injury or death, due to OSSD malfunction.
- When using PNP output type cable, do not cause short-circuit between the OSSD and +24 V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- When using PNP output type cable, be sure to connect the load between the OSSD and 0 V to avoid a dangerous situation. If the load is incorrectly connected between the OSSD and +24V, the logic of OSSD operation is reversed, and then OSSD turns to the ON-state. This is a dangerous situation.
- When using NPN output type cable, do not cause short-circuit between the OSSD and 0 V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- When using NPN output type cable, be sure to connect the load between the OSSD and +24 V to avoid dangerous situation. If the load is incorrectly connected between the OSSD and 0 V, the logic of OSSD operation is reversed, and then OSSD turns to the ON-state. This is a dangerous situation.
- In case of wiring, regardless of PNP output type cable and NPN output type cable, you must fulfill the requirements of Clause 9.4.3 in IEC60204-1: 2005 in order for the protection against maloperation due to earth fault of the OSSD.
- The AUX output is not allowed to be used as a safety output for safety-related control systems. Usage of these functions as safety output could result in the serious injury or death.
- The check input is not allowed to be connected to the safety output provided from the safety-related control system. If the check input is connected to the safety output, it may result in significant harm to the machine operators, including serious injury or death.
- The connector cable must have a length less than or equal to the specification in this user’s manual. Usage of connector cables longer than the specified length may cause the improper operation of safety functions and may cause a dangerous situation.
4-2 Power supply

If the power supply for the SZ is the converting type, the power supply for the SZ must meet the conditions listed below in order to meet the requirements specified in IEC61496-1, UL61496-1, and EN61496-1.

- A rated output voltage of 24 V DC (SELV circuit, Overvoltage Category II) within ±10%.
- Double insulation or reinforced insulation between the primary and secondary circuits.
- Output holding time of 20 ms or more.
- A power supply must meet the requirements of the electrical safety and electromagnetic compatibility (EMC) regulations or standards in all countries and/or regions where the SZ is used.

Note

If the power supply for the SZ is shared with the one for the machine or the other electronic devices, voltage reduction to the SZ or noise influence to the SZ may occur due to the temporary increasing of the current consumption on the machine or the other electronic devices. Since the SZ may go to the error state in such case, the power supply for the SZ should only be shared with the one for the load and muting devices. We do not recommend the power supply for the SZ is shared with the one for the machine or the other electronic devices.
4-3 Mounting the connector cable

For more information about the shape or model of the connector cable, see "Connector cable" (page 1-6).

Note
Do not remove the gray gasket mounted on the connector. The specification of IP65 cannot be fulfilled without this gasket.

How to mount
As shown in the figures below, you can use the M2.6 screws (2 screws) to mount the connector cable, and tighten the screws according to the specified tightening torque.
(Recommended tightening torque: 0.3N·m)

1. 2.

Removal
You can perform the removal of the connector cable in reverse order.
## Wire color and assigned function

### SZ-01S

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>+24V</td>
</tr>
<tr>
<td>Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1:Reset input / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2:EDM input</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
</tbody>
</table>

### SZ-04M

- **Multi-OSSD function: Mode D**
- **(1) In case of applying the bank switching function**

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>Brown</td>
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<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Gray</td>
<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1:Reset input (for OSSD1/2) / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2:EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3:Bank input 1</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4:Bank input 2</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5:Reset input (for OSSD3/4)</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6:EDM input (for OSSD3/4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>Pink</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>
(2) In case of NOT applying the bank switching function

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>+24V</td>
</tr>
<tr>
<td>Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Gray</td>
<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1: Reset input (for OSSD1/2) / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2: EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3: Not use</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4: Not use</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5: Reset input (for OSSD3/4)</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6: EDM input (for OSSD3/4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>Pink</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>

---

### Multi-OSSD function: Mode A, B, C and Not use

(1) In case of applying the bank switching function

<table>
<thead>
<tr>
<th>Wire color</th>
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</tr>
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<tbody>
<tr>
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</tr>
<tr>
<td>Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Gray</td>
<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1: Reset input / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2: EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3: Bank input 1</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4: Bank input 2</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5: Bank input 3</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6: EDM input (for OSSD3/4/Bank input 4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
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<tr>
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<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>

---

**Note**

When “Not use” is applied as the operation mode for OSSD3/4, the gray and gray/black wire is always the OFF-state. Further, red/black is assigned to bank input 4 in this case.
(2) In case of applying the muting function

<table>
<thead>
<tr>
<th>Wire color</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
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<tr>
<td>Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
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<td>Gray</td>
<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1:Reset input / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2:EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3:Teach mode input</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4:Teach ready input</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5:Override input</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6:EDM input (for OSSD3/4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
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<tr>
<td>Pink</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>

**Note**
When “Not use” is applied as the operation mode for OSSD3/4, the gray and gray/black wire is always the OFF-state.

(3) In case of applying the suspension in teaching mode

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
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<tr>
<td>White</td>
<td>OSSD2</td>
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<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
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<td>Input 1:Reset input / Check input</td>
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<tr>
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<td>Input 2:EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3:Teach mode input</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4:Teach ready input</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5:Override input</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6:EDM input (for OSSD3/4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>Pink</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>

**Note**
When “Not use” is applied as the operation mode for OSSD3/4, the gray and gray/black wire is always the OFF-state.
(4) In case of NOT applying bank switching, muting function and the suspension in teaching mode

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
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<td>Brown</td>
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</tr>
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<td>Blue</td>
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</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Gray</td>
<td>OSSD3</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>OSSD4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1:Reset input / Check input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2:EDM input (for OSSD1/2)</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3:Not use</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 4:Not use</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Input 5:Not use</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Input 6:EDM input (for OSSD3/4)</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>Pink</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>AUX output 4</td>
</tr>
<tr>
<td>Green</td>
<td>AUX output 5</td>
</tr>
<tr>
<td>Green/Black</td>
<td>AUX output 6</td>
</tr>
</tbody>
</table>

Note: When “Not use” is applied as the operation mode for OSSD3/4, the gray and gray/black wire is always the OFF-state.

---

**SZ-16V**

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>+24V</td>
</tr>
<tr>
<td>Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>OSSD1</td>
</tr>
<tr>
<td>White</td>
<td>OSSD2</td>
</tr>
<tr>
<td>Yellow</td>
<td>Input 1:Reset input</td>
</tr>
<tr>
<td>Red</td>
<td>Input 2:EDM input</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Input 3:Bank input A</td>
</tr>
<tr>
<td>Gray</td>
<td>Input 4:Bank input B</td>
</tr>
<tr>
<td>Pink</td>
<td>Input 5:Bank input C</td>
</tr>
<tr>
<td>Green</td>
<td>Input 6:Bank input D</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Input 7:Bank input a</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>Input 8:Bank input b</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Input 9:Bank input c</td>
</tr>
<tr>
<td>Green/Black</td>
<td>Input 10:Bank input d</td>
</tr>
<tr>
<td>Orange</td>
<td>AUX output 1</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>AUX output 2</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>AUX output 3</td>
</tr>
<tr>
<td>Red/Black</td>
<td>AUX output 4</td>
</tr>
</tbody>
</table>
Examples of wiring

4-5

SZ-01S

Configuration of start/restart mode: Manual/Manual

For the PNP output type cable

K1, K2: External device
(Safety relay, magnet contactor, etc.)
K3: Solid state contactor
S1: Switch for reset operation (N.O.)
PLC: Used for monitoring, not for control systems related to safety.

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, the yellow wire should be short-circuited to +24 V.
- In case of NOT applying the EDM function, the red wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 and PLC are NON SAFETY-RELATED systems.

For the NPN output type cable

K1, K2: External device
(Safety relay, magnet contactor, etc.)
K3: Solid state contactor
S1: Switch for reset operation (N.O.)
PLC: Used for monitoring, not for control systems related to safety.

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, the yellow wire should be short-circuited to 0 V.
- In case of NOT applying the EDM function, the red wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 and PLC are NON SAFETY-RELATED systems.
4-5 Examples of wiring

SZ-04M

- Multi-OSSD function: Mode D
- Configuration of start/restart mode: Manual/Manual
- For the PNP output type cable

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for resetting OSSD1/2 (N.O.)
S2: Switch for resetting OSSD3/4 (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
S3-1, S3-2: Switch for bank switching
M: 3-phase motor

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1, S2) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to +24 V.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
For the NPN output type cable

- K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
- K5, K6: Solid state contactor
- S1: Switch for resetting OSSD1/2 (N.O.)
- S2: Switch for resetting OSSD3/4 (N.O.)
- PLC: Used for monitoring, not for control systems related to safety.
- S3-1, S3-2: Switch for bank switching
- M: 3-phase motor

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.O. type (S1, S2) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to 0 V.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
Multi-OSSD function: Mode A, B, C and Not use

Configuration of start/restart mode: Manual/Manual

In case of applying the bank switching function

For the PNP output type cable

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for reset operation (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
S3-1, S3-2, S3-3: Switch for bank switching
M: 3-phase motor

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- When "Not use" is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
For the NPN output type cable:

- K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
- K5, K6: Solid state contactor
- S1: Switch for reset operation (N.O.)
- PLC: Used for monitoring, not for control systems related to safety.
- S3-1, S3-2, S3-3: Switch for bank switching
- M: 3-phase motor

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to 0 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- When "Not use" is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
Multi-OSSD function: Mode A, B, C and Not use
Configuration of start/restart mode: Manual/Manual
In case of applying the muting function
- For the PNP output type cable

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for reset operation (N.O.)
S2: Switch for override (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
P1, P2: Muting devices (ex. PZ series with PNP output, Keyence Corp.)
M: 3-phase motor
L: Muting lamp

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
For the NPN output type cable

- K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
- K5, K6: Solid state contactor
- S1: Switch for reset operation (N.O.)
- S2: Switch for override (N.O.)
- PLC: Used for monitoring, not for control systems related to safety.
- P1, P2: Muting devices (ex. PZ series with NPN output, Keyence Corp.)
- M: 3-phase motor
- L: Muting lamp

- In case of “Manual/Automatic” on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of “Automatic/Automatic” on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to 0 V.
- When “Not use” is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- When “Not use” is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
Multi-OSSD function: Mode A, B, C and Not use
Configuration of start/restart mode: Manual/Manual
In case of applying the suspension in teaching mode
● For the PNP output type cable

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for reset operation (N.O.)
S2: Switch for override (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
M: 3-phase motor
L: Muting lamp

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
● **For the NPN output type cable**

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for reset operation (N.O.)
S2: Switch for override (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
M: 3-phase motor
L: Muting lamp

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to 0 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- When "Not use" is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.
SZ-16V

Configuration of start/restart mode: Manual/Manual

For the PNP output type cable

- K1, K2: External device
  (Safety relay, magnet contactor, etc.)
- K3: Solid state contactor
- S1: Switch for reset operation (N.O.)

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to +24 V.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 is NON SAFETY-RELATED system.
For the NPN output type cable

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, both yellow and yellow/black wire should be short-circuited to 0 V.
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 is NON SAFETY-RELATED system.
Input / output circuit

**OSSD output circuit (Safety output)**
For the PNP output type cable

**For the NPN output type cable**

**AUX output circuit (Non-safety output)**
Common for the PNP output type cable / NPN output type cable

**Muting lamp output**
Common for the PNP output type cable / NPN output type cable

**Input circuit**
For the PNP output type cable
For the NPN output type cable
5-1 For changing the factory default (Password input) ............ 5-2
5-2 Manual configuration for SZ-01S and SZ-04M ............... 5-4
5-3 Manual configuration for SZ-16V .............................. 5-20
5-4 Monitoring ...................................................... 5-23
For changing the factory default (Password input)

**Note**
The SZ cannot perform the normal operation with factory default. Password input and the configuration are required to start normal operation.
Functions for SZ-16V must be configured through SZ Configurator because the system does not provide for manual configuration on the SZ.

See "Configuration of Others" (page 5-17) for setting password on the SZ-01S and SZ-04M, or "5-3 Manual configuration for SZ-16V" (page 5-20).

1. **Two screws must be loosed to open the setting cover. (The setting cover must be closed after completing the configuration, and then two screws must be tightened. (Recommended tightening torque: 0.3 N·m))**

![Mode Switch](A: Run/PC Communication  B: Configuration on SZ)

**Note**
The specification of IP65 cannot be fulfilled unless the screw for setting cover is tightened with recommended torque.

2. **The following is the procedure after power is supplied to the SZ. You can operate this process through the front panel and information display.**

Start-up display 1 → Start-up display 2 → Initial display

- **Display for selection of what you want to do**
  1. Setting : You can configure/change something
  2. Reconfirm : You can confirm the configuration.

- **Display for "Input Password"**
  You should enter a password with 4 to 8 characters.
The followings are acceptable characters: numbers 0 through 9, letters "a" through "z", or a hyphen. For changing the factory default, you must enter "1111" as default password.

- **Display for Password acceptance * 1**
  If the password is not acceptable, this does not appear. Display for "Input Password" appears again in this situation.

- **Display for Setting**
  1. Safety : You can configure safety-related functions
  2. Non-Safety : You can configure non-safety functions
  3. Others : You can configure other functions

This appears if the power is supplied while the mode switch is set to "A: Run/PC Communication". The next process is shown if the mode switch is changed to "B: Configuration on SZ".

Press or to select "1. Setting".
Press to set.

Press the keys for character selection and the key to change the digit.
Press to set.

You can see next display if you leave the SZ untouched or press or .

You must configure the safety-related function. For more information about the configuration, see "Configuration and confirmation of safety-related functions" (page 5-5).
5-1 For changing the factory default (Password input)

*1 If you don’t change the default password, the following display appears. You can change the default password to anything you want. See “Configuration of Others” (page 5-17) for setting password on the SZ-01S and SZ-04M, or “5-3 Manual configuration for SZ-16V” (page 5-20) for the SZ-16V.

If the password is not acceptable, such as incorrect password, the following display appears. Display for “Input Password” appears again in this situation.

Note
The configuration for safety-related functions and the others cannot be performed without the password (e.g., when you forget password). Store the password carefully. See “When you forget the password” (page 6-56)
Manual configuration for SZ-01S and SZ-04M

Note

• If the SZ Configurator is used to configure the SZ, you cannot move the configuration process forward. The following display appears when you select either "1. Safety" or "2. Non-safety" at "Display for setting".

  ![Diagram of unacceptable operation]

If you want to perform the manual configuration on the SZ, such as the configuration for "1. Safety" or "2. Non-Safety", you must initialize the configuration that was carried out through the SZ Configurator. For more information, see "Configuration of Others" (page 5-17).

• It is necessary for the SZ-16V to configure the functions through the SZ Configurator, because it does not provide the system for the manual configuration on the SZ.

Preparation for configuration (Common procedure)

You can configure the function and confirm the configured function if you set the mode switch to "B: Configuration on SZ". The mode switch must be set back to the "A: RUN/PC Communication" in order to restart the normal operation.

- Display for normal operation
- Display for selection of what you want to do
  1. Setting : You can configure/change something
  2. Reconfirm : You can confirm the configuration.

Parameter

- Normal Operation

- Display for "Input Password"

You can enter a password with 4 to 8 characters. The following are acceptable characters: numbers 0 through 9, letters "a" through "z", or a hyphen. For changing the factory default, you must enter "1111" as default password.

- Display for Password acceptance

If the password is not acceptable, this does not appeared. Display for "Input Password" appears again in this situation.

- Display for setting
  1. Safety : You can configure the safety-related functions
  2. Non-Safety : You can configure the non-safety functions
  3. Others : You can configure the other functions

You should select "1. Safety" to configure the safety-related functions. You should select "2. Non-Safety" to configure the non-safety functions. You should select "3. Others" to configure the other functions.

Press the keys for character selection and the key to change the digit.
Press to set.
5-2 Manual configuration for SZ-01S and SZ-04M

Configuration and confirmation of safety-related functions

Note

If the SZ Configurator is used to configure the SZ, the following display appears and you cannot move the configuration process forward.

If you want to perform the manual configuration on the SZ, you must initialize the configuration that was carried out through the SZ Configurator. For more information, see “Configuration of Others” (page 5-17)

Configuration procedure

From “Preparation for configuration (Common procedure)” (page 5-4)

Display for safety
1. Safety : You can configure safety-related functions.
2. Non-Safety : You can configure non-safety functions.
3. Others : You can configure other functions.

Display for configuration of start/restart mode
Automatic : Automatic start / Automatic restart

Display for configuration of EDM
Enable : EDM function enabled
Disable : EDM function disabled

Display for the configuration of minimum detectable object size
30, 40, 50, 70 and 150 mm are options

Display for the configuration of response time
60 to 480 ms are options

Display for the configuration of protection zone
Refer to “Details of display for the configuration of protection zone” (page 5-7)
(1) to (3) : The distance of protection zone 0 to maximum distance in units of 10 mm
(4) to (6) : The SZ indicates the measured distance value in the direction of arrow in the display. It indicates that the distance to the object located at the direction of 90 degrees (to front boundary), 180 degrees (to left boundary) and 0 degree (to right boundary). Units are “mm” or “inch”.
You can configure the protection zone based on the measured distance value, which is the distance to something you prepare, such as a flat board.

Display for saving the configuration
Yes : You save the configuration to the SZ
No : You don’t save the configuration to the SZ

In case of “Yes”, press .

In case of “No”, press .

Return to the Display for configuration of start/restart mode

*1 The configuration for restart-delay (ON-delay) function cannot be performed through the manual configuration on the SZ.

*2 The configuration for scan cycle cannot be performed through the manual configuration on the SZ.

*3 You can only configure the quadrangle and rectangular protection zone through the manual configuration on the SZ.


Press , and then the third row blinks. Use the keys to change the start/restart mode. Press to set.

Press , and then the third row blinks. Use the keys to change the EDM configuration. Press to set.

Press , and then the third row blinks. Use the keys to change the minimum detectable object size. Press to set.

Press , and then the third row blinks. Use the keys to change the response time. Press to set.

Press , and then the third row blinks. Use the keys to change the distance (1) of protection zone. Press to set.

Press , and then the item 1 blinks. Use the keys to change the distance (2) of protection zone. Press to set.

Press , and then the item 2 blinks. Use the keys to change the distance (3) of protection zone. Press to set.

Press , and then the item 3 blinks. Use the keys to change the distance (4) of protection zone. Press to set.

Save? No Yes

In case of “Yes”, press .

In case of “No”, press .

To “Confirmation procedure” (page 5-9)
5-2 Manual configuration for SZ-01S and SZ-04M

Note

- Press on any display for the configuration, and then go back to the “Display for setting”.
- Even though the configurations are changed at each step on the configuration procedure, the SZ does not enable these configurations at this moment. In order to enable these configurations, you must select “Yes” at the “Display for saving the configuration” and complete the following confirmation procedures. If you change the mode switch to “A: RUN/PC communication” without saving these configurations, the following display appears, and then the SZ goes back to the normal operation without enabling these configuration. (The SZ operates in accordance with the original configurations.)

If you change the mode switch to “A: RUN/PC communication” without confirmation procedures, the following display appears to show that the SZ is waiting for the configuration.

- The maximum protection distance varies depending on the minimum detectable object size. If you change the current configuration of minimum detectable object size to smaller one, the following display may appear, and then the protection distance may be automatically changed accordingly. This is because the protection distance configured corresponding to the current minimum detectable object size may not meet the specification of maximum protection distance corresponding to new minimum detectable object size. If you find the following display, you must reconfigure the protection zone according to the specification. “2-3 Protection zone” (page 2-6)

- If you change the current configuration for the distance (1) of the protection zone, the following display may appear, and then the distance (2) and (3) of the protection zone may be automatically changed accordingly in order to meet the specification of maximum protection zone according to the new protection distance (1). If you find the following display, you must reconfigure the protection zone according to that specification.

If you have any change from the default configuration, you can see an asterisk (*) in the lower left corner of the information display.

Reference

11. Resolution

30mm
Details of display for the configuration of protection zone

- "Protection zone" (page 2-6)

Example of Protection zone

Condition for the configuration of protection zone

You can configure the protection zone on the SZ under the following condition. The following conditions are always applicable:

1. The shape of the protection zone must be the quadrate or rectangular.
2. The protection zone composed of 3 distances (distance 1, 2 and 3) must be within the specification of maximum protection zone.
3. The rear boundary of the protection zone must be on the line including the protection zone origin.
4. The distance from the protection zone origin to the front boundary must be 100mm or more. The distance from the protection zone origin to the left or right boundary must be also 100mm or more.

Example of unconfigurable protection zone

- The following protection zone is beyond the specification of maximum protection zone.
- The rear boundary of the protection zone is not on the line including the protection zone origin.
- The distance from the protection zone origin to the right boundary is less than 100mm.
**5-2 Manual configuration for SZ-01S and SZ-04M**

- **Detail procedure for the configuration of protection zone**
  In order to configure the protection zone, especially the shape of the protection zone, you must determine the 3 distances from the protection zone origin, 1) to front boundary, 2) to left boundary, and 3) right boundary.

  15. Display for Front boundary
  16. Display for Left boundary
  17. Display for Right boundary

  *1 The protection zone image is shown assuming that the front panel is to be seen from the front side of the SZ.
  *2 "M****" appears if the measured distance value exceeds 9,999mm.

- **You can set the actual measured distance value as the distance of protection zone if you press both A and B at the same time while the distance of protection zone is blinking.**
- **If you perform the above operation when the measured distance value exceeds the maximum protection distance, the following display appears, and then the distance of protection zone automatically set to the maximum protection distance according to the specification.**
  
  If you find the following display, you must reconfigure the protection zone according to the specification.
  
  - **When the above display appears, you can see the original display if you leave the SZ untouched or press C or D.**
Confirmation procedure

The following confirmation procedure is required to enable the configuration. According to the following procedure, you must confirm whether the configuration is as intended.

2. EDM Enable
3. Safety Parameters
   - OK
   - Completed
4. Detection Capability
   - 70mm
5. Response Time
   - 120ms
6. Zone
   - Front: 1000 M 1350
   - Left: 900 M 700
   - Right: 900 M 750
7. All Parameters OK?
   - No
   - Yes

In case of "Yes": press .
In case of "No": press .

If you change the mode switch to "A: Run / PC Communication" after the display goes back to "Display for setting", the SZ operates in accordance with new configuration.
• If you press the [ ] at each step, the following display appears.

If you select "No" (press [ ]), the display goes back to the confirmation procedure.
If you select "Yes" (press [ ]), the display goes back to the "display for setting" after the following display appears. In this case, the SZ does not perform the normal operation even if you change the mode switch to "A: RUN/PC Communication", because the configuration is not completed.

• If you change the mode switch to "A: RUN/PC Communication" without completing the confirmation procedure, the following display appears to show that the SZ is waiting for the configuration.
Details of display for the confirmation of protection zone

You must confirm whether the protection zone is configured as intended. You must confirm whether the SZ detects the object, such as test piece, at the boundary of protection zone.

The sequence of confirmation

1. While you find the display for the confirmation of protection zone, you should move an object, such as test piece, along with the boundary of the protection zone.

2. The information display lights in red if the SZ detects an object in the protection zone. On the other hand, the information display lights in green if the SZ detects no object in the protection zone. You can easily confirm the boundary of the protection zone because of the changing color on the information display.

3. The following display appears at the "display for the confirmation of protection zone" if the SZ detects an object all over the boundary of the protection zone. The display changes to the "display for acceptance" if you press .

Note

You can find that there are some segments that are not inverted on the boundary unless the SZ detects an object all over the boundary of the protection zone. If you press in this situation, the following display appears, and then the display goes back to the "display for the confirmation of protection zone".

Reference

You can perform the confirmation fro boundary in any order.
5-2 Manual configuration for SZ-01S and SZ-04M

Configuration of Non-safety Function

If the SZ Configurator is used to configure the SZ, the following display appears and you cannot move the configuration process forward.

Note

If you want to perform the manual configuration on the SZ, you must initialize the configuration that was carried out through the SZ Configurator. For more information, see "Configuration of Others" (page 5-17).

Configuration procedure

From "Preparation for configuration (Common procedure)" (page 5-4)

Save? Yes No

Display goes back to the "Display for setting".

From "Preparation for configuration (Common procedure)" (page 5-4)

OSSD State Output: "OSSD state output" (page 2-37)

Error/Alert Output: "Error or alert output" (page 2-37)

Warning Zone Output: "Output for detection in the warning zone" (page 2-38)

You go to the "A" in next page if you select "Warning Zone Output".

In case of "Yes", press Esc. In case of "No", press .

Press , and then the third and forth row blinks. Press or to change the AUX1 function. Press to set.

Press once, and then the third and forth row blinks. Press or to change the AUX2 function. Press to set.

Press or to select "2. Non-Safety". Press to set.

Press Enter.

Press Enter.

Blinking in a few seconds

Moves automatically
5-2 Manual configuration for SZ-01S and SZ-04M

Note

- Press on any display for the configuration, and then go back to the “Display for setting”.
- Even though the configurations are changed at each step on the configuration procedure, the SZ does not enable these configurations at this moment. In order to enable these configurations, you must select “Yes” at the “Display for saving the configuration” and complete the following confirmation procedures. If you change the mode switch to “A: RUN/PC Communication” without saving these configurations, the following display appears, and then the SZ goes back to the normal operation without enabling these configuration. (The SZ operates in accordance with the original configurations.)

• The maximum warning distance varies depending on the minimum detectable object size. If you change the current configuration of minimum detectable object size to smaller one, the following display may appear, and then the warning distance may be automatically changed accordingly. This is because the warning distance configured corresponding to the current minimum detectable object size may not meet the specification of maximum warning distance corresponding to new minimum detectable object size. If you find the following display, you must reconfigure the warning zone according to that specification. 
  
"2-4 Warning zone" (page 2-6)

• If you change the current configuration for the distance (1) of the warning zone, the following display may appear, and then the distance (2) and (3) of the warning zone may be automatically changed accordingly in order to meet the specification of maximum warning zone according to the new warning distance (1). If you find the following display, you must reconfigure the warning zone according to the specification.

If you have any change from the default configuration, you can see an asterisk (*) in the lower left corner of the information display.

<Example>

| CAUTION Zone(Left) Changed | CAUTION Zone(Right) Changed | CAUTION Zone(Left/Right) Changed |

| 22.AUX2 Warning Zone Output |
5-2 Manual configuration for SZ-01S and SZ-04M

A (from page 5-12 "22.AUX2")

23. Detection Capability
   70mm (Warning-Z)

Press \( \hat{A} \), and then the third row blinks.

Use the \( \wedge \) keys to change the minimum detectable object size.

Press \( \hat{A} \) to set.

24. Response Time
   60ms (Warning-Z)

Press \( \hat{A} \), and then the third row blinks.

Use the \( \wedge \) keys to change the response time.

Press \( \hat{A} \) to set.

25. Zone
   ● \( \wedge \)

Front \( \wedge \)
1600 M 1350

26. Zone
   ● \( \wedge \)

Left \( \wedge \)
900 M 700

27. Zone
   ● \( \wedge \)

Right \( \wedge \)
900 M 750

Display for the configuration of minimum detectable object size
30, 40, 50, 70 and 150 mm are options

Display for the configuration of response time\(^*1\)
60ms to 480 ms are options

Display for the configuration of warning zone\(^*3\)

Refer to \( \hat{A} \) display for saving the configuration (page 5-13)

(1) to (3) : The distance of warning zone
0 to maximum distance in units of 10 mm

(4) to (6) : The SZ indicates the measured distance value in the direction of arrow in the display. It indicates that the distance to the object located at the direction of 90 degrees (to front boundary), 180 degrees (to left boundary) and 0 degree (to right boundary). Units are "mm" or "inch".

You can configure the warning zone based on the measured distance value, which is the distance to something you prepare, such as flat board.

Press \( \hat{A} \), and then the third row blinks.

Use the \( \wedge \) keys to change the minimum detectable object size.

Press \( \hat{A} \) to set.

Press \( \hat{A} \), and then the third row blinks.

Use the \( \wedge \) keys to change the response time.

Press \( \hat{A} \) to set.

Press \( \hat{A} \), and then the item 1 blinks.

Use the \( \wedge \) keys to change the distance (1) of protection zone.

Press \( \hat{A} \) to set.

Press \( \hat{A} \), and then the item 2 blinks.

Use the \( \wedge \) keys to change the distance (2) of protection zone.

Press \( \hat{A} \) to set.

Press \( \hat{A} \), and then the item 3 blinks.

Use the \( \wedge \) keys to change the distance (3) of protection zone.

Press \( \hat{A} \) to set.

To \( \hat{A} \) "display for saving the configuration" (page 5-12)

* When the configuration is made using the SZ, the shape of the protection zone is limited to a quadrate or rectangle.
Details of display for the configuration of warning zone

“2-4 Warning zone” (page 2-8)

Example of warning zone

Condition for the configuration of warning zone

You can configure the warning zone on the SZ under the following condition. The following conditions are always applicable.

1. The shape of the warning zone must be the quadrate or rectangular.
2. The warning zone composed of 3 distances (distance 1, 2 and 3) must be within the specification of maximum warning zone.
3. The rear boundary of the warning zone must be on the line including the protection zone origin.
4. The distance from the protection zone origin to the front boundary must be 100mm or more. The distance from the protection zone origin to the left or right boundary must be also 100mm or more.

Example of unconfigurable warning zone

The following warning zone is beyond the specification of maximum warning zone.
The rear boundary of warning zone is not on the line including the protection zone origin.
The distance from the protection zone origin to the right boundary is less than 100mm.
5-2 Manual configuration for SZ-01S and SZ-04M

● Detail procedure for the configuration of warning zone
In order to configure the warning zone, especially the shape of the warning zone, you must determine the 3 distances from the protection zone origin, 1) to front boundary, 2) to left boundary, and 3) right boundary.

25. Display for Front boundary
26. Display for Left boundary
27. Display for Right boundary

You can set the actual measured distance value as the distance of warning zone if you press both \( \) and \( \) at the same time while the distance of warning zone is blinking.

If you perform the above operation when the measured distance value exceeds the maximum warning distance, the following display appears, and then the distance of warning zone automatically set to the maximum warning distance according to the specification.

If you find the following display, you must reconfigure the warning zone according to the specification.

When the above display appears, you can see the original display if you leave the SZ untouched or press \( \) or \( \).

*1 The warning zone image is shown assuming that the front panel is to be seen from the front side of the SZ.

*2 "M*****" appears if the measured distance value exceeds 9,999mm.
**Configuration of Others**

1. **Display for Setting**
   - 1. Safety: You can configure the safety-related functions.
   - 3. Others: You can configure the other functions.

2. **Display for password change**
   You can change the password. If you change the password through this configuration, that password is still enabled for SZ Configurator.

3. **Reserved for future use.**

4. **Display for initialization**
   You can bring all configurations, except for password, back to the factory default.
   - Yes: Initialize
   - No: Not initialize

5. **Display for contrast setting**
   You can change the contrast of the display. You can get high brightness if you increase the number.

6. **Display for Unit setting**
   You can change the units for the distance, such as protection distance or warning distance. Either "mm" or "inch" is available.

---

**Preparation for configuration (Common procedure)** (page 5-4)

- Press  or  to select "3. Others".
- Press  to set.

- Press the  keys for character selection and the  key to change the digit.
- Press  to set.

- Press  after confirmation of password.

- Press  in case of "No".
- Press  in case of "Yes".

- Press , and then the third row blinks
  Use the  keys to change the number
  Press  to set.

- Hold down  for over 3 seconds.

- Press , and then the third row blinks
  Use the  keys to change the units
  Press  to set.
5-2 Manual configuration for SZ-01S and SZ-04M

*1 The following display (1) appears if you complete the password change. The following display (2) or (3) appears if you fail to complete the password change.

(1) In case of completion of password change. You can use new password.

Leave the SZ untouched or press or to go back to the "Display for setting".

(2) In case of short digit password. You must create a password with 4 characters or more.

Press or to go back to the "Display for password change".
Enter new password with 4 characters or more.

(3) In case of password change failed. The previous password is still valid.

Press or to go back to the "Display for password change".
Enter new password again.

*2 The following display appears if you perform the initialization.

The SZ is under initialization.

Initialization successful
Leave the SZ untouched or press or to go back to the "Display for initialization".

Initialization failed
Press or to go back to the "Display for initialization".
You should perform the initialization again.

Note
The configuration for safety-related functions and the others cannot be performed without the password (ex. when you forget a password.) You must strictly keep the password.

"When you forget the password" (page 6-56)
Reconfirmation Procedure

**Note**
- If the SZ Configurator is used to configure the SZ, you cannot reconfirm the configurations on the SZ.
- It is necessary for the SZ-16V to reconfirm the configurations through the SZ Configurator, because it does not provide the system for the manual configuration on the SZ.

If you change the mode switch to "B: Configuration on SZ" after opening the setting cover, and then the following display appears.

- Normal Operation
- Parameter
  - Setting
  - Reconfirm

If you want to change the configuration, refer to "5-2 Manual configuration for SZ-01S and SZ-04M" (page 5-4)
You can perform the following configuration on the SZ if you change the mode switch to "B: Configuration on SZ.

- Password change
- Initialize
- Contrast change
- Units change

You must change the mode switch to "A: RUN/PC Communication" in order to start the normal operation.

Display for normal operation

Display for "Input Password"
You can enter a password with 4 to 8 characters. The followings are acceptable characters: numbers 0 through 9, letters "a" through "z", or a hyphen. For changing the factory default, you must enter "1111" as default password.

Display for Password acceptance
If the password is not acceptable, this does not appear. Display for "Input Password" appears again in this situation.

Display for Password failure
If the password is not acceptable, this does not appear. Display for "Input Password" appears again in this situation.

Press the \( \text{key} \) keys for character selection and the \( \text{key} \) to change the digit.
Press \( \text{key} \) to set.

Display for Password acceptance
You can see next display if you leave the SZ untouched or press \( \text{key} \) or \( \text{key} \).
The following display (1) appears if you complete the password change. The following display (2) or (3) appears if you fail to complete the password change.

1. In case of completion of password change. You can use new password.
- Leave the SZ untouched or press \( \text{ESC} \) or \( \text{ESC} \) to go back to the "Display for setting"

2. In case of short digit password. You must create a password with 4 characters or more.
- Press \( \text{ESC} \) or \( \text{ESC} \) to go back to the "Display for password change"
- Enter new password with 4 characters or more.

3. In case of password change failed, previous password is still valid.
- Press \( \text{ESC} \) or \( \text{ESC} \) to go back to the "Display for password change"
- Enter new password again.

**Note**

The configuration for safety-related functions and the others cannot be performed without the password (ex. when you forget a password). You must strictly keep the password.

"When you forget the password" (page 6-56)
*2 The following display appears if you perform the initialization.

The SZ is under initialization.

- Initialization successful
  - Leave the SZ untouched or press OK or ENTER to go back to the "Display for initialization".

- Initialization failed
  - Press ESC or ENTER to go back to the "Display for initialization".
  - You should perform the initialization again.

Initialization successful
Initialization processing
Initialization failed
OK
Failed
Completed

The SZ can indicate the I/O information, zone information, and OSSD OFF history through the information display, in addition to the information related to the configuration and current status of the SZ.

Preparation for monitoring (Common procedure)

Note: If the SZ Configurator is used to configure the SZ, you can only check "1. I/O" and "3. History" through this monitoring.

Display for normal operation

Normal Operation

Hold down \( \text{Esc} \) for over 3 seconds, and then the following display appears.

Display for monitoring

- In case of SZ-16V
  1. I/O
  2. History
  on this display ("Zone" is not shown.)

Use the \( \text{Esc} \) keys to select.
Press \( \text{Esc} \) to set.

In case of I/O selected

Display for I/O information

- I/O: It displays the ON/OFF state of each AUX output and each input.
- Wiring: It displays the color and the assigned function for each wire.

Press \( \text{Esc} \) to go back to the "Display for monitoring".
Use the \( \text{Esc} \) keys to select.
Press \( \text{Esc} \) to set.

In case of selecting "I/O"

"I/O monitoring" (page 5-24)

In case of selecting "Wiring"

"Wiring confirmation" (page 5-25)

Display for zone information

- Protect: It displays the configured value and the measured value for 3 distances of the protection zone.
- Warning: It displays the configured value and the measured value for 3 distances of the warning zone.

Display for history information

- OSSD OFF: It displays the reason and time for OSSD-OFF. Additionally, it displays the detected position in case of detection of object in the protection zone.

Press \( \text{Esc} \) to go back to the "Display for monitoring".
Press \( \text{Esc} \) to set.

In case of selecting "Protect"

"Protection zone monitoring" (page 5-29)

In case of selecting OSSD OFF

"OSSD OFF History" (page 5-31)

In case of selecting "Warning"

"Warning zone monitoring" (page 5-30)
5-4 Monitoring

I/O monitoring

You should refer to "Preparation for monitoring (Common procedure)" (page 5-23) before using this function. The information on the display varies depending on the model.

< SZ-01S >

![Diagram]

Press \( \text{ESC} \) to go back to the previous display.

The information display shows the ON/OFF state for Input 1 and 2 at the upper side. On the other hand, it shows the ON/OFF state for AUX output 1 and 2. The item in question is ON when there is a square \( \boxed{\text{ON}} \) for ON and a dash \( \boxed{-} \) for OFF. The item in question is OFF when there is a square \( \boxed{-} \) for OFF and a dash \( \boxed{\text{ON}} \) for ON.

In the example to the left: Input 1 and 2 are ON state, and AUX output 1 and 2 are ON state.

< SZ-04M >

![Diagram]

Press \( \text{ESC} \) to go back to the previous display.

The information display shows the ON/OFF state for Input 1, 2, 3, 4, 5, and 6 at the upper side. On the other hand, it shows the ON/OFF state for AUX output 1, 2, 3, 4, 5, and 6. The item in question is ON when there is a square \( \boxed{\text{ON}} \) for ON and a dash \( \boxed{-} \) for OFF. The item in question is OFF when there is a square \( \boxed{-} \) for OFF and a dash \( \boxed{\text{ON}} \) for ON.

In the example to the left: Input 1, 2, and 5 are ON state, while Input 3, 4, and 6 are OFF state. AUX output 1, 2, 5, and 6 are ON state, while AUX output 3 and 4 are OFF state.

< SZ-16V >

![Diagram]

Press \( \text{ESC} \) to go back to the previous display.

The information display shows the ON/OFF state for Bank input A, B, C, D, a, b, c, and d. The item in question is ON when there is a square \( \boxed{\text{ON}} \) for ON and a dash \( \boxed{-} \) for OFF. The item in question is OFF when there is a square \( \boxed{-} \) for OFF and a dash \( \boxed{\text{ON}} \) for ON.

In the example to the left: Bank input D, A, c, and b are ON state, and bank input C, B, d, and a are OFF state.

It shows the ON/OFF state for reset input (RST) and EDM input.

In the example to the left: Reset input is ON state, and EDM input is OFF state.

It shows the ON/OFF state for AUX output 1, 2, 3, and 4.

In the example to the left: AUX output 1 and 2 are ON state, while AUX output 3 and 4 are OFF state.
You should refer to "Preparation for monitoring (Common procedure)" (page 5-23) before using this function.

It shows (1) the cable color and (2) the assigned function.
The information on the display varies depending on the model and the configuration.
Input 1 and AUX output 1 in the third row corresponds to the Input 1 and AUX output 1 of the I/O monitoring.

You can check all information related to the cable color and the assigned function if you press .
The following table shows the cable color and assigned function that you can see on the information display

**SZ-01S**

<table>
<thead>
<tr>
<th>Color</th>
<th>Assigned function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Brown</td>
<td>+24V DC</td>
</tr>
<tr>
<td>Blue Black</td>
<td>0V</td>
</tr>
<tr>
<td>Black Black</td>
<td>OSSD 1</td>
</tr>
<tr>
<td>White White</td>
<td>OSSD 2</td>
</tr>
<tr>
<td>Yellow Yellow</td>
<td>Reset, Check Input</td>
</tr>
<tr>
<td>Red Red</td>
<td>Not Used EDM</td>
</tr>
<tr>
<td>Orange Orange</td>
<td>Not Used, Error, Alert</td>
</tr>
<tr>
<td>Orange/Black Orange/Black</td>
<td>OSSD State, Protection-Z, Warning-Z, Interlock</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Color</th>
<th>Assigned function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Brown</td>
<td>+24V DC</td>
</tr>
<tr>
<td>Blue Blue</td>
<td>0V</td>
</tr>
<tr>
<td>Black Black</td>
<td>OSSD 1</td>
</tr>
<tr>
<td>White White</td>
<td>OSSD 2</td>
</tr>
<tr>
<td>Yellow Yellow</td>
<td>Reset, Check Input</td>
</tr>
<tr>
<td>Red Red</td>
<td>Not Used EDM</td>
</tr>
<tr>
<td>Orange Orange</td>
<td>Not Used, Error, Alert</td>
</tr>
<tr>
<td>Orange/Black Orange/Black</td>
<td>OSSD State, Protection-Z, Warning-Z, Interlock</td>
</tr>
</tbody>
</table>

Cable color Brown, Blue, Black, White, Yellow, Red, Orange, Orange/Black

(1) Cable color (2) Assigned function

For detailed information on the SZ-M-N05-E manual configuration on the SZ, please refer to the section titled "5-4 Monitoring."
### SZ-04M

<table>
<thead>
<tr>
<th>(1)</th>
<th>Cable color</th>
<th>(2)</th>
<th>Assigned function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Brown</td>
<td>+24V DC</td>
<td>+24V DC</td>
</tr>
<tr>
<td>Blue</td>
<td>Blue</td>
<td>0V</td>
<td>0V</td>
</tr>
<tr>
<td>Black</td>
<td>Black</td>
<td>OSSD 1</td>
<td>OSSD 1</td>
</tr>
<tr>
<td>White</td>
<td>White</td>
<td>OSSD 2</td>
<td>OSSD 2</td>
</tr>
<tr>
<td>Gray</td>
<td>Gray</td>
<td>Not Used</td>
<td>Not Used</td>
</tr>
<tr>
<td>Gray/Black</td>
<td>Gray/Black</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>Yellow</td>
<td>Yellow</td>
<td>Reset</td>
<td>Reset input</td>
</tr>
<tr>
<td>Yellow</td>
<td>Yellow</td>
<td>Check Input</td>
<td>Reset input for OSSD 1/2</td>
</tr>
<tr>
<td>Red</td>
<td>Red</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Red</td>
<td>Red</td>
<td>EDM (OSSD 1/2)</td>
<td>EDM input for OSSD 1/2</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Light Blue</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Light Blue</td>
<td>Bank 1</td>
<td>Bank input 1</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Light Blue</td>
<td>Muting 1</td>
<td>Muting input 1</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Light Blue</td>
<td>Teach Mode</td>
<td>Teach mode input</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Light Blue/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Light Blue/Black</td>
<td>Bank 2</td>
<td>Bank input 2</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Light Blue/Black</td>
<td>Muting 2</td>
<td>Muting input 2</td>
</tr>
<tr>
<td>Light Blue/Black</td>
<td>Light Blue/Black</td>
<td>Teach Ready</td>
<td>Teach ready input</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Yellow/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Yellow/Black</td>
<td>Bank 3</td>
<td>Bank input 3</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Yellow/Black</td>
<td>Override</td>
<td>Override input</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>Yellow/Black</td>
<td>RST (OSSD 3/4)</td>
<td>Reset input for OSSD 3/4</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Red/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Red/Black</td>
<td>Bank 4</td>
<td>Bank input 4</td>
</tr>
<tr>
<td>Red/Black</td>
<td>Red/Black</td>
<td>EDM (OSSD 3/4)</td>
<td>EDM input for OSSD 3/4</td>
</tr>
<tr>
<td>Orange</td>
<td>Orange</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Orange</td>
<td>Orange</td>
<td>State Info.1</td>
<td>State information output 1</td>
</tr>
<tr>
<td>Orange</td>
<td>Orange</td>
<td>State Info.2</td>
<td>State information output 2</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>Orange/Black</td>
<td>Error</td>
<td>Error output</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>Orange/Black</td>
<td>Error</td>
<td>Alert output</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>Orange/Black</td>
<td>Error/Aert</td>
<td>Error or alert output</td>
</tr>
<tr>
<td>Orange/Black</td>
<td>Orange/Black</td>
<td>Mute/O-ride</td>
<td>Muting or Override output</td>
</tr>
<tr>
<td>Pink</td>
<td>Pink</td>
<td>OSSD State</td>
<td>OSSD state output</td>
</tr>
<tr>
<td>Pink</td>
<td>Pink</td>
<td>OSSD 1/2 State</td>
<td>OSSD1/2 state output</td>
</tr>
<tr>
<td>Pink</td>
<td>Pink</td>
<td>OSSD 3/4 State</td>
<td>OSSD3/4 state output</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Protection-Z</td>
<td>Protection-Z output in protection zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Protection-12</td>
<td>Protection-12 output in protection zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Protection-34</td>
<td>Protection-34 output in protection zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Protection-A</td>
<td>Protection-A output in protection zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Protection-B</td>
<td>Protection-B output in protection zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Warning-Z</td>
<td>Warning-Z output in warning zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Warning-A</td>
<td>Warning-A output in warning zone</td>
</tr>
<tr>
<td>Pink/Black</td>
<td>Pink/Black</td>
<td>Warning-B</td>
<td>Warning-B output in warning zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>OSSD State</td>
<td>OSSD state output</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>OSSD 1/2 State</td>
<td>OSSD1/2 state output</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>OSSD 3/4 State</td>
<td>OSSD3/4 state output</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Protection-Z</td>
<td>Protection-Z output in protection zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Protection-12</td>
<td>Protection-12 output in protection zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Protection-34</td>
<td>Protection-34 output in protection zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Protection-A</td>
<td>Protection-A output in protection zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Protection-B</td>
<td>Protection-B output in protection zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Warning-Z</td>
<td>Warning-Z output in warning zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Warning-A</td>
<td>Warning-A output in warning zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Warning-B</td>
<td>Warning-B output in warning zone</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Interlock</td>
<td>Interlock-reset-ready output</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Interlock 1/2</td>
<td>Interlock-reset-ready output for OSSD 1/2</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Interlock 3/4</td>
<td>Interlock-reset-ready output for OSSD 3/4</td>
</tr>
</tbody>
</table>
### SZ-16V

<table>
<thead>
<tr>
<th>Cable color</th>
<th>(2)</th>
<th>Assigned function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Brown</td>
<td>+24V DC</td>
<td>+24V DC</td>
</tr>
<tr>
<td>Blue Blue</td>
<td>0V</td>
<td>0V</td>
</tr>
<tr>
<td>Black Black</td>
<td>OSSD 1</td>
<td>OSSD 1</td>
</tr>
<tr>
<td>White White</td>
<td>OSSD 2</td>
<td>OSSD 2</td>
</tr>
<tr>
<td>Yellow Yellow</td>
<td>Reset</td>
<td>Reset input</td>
</tr>
<tr>
<td>Red Red</td>
<td>EDM</td>
<td>EDM input</td>
</tr>
<tr>
<td>Light Blue Light blue</td>
<td>Bank A</td>
<td>Bank input A</td>
</tr>
<tr>
<td>Gray Gray</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Pink Pink</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Green Green</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>L-Blue/Black Light blue/Black</td>
<td>Bank a</td>
<td>Bank input a</td>
</tr>
<tr>
<td>Gray/Black Gray/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Pink/Black Pink/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Green/Black Green/Black</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Orange Orange</td>
<td>Not Used</td>
<td>Not used</td>
</tr>
<tr>
<td>Orange/Black Orange/Black</td>
<td>State Info.1</td>
<td>State information output 1</td>
</tr>
<tr>
<td>Yellow/Black Yellow/Black</td>
<td>OSSD State Protection-Z</td>
<td>OSSD state output</td>
</tr>
<tr>
<td>Red/Black Red/Black</td>
<td>Warning-2</td>
<td>Output for detection in warning zone 2</td>
</tr>
</tbody>
</table>

**Legend:**
- Brown +24V DC
- Blue 0V
- Black OSSD 1
- White OSSD 2
- Yellow Reset
- Red EDM
- Light Blue Bank A
- Gray Not Used
- Pink Not Used
- Green Not Used
- L-Blue/Black Bank a
- Gray/Black Not Used
- Pink/Black Not Used
- Green/Black Not Used
- Orange Not Used
- Orange/Black State Info.1
- Yellow/Black OSSD State
- Red/Black Warning-2
- Orange/AUX 1 Not used
- Orange/AUX 2 State information output 2
- Yellow/AUX 3 OSSD state output
- Red/AUX 4 Interlock
- Orange/AUX 2 Error output
- Yellow/AUX 3 Output for detection in warning zone 1
- Red/AUX 4 Interlock-reset-ready output

---

**Manual Configuration on the SZ**

5-4 Monitoring
Protection zone monitoring

You should refer to “Preparation for monitoring (Common procedure)” (page 5-23) before using this function.

• The SZ-16V cannot perform this function.
• If the SZ Configurator is used to configure the SZ, you cannot select this function. The following display appears if you try to select.

Note

Unacceptable Operation

Press \( \uparrow \) to go back to the previous display.

Select Protect

21. Protect
22. Warning

Display for the monitoring on front boundary
You should refer to “Details of display for the configuration of protection zone” (page 5-7)

Display for the monitoring on left boundary
You should refer to “Details of display for the configuration of protection zone” (page 5-7)

Display for the monitoring on right boundary
You should refer to “Details of display for the configuration of protection zone” (page 5-7)
5-4 Monitoring

Warning zone monitoring

You should refer to "Preparation for monitoring (Common procedure)" (page 5-23) before using this function.

**Note**
- The SZ-16V cannot perform this function.
- If the SZ Configurator is used to configure the SZ, you cannot select this function. The following display appears if you try to select.

  Unacceptable Operation

- The following display appears if you don’t configure the warning zone.

  No Setting

Press \( \text{Select Warning} \) to go back to the previous display.

Display for the monitoring on front boundary
You should refer to "Details of display for the configuration of warning zone" (page 5-15)

Display for the monitoring on front boundary
You should refer to "Details of display for the configuration of warning zone" (page 5-15)

Display for the monitoring on front boundary
You should refer to "Details of display for the configuration of warning zone" (page 5-15)
You should refer to "Preparation for monitoring (Common procedure)" (page 5-23) before using this function.
The SZ stores a history that the OSSD went to the OFF-state since the power to the SZ had been supplied.
The SZ stores maximum 20 events. The SZ deletes the oldest event when new event occurs, if the records of events exceed 20. You can check the reason why the OSSD went to the OFF-state at "Display 1". You can also check the time when the OSSD went to the OFF-state and went back to the ON-state.

**Note**
The history is retained as long as the power is supplied to the SZ. The history is cleared when the power is turned off.

### Explanation on "Display 1"
Information on "Display 1" varies depending on the reason why the OSSD went to the OFF-state.

- **In case of detection in the protection zone**

  [Diagram showing OSSD OFF History]

  You can check whether the OSSD 1/2 or OSSD 3/4 goes to the OFF-state for the SZ-04M. For the SZ-01S and SZ-16V, it only displays "OSSD".

  - Symbol meaning:
    - Down arrow (\(/a_2\text{down}\)) - front direction
    - Up arrow (\(/a_2\text{up}\)) - rear direction
    - Right arrow (\(/a_2\text{right}\)) - left direction
    - Left arrow (\(/a_2\text{left}\)) - right direction

- **In case where the check input went to the ON-state (SZ-01S and SZ-04M only)**

  [Diagram showing OSSD OFF History]

  These values means that the SZ detects an object at 1200 mm in the front direction and 500 mm in the right direction. "Dist" means the distance from the protection zone origin.

  - Image on detected position:
    - Protection zone origin
    - Detected position
    - 1200mm

- **2-15 Monitoring function** (page 2-45)
5-4 Monitoring

- In case where the laser shutdown was activated (Only for SZ-16V)
  "Laser Shutdown" (page 2-26)
  - OSSD OFF 2
  - Laser OFF

- In case of error state
  "Error state" (page 8-2)
  - OSSD OFF 20
  - Error

- In case of no OSSD OFF history
  In this case, "Display 2" does not appear.
  - OSSD OFF
  - No History

■ Explanation on "Display 2"

"Display 2" indicates the time when the OSSD went to the OFF-state and went back to the ON-state. This time is counted from the power on.

- Time 1:1
  - OFF 20:15:33
  - ON 20:16:01

This is an order of the events in the history. The most recent event is #1.

This means the OSSD has turned to the OFF-state at 20 hours, 15 min and 33 seconds since power on, and the OSSD has turned to the ON-state at 20 hours, 16 minutes and 1 second since power on.

It does not show the time for "ON-state" if the reason is either "In case where the check input went to the ON-state" or "Error state".

H: Hours M: Minutes S: Seconds
Configuration through
SZ Configurator (SZ-H1S)

6-1  Before using SZ configuration .......................... 6-2
6-2  Part names and functions ............................... 6-9
6-3  Configuration tab ........................................ 6-11
6-4  Monitoring tab ............................................ 6-33
6-5  Operation menu ........................................... 6-34
## System Environment

The following system requirements are necessary to use SZ Configurator.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>Pentium III, 800 MHz or higher</td>
</tr>
<tr>
<td><strong>Compatible OS</strong></td>
<td>Windows Vista&lt;sup&gt;1&lt;/sup&gt; (SP1 or later)</td>
</tr>
<tr>
<td></td>
<td>Windows XP&lt;sup&gt;1&lt;/sup&gt; (SP2 or later)</td>
</tr>
<tr>
<td></td>
<td>Windows 2000&lt;sup&gt;2&lt;/sup&gt; (SP4 or later)</td>
</tr>
<tr>
<td><strong>Required memory size</strong></td>
<td>256 MB or more</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>XGA (1024 x 768 pixels) or greater, High Color (16 bit) or greater</td>
</tr>
<tr>
<td><strong>Free space on hard disk</strong></td>
<td>100 MB or more&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>CD-ROM drive</strong></td>
<td>Available</td>
</tr>
<tr>
<td><strong>Communication interface</strong></td>
<td>USB 1.1/2.0</td>
</tr>
<tr>
<td><strong>Operation condition</strong></td>
<td>.NET Framework 2.0 must be installed&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Only supports 32 bit.

<sup>2</sup> Only supports Japanese or English OS.

<sup>3</sup> 400 MB or more free space is required for the computer where .NET Framework 2.0 is not installed.

<sup>4</sup> If .NET Framework 2.0 is not installed on the computer, .NET Framework 2.0 is installed automatically when installing SZ Configurator.

The following conditions must be met in order to install .NET Framework 2.0.

- 300 MB or more free space is available on the hard disk.
- Windows Installer 3.0 or greater is installed.
- Internet Explorer 5.01 or greater is installed.

---

### Note

The specification of IP65 cannot be fulfilled without closing the setting-cover. You must close the setting-cover and tighten two screws on the cover with recommended torque before starting operation.

(Recommended tightening torque: 0.3N·m)
Installing SZ Configurator

This section describes how to install SZ Configurator to a computer.

Before installation

Check the following items before installing.

Note: We recommend making a backup of the CD-ROM in case it becomes damaged.

- **Free space on hard disk**
  SZ Configurator can only be installed on the hard disk. The hard disk where the software will be installed must have at least 100 MB free space (400 MB free space on the computer where .NET Framework 2.0 is not installed). If there is insufficient free space, delete unnecessary items to free the space.

- **Pre-installation Windows environment**
  SZ Configurator is a Windows application and the software is installed in Windows. Check that Windows Vista/XP/2000 is installed on the computer and is working properly.

- **USB (USB port)**
  The USB port on the PC can be used to transfer setting data from the PC to the SZ Series or to use the monitoring function. For more information about the setting method, see the PC manual.

- **Manual file**
  The manual file for this software was created in PDF file format. The viewing software Adobe Reader from Adobe Systems Incorporated must be installed onto your computer to use the help file. You can download the latest version for free from the Adobe Systems Incorporated web site: http://www.adobe.com

Precautions for Windows XP/2000

- **User privileges**
  When SZ Configurator is installed into the default folder (C:\Program Files\KEYENCE\SZ Configurator\), set the following access privileges.

  - Users must be given rights for "Administrator" or greater in order to use SZ Configurator.
6-1 Before using SZ configuration

Precautions for Windows Vista

■ User privileges
When SZ Configurator is installed into the default folder (C:\Program Files\Keyence\SZ Configurator\), set the following access privileges.

• Users must be given rights for “Administrator” or greater in order to use SZ Configurator.

If the “User Account Control” window appears during installation, click [Continue].

Installing

This section explains how to install SZ Configurator using the following drive configuration as an example.

C drive: Hard disk drive
E drive: CD-ROM drive

1 Start up Windows and insert the “SZ-H1S” into the CD-ROM drive.

• The auto-run function on the computer automatically starts up the installation program. If the installation program does not start up, select “Run...” from the Start menu. Enter “E:\setup” into the [File name] dialog box and click the [OK] button.

• Install the SZ Configurator by following the directions on the installation program.

Note
To install, log onto the PC as a user with Administrator privileges.

■ SZ Configurator installation folder
When installing SZ Configurator with the default settings, the program is installed to the following folder:
C:\Program Files\KEYENCE\SZ Configurator\

Uninstalling SZ Configurator

SZ Configurator can be uninstalled by using [Add/Remove Programs] from the Windows Control Panel.

Note
To uninstall, log onto the PC as a user with Administrator privileges.
Starting and Exiting SZ Configurator

This section describes starting and exiting SZ Configurator.

Start-up

SZ Configurator starts up with the following methods.

1. **Click the Windows [Start] button and select [All Programs] - [KEYENCE Applications] - [SZ Configurator], or double-click the SZ Configurator icon on the desktop.**

   SZ Configurator starts up and the main screen and dialog box are displayed.

2. **Select the startup method and click the [OK] button.**

   You should click the [Cancel] button in order to exit SZ Configurator.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Read out the configuration data from SZ. Before start-up, reading the configuration data saved to the SZ Series itself.</td>
</tr>
<tr>
<td></td>
<td>Create a new configuration file. Creates a new configuration file.</td>
</tr>
<tr>
<td></td>
<td>Open a configuration file. Opens a configuration file currently saved to the personal computer.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Start monitoring for SZ. Communicates with the SZ Series and starts up in the monitoring mode.</td>
</tr>
</tbody>
</table>
6-1 Before using SZ configuration

**When [Read out the configuration data from SZ.] is selected**
When SZ Configurator is started up with [Read out the configuration data from SZ.] selected, the configuration data is loaded from the connected SZ Series.

- Before selecting [Read out the configuration data from SZ.], you should check that the USB cable is properly connected between the personal computer and SZ Series.
- You should check that the power is supplied to the SZ.
- You should check that the mode switch on the SZ Series is set to [A:RUN/PC Communication]. If it is set to [B:Configuration on SZ], communication will not be performed.

**When [Create a new configuration file] is selected**
When [Create a new configuration file] is selected, the [Model selection] dialog box appears. You can see the default configuration/value on the SZ Configurator if you click the [OK] button after selecting the model of SZ series.

**When [Open a configuration file] is selected**
When [Open a configuration file] is selected, the [Open] dialog box appears. Select the appropriate SZ Configurator file (*.szd) and click the [Open] button to open the configuration file.
When [Start monitoring for SZ.] is selected
When [Start monitoring for SZ.] is selected, the configuration data is read from the SZ Series and the screen for monitoring is appeared.

**Note**
- Before selecting [Start monitoring for SZ.], you should check that the USB cable is properly connected between the computer and SZ Series.
- You should check that the power is supplied to the SZ.
- You should check that the mode switch for the SZ Series is set to [A:RUN/PC Communication]. If it is set to [B:Configuration], communication will not be performed.

**Exiting**
When exiting SZ Configurator, select [Exit] from the [File] menu.

**Note**
When changing the settings, the configuration file must be saved before exiting SZ Configurator. If SZ Configurator is exited without saving, the changes are lost.

When changing the settings, the confirmation dialog box appears.

**Note**
Click the [No] button to exit without saving.
Connecting the SZ Series to the PC

This section describes connecting method between the SZ Series and the personal computer with a USB cable.

Connecting

1. Open the setting-cover on the SZ Series.
   Loosen the two screws on the setting-cover and open the cover.

2. Use the USB cable (OP-86941) to connect the SZ Series to the personal computer.

Note
The specification of IP65 cannot be fulfilled without closing the setting-cover.
You must close the setting-cover and tighten two screws on the cover with recommended torque before starting operation.
(Recommended tightening torque: 0.3N·m)
Part names and functions

This section describes names and functions of each part in the main window.

■ Menu bar
Displays the menus for each function.
For more information about the menus, see "6-5 Operation menu" (page 6-34).

■ Toolbar
Display a row of buttons for frequently used functions.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(New)</td>
<td>Creates a new configuration file.</td>
</tr>
<tr>
<td>(Open)</td>
<td>Opens a saved configuration file (*.szd).</td>
</tr>
<tr>
<td>(Save)</td>
<td>Saves the configuration file being edited over the old file.</td>
</tr>
<tr>
<td>(Print)</td>
<td>Prints the information in the configuration file being edited.</td>
</tr>
<tr>
<td>Enter P.</td>
<td>Enter a password to login to the SZ Series.</td>
</tr>
<tr>
<td></td>
<td>Logs out.</td>
</tr>
<tr>
<td>(Transfer)</td>
<td>Transfers a configuration file to the SZ Series.</td>
</tr>
<tr>
<td>(Read)</td>
<td>Reads configuration data from the SZ Series.</td>
</tr>
<tr>
<td>(PDF)</td>
<td>Displays the PDF file of the SZ Series User's Manual.</td>
</tr>
</tbody>
</table>
6-2 Part names and functions

■ Configuration area
The tabs can be used to switch between configuration and monitoring.

<table>
<thead>
<tr>
<th>Tab</th>
<th>Function</th>
</tr>
</thead>
</table>
| Configuration | Sets each of the functions.  
|            | "6-3 Configuration tab" (page 6-11)                                     |
|            | You can select the configuration item in the subpanel and set the item in the main panel.  
|            | Property: You can configure the information for the configuration file.  
|            | Safety 1: You can configure OSSD1/2.                                     |
|            | Safety 2: You can configure OSSD3/4 and additional functions.             |
|            | Non-safety: You can configure non-safety related functions, such as detection in warning zone or AUX.  
|            | Zone: You can configure the zones where the SZ Series performs detection.  
|            | Transfer: You can transfer a configuration file to the SZ Series.         |
| Monitoring | Displays the screen for monitoring for the SZ Series.  
|            | "6-4 Monitoring tab" (page 6-33)                                          |

■ Subpanel
You can select (click on) the configuration item in the subpanel.
The background color of subpanel indicates the status of selection.
Configuration should be done in order from the top to bottom.

- (Background color: blue) Item is under configuration on the main panel.
- (Background color: gray) Item can be selected for configuration.  
  Click here to change the configuration on the main panel.
- (Background color: none) Unconfigured items that cannot be selected at this moment.  
  These items can be selected once the upper items are configured.  
  Once all of the configurations are completed, the [Transfer] button can be selected.

■ Status bar
Displays the communication status and login information.

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
</table>
| Under communication | SZ Configurator (computer) and the SZ Series are online (communicating).  
| Status Login  | Logged in. The configuration can be changed.  
| Status Logout | Logged out. Configuration cannot be changed.  

## Configuration tab

### Property

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File name</td>
<td>This shows the name of the configuration file. &quot;untitled.szd&quot; is displayed as the name for new, unsaved files.</td>
</tr>
<tr>
<td>Title / Department</td>
<td>You can enter the title or department information. Up to 80 characters can be entered (two lines of 40 characters).</td>
</tr>
<tr>
<td>Name of the person responsible</td>
<td>You can enter the name of the person in charge of configuration. Up to 40 characters can be entered.</td>
</tr>
<tr>
<td>Comments</td>
<td>You can enter a comment. Up to 100 characters can be entered.</td>
</tr>
<tr>
<td>Information</td>
<td>This shows information about the configuration.</td>
</tr>
<tr>
<td>Date of configuration*3</td>
<td>This shows the date and time that the configuration was transferred from SZ Configurator to the SZ Series.*2</td>
</tr>
<tr>
<td>Software version*3</td>
<td>This shows the version information for the SZ Configurator software, which was used to create the configuration data transferred to the SZ Series.*2</td>
</tr>
<tr>
<td>Model</td>
<td>This shows the model of the SZ Series.</td>
</tr>
<tr>
<td>Serial number on SZ</td>
<td>This shows the serial number of the SZ Series.*2</td>
</tr>
</tbody>
</table>

*1 Line breaks can be inserted into comments, but each line break counts as two characters.

*2 Displays this information when transferring a configuration file to the SZ Series or reading out a configuration file from the SZ Series. If any of the settings are changed, this information is no longer displayed.

*3 If the configuration is changed on the SZ Series after the configuration file is transferred with SZ Configurator, [Manual configuration on SZ] is appeared.
6-3 Configuration tab

Safety 1

Refer to the following section for detail information of each function.
- "2-3 Protection zone" (page 2-6)
- "2-6 Response time and scan cycle" (page 2-11)
- "2-7 Interlock" (page 2-12)
- "2-8 External device monitoring function (EDM)" (page 2-16)
- "2-9 Reference points monitoring function" (page 2-17)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD1/2(A)*1</td>
<td>Configuration for the OSSD1/2 function.</td>
</tr>
<tr>
<td>Minimum detectable object size</td>
<td>Setting for the minimum detectable object size.</td>
</tr>
<tr>
<td>Selectable size : 30 mm (1.19 inch), 40 mm (1.58 inch), 50 mm (1.97 inch), 70 mm (2.76 inch), 150 mm (5.91 inch)</td>
<td>Default : 70 mm (2.76 inch)</td>
</tr>
<tr>
<td>Maximum protection distance</td>
<td>This shows the maximum protection distance. This cannot be set. The distance varies depending on the minimum detectable object size setting.</td>
</tr>
<tr>
<td>Minimum detectable object size</td>
<td>30mm (1.19in.), 40mm (1.58in.), 50mm (1.97in.), 70mm (2.76in.), 150mm (5.91in.)</td>
</tr>
<tr>
<td>Max distance</td>
<td>1.8m (70.87in.), 2.4m (94.49in.), 3.0m (118.11in.), 4.2m (165.35in.)</td>
</tr>
<tr>
<td>Scan cycle A (General)</td>
<td>You can select the following time when using scan cycle A. The response time can be selected in 30 ms increments.</td>
</tr>
<tr>
<td>Selectable time : 60 ms, 90 ms, 120 ms, 150 ms, 180 ms, 210 ms, 240 ms, 270 ms, 300 ms, 330 ms, 360 ms, 390 ms, 420 ms, 450 ms, 480 ms</td>
<td>Default : 120 ms</td>
</tr>
<tr>
<td>Scan cycle B</td>
<td>You can select the following time when using scan cycle B. The scan cycle can be selected in 33 ms increments.</td>
</tr>
<tr>
<td>Selectable time : 66 ms, 99 ms, 132 ms, 165 ms, 198 ms, 231 ms, 264 ms, 297 ms, 330 ms, 363 ms, 396 ms, 429 ms, 462 ms, 495 ms, 528 ms</td>
<td>Default : 132 ms</td>
</tr>
</tbody>
</table>
## Configuration tab

### Item Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Start/Restart mode (Interlock)** | Setting for start/restart mode (interlock).  
Default: Manual/Manual |
| **Restart delay (ON-delay)** | Setting for restart delay (ON-delay).  
This can be set when [Automatic/Automatic] or [Manual/Automatic] is selected for start/restart mode (interlock).  
Place a check mark [ ] in the [Enable] checkbox to set the delay time.  
Setting range: 2 to 60 (Unit: seconds)  
Default: 2 |
| **EDM (OSSD1/2) Enable** | Setting for EDM function.  
Place a check mark [ ] in the checkbox to enable the EDM function.  
Default: [ ] (Checked) |
| **Reference points monitoring**<sup>3</sup> | Setting for the reference points monitoring function.  
Place a check mark [ ] in the checkbox to enable the reference points monitoring function.  
Default: [ ] (Unchecked) |

---

<sup>1</sup> This item is displayed as [OSSD] for "SZ-01S" or "SZ-16V".

<sup>2</sup> The scan cycle of OSSD3/4 is always the same as the one of OSSD1/2 for "SZ-04M".

<sup>3</sup> The setting for the reference points monitoring function is only displayed for "SZ-01S" or "SZ-04M".

<sup>4</sup> When a check mark is placed in the [Enable] checkbox [ ] for "Restart delay (ON-delay)", "Manual/Manual" cannot be selected (grayed out). You have to remove the check mark from the [Enable] checkbox [ ] in order to change Start/Restart mode to "Manual/Manual".
6-3 Configuration tab

Safety 2

This is the configuration for OSSD3/4 and additional functions.

**Note**

- This configuration cannot be done when the model is “SZ-01S”. (“Safety 2” is not displayed in the subpanel.)
- The [Operation mode for OSSD3/4] item cannot be set (is not displayed) when the model is “SZ-16V”.
- Only the bank function can be set for the [Additional function] item when the model is “SZ-16V”.

Refer to the following section for detail information of each function.

- “2-10 Multi-OSSD function” (page 2-18)
- “2-11 Bank switching function” (page 2-20)
- “2-12 Temporary suspension of safety function” (page 2-27)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation mode for OSSD3/4</td>
<td>Setting for the operation mode for OSSD3/4. A description of the operations for each mode appears in the box next to the selections.</td>
</tr>
<tr>
<td></td>
<td>Possible setting: Not used, Mode A, Mode B, Mode C, Mode D</td>
</tr>
<tr>
<td></td>
<td>Default: Not used</td>
</tr>
<tr>
<td>Additional function</td>
<td>Setting for the additional function.</td>
</tr>
<tr>
<td></td>
<td>Possible setting: Not used, Bank, Muting, Suspension in teaching mode</td>
</tr>
<tr>
<td></td>
<td>Default: Not used</td>
</tr>
</tbody>
</table>
6-3 Configuration tab

■ Operation mode for OSSD3/4

Note
This can only be configured when the model is “SZ-04M”.

● When "Not used" is selected
OSSD3/4 is not used. (OSSD3/4 is always turned OFF.)

● When "Mode A" is selected
OSSD 3/4 performs completely the same operation for the detection as OSSD 1/2.
In this mode, only the EDM function can be set for OSSD3/4.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD3/4 (B)</td>
<td>Setting for the EDM function. Place a check mark in the checkbox to enable the EDM function for OSSD3/4. Default: (Checked)</td>
</tr>
</tbody>
</table>

● When "Mode B" is selected
OSSD3/4 performs the same operation for the detection as OSSD1/2, but the following functions are not enabled:
- Interlock
- Muting
- Override
- Restart delay (ON-delay)
- Suspension in teaching mode

In this mode, only the EDM function can be set for OSSD3/4.
6-3 Configuration tab

● When "Mode C" is selected
OSSD 3/4 performs the different operation for the detection form OSSD 1/2, especially the minimum detectable object size and response time, but protection zone is completely the same as OSSD 1/2. In this mode, only the EDM function can be set for OSSD3/4.

For more information about the details and default values for each item, refer to “Safety 1” (page 6-12).

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD3/4 (B)</td>
<td>Configuration for the OSSD3/4 function.</td>
</tr>
<tr>
<td>Minimum detectable object size</td>
<td>Setting for the minimum detectable object size. You can set the minimum detectable object size different from OSSD 1/2.</td>
</tr>
<tr>
<td>Maximum protection distance</td>
<td>This shows the maximum protection distance. This cannot be set.</td>
</tr>
<tr>
<td>Response time</td>
<td>Setting for the response time. The scan cycle for OSSD3/4 is consequently the same as the cycle for OSSD 1/2, so it cannot be set here.</td>
</tr>
<tr>
<td>Scan cycle A (General)</td>
<td>Scan cycle B</td>
</tr>
<tr>
<td>EDM (OSSD3/4) Enable</td>
<td>Setting for the EDM function for OSSD3/4. Place a check mark in the checkbox to enable the EDM function. Default: (Checked)</td>
</tr>
</tbody>
</table>
When "Mode D" is selected
OSSD 3/4 performs the non-related (independent) operation from OSSD 1/2. Therefore, all of parameters related to OSSDs, including the protection zone, can be different from OSSD 1/2. In this mode, only the EDM function can be set for OSSD3/4.

Note
"Mode D" cannot be selected if "Muting" or "Suspension in teaching mode" are selected as additional functions.

"Additional functions" (page 6-18)

For more information about the details and default values for each item, refer to "Safety 1" (page 6-12).

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD3/4 (B)</td>
<td>Configuration for the OSSD 3/4 function.</td>
</tr>
<tr>
<td>Minimum detectable object size</td>
<td>Setting for the minimum detectable object size. You can set the minimum detectable object size different from OSSD 1/2.</td>
</tr>
<tr>
<td>Maximum protection distance</td>
<td>This shows the maximum protection distance. This cannot be set.</td>
</tr>
<tr>
<td>Response time</td>
<td>Setting for the response time.</td>
</tr>
<tr>
<td>Scan cycle A (General)</td>
<td>The scan cycle for OSSD3/4 is consequently the same as the cycle for OSSD 1/2, so it cannot be set here.</td>
</tr>
<tr>
<td>Scan cycle B</td>
<td></td>
</tr>
<tr>
<td>Start/Restart mode (interlock)</td>
<td>Setting for start/restart mode (interlock). This can be set when [Automatic/Automatic] or [Manual/Automatic] is selected for start/restart mode (interlock). Place a check mark in the [Enable] box to set the delay time.</td>
</tr>
<tr>
<td>Restart delay (ON-delay)</td>
<td>Setting for restart delay (ON-delay). This can be set when [Automatic/Automatic] or [Manual/Automatic] is selected for start/restart mode (interlock). Place a check mark in the [Enable] box to set the delay time.</td>
</tr>
<tr>
<td>Enable</td>
<td>Place a check mark in the [Enable] box to enable the EDM function. Default: [ ] (Checked)</td>
</tr>
</tbody>
</table>
### Additional functions

**Note**
- This can only be configured when the model is "SZ-04M" or "SZ-16V".
- Only the bank function can be set when the model is "SZ-16V".

- **When "Not used" is selected**
  Additional function is not used.

- **When the bank function is selected – in case of "SZ-04M" –**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank</td>
<td>Setting for the number of banks for use.</td>
</tr>
<tr>
<td>Setting range</td>
<td>2 to 4 *</td>
</tr>
<tr>
<td>Default</td>
<td>2</td>
</tr>
<tr>
<td>Bank transition time</td>
<td>If bank switching is not completed within the specified transition time, &quot;Error10 Bank Error&quot; will be generated.</td>
</tr>
<tr>
<td>Selectable time</td>
<td>0.10 seconds, 0.25 seconds, 1.00 seconds, 2.50 seconds, 5.00 seconds</td>
</tr>
<tr>
<td>Default</td>
<td>0.10 seconds</td>
</tr>
<tr>
<td>Bank sequence monitoring</td>
<td>This can be set when 3 or more banks are set for &quot;Bank&quot;.</td>
</tr>
<tr>
<td>Checked</td>
<td>The bank sequence is set by the presence of a check in the checkboxes.</td>
</tr>
<tr>
<td>Unchecked</td>
<td>Bank switching in the specified sequence will generate &quot;Error10 Bank Error&quot;.</td>
</tr>
</tbody>
</table>

* The setting range varies depending on the setting for [Operation mode for OSSD3/4].

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Setting range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not use</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Mode A</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Mode B</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Mode C</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Mode D</td>
<td>2</td>
</tr>
</tbody>
</table>
### When the bank function is selected – in case of "SZ-16V" –

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of banks</td>
<td>Setting for the number of banks for use. Setting range : 1 to 16  Default : 1</td>
</tr>
<tr>
<td>Bank transition time *1</td>
<td>If bank switching is not completed within the specified transition time, &quot;Error10 Bank Error&quot; will be generated. Selectable time : 0.10 seconds, 0.25 seconds, 1.00 seconds, 2.50 seconds, 5.00 seconds  Default : 0.10 seconds</td>
</tr>
<tr>
<td>Bank sequence monitoring *2</td>
<td>You can place a check mark in the [Enable] box to monitor the bank switching sequence. The bank sequence is set separately for each bank. Default : (Unchecked)</td>
</tr>
<tr>
<td>[Not specified] radio button</td>
<td>ON : This permits switching to any bank.</td>
</tr>
<tr>
<td>[Specified] radio button</td>
<td>ON : This permits switching to any of the banks specified (maximum 3). Checking this box allows the available banks to be specified. Switching to the bank unspecified will generate &quot;Error10 Bank Error&quot;. Setting Range : 0 to 15  Default : 0 (or &quot;1&quot; if &quot;From Bank 0&quot; is set)</td>
</tr>
</tbody>
</table>
6-3 Configuration tab

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser shutdown function*5</td>
<td>Checking [Enable] causes the laser to be shut down when the bank specified in &quot;Bank No. for laser shutdown&quot; is activated. The laser shutdown function stops the laser radiation and the OSSD forcibly goes to the OFF-state.</td>
</tr>
<tr>
<td>Bank No. for laser shutdown</td>
<td>Switching to the specified bank will cause the laser to be shut down. Setting range : 0 to 15 *3 *4 Default : 0</td>
</tr>
</tbody>
</table>

*1 This cannot be set when "Number of Banks" is set to "1". (The option will be Grayed out.)
*2 This is not displayed when "Number of Banks" is set to "1" or "2".
*3 Additionally, the bank information for setting, which is higher than the setting value in "Number of banks", is not displayed. Example: "3" cannot be set when you specify the "To bank" for "From bank3".
*4 Values beyond this range (i.e., 16 through 99) can be entered, but this will result in an error when moving to another item. This error will also be displayed if the setting is higher than the setting for "Number of banks."
*5 This will not be displayed when "Number of Banks" is set to "1".

![Input error dialog box]

**Note**

You must configure the protection zones for all banks when the bank is set. If there are banks without a protection zone configured, configuration data cannot be transferred to the SZ Series.

"Zone" (page 6-25)
### When "Muting" is selected

*Note*

"Muting" and "Suspension in teaching mode" cannot be selected when the "Operation mode for OSSD3/4" is set to "Mode D".

"Operation mode for OSSD3/4" (page 6-15)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition for initiation of muting</td>
<td>Configuration for the condition for initiation of muting.</td>
</tr>
<tr>
<td>Sequence of muting inputs</td>
<td>Setting for the sequence of muting input.</td>
</tr>
<tr>
<td></td>
<td>Possible setting: Muting input 1: First / Muting input 2: Second</td>
</tr>
<tr>
<td></td>
<td>: Muting input 2: First / Muting input 1: Second</td>
</tr>
<tr>
<td></td>
<td>: Not specified</td>
</tr>
<tr>
<td></td>
<td>Default: Muting input 1: First / Muting input 2: Second</td>
</tr>
<tr>
<td>Time period between muting inputs</td>
<td>Setting for the time period between muting inputs</td>
</tr>
<tr>
<td></td>
<td>Muting is initiated if the SZ Series detects the muting inputs (muting input 1 and 2) within the specified time period according to the &quot;Sequence of muting inputs&quot; above.</td>
</tr>
<tr>
<td></td>
<td>Selectable time: 3 seconds, 5 seconds, 10 seconds, not specified *1</td>
</tr>
<tr>
<td></td>
<td>Default: 3 seconds</td>
</tr>
<tr>
<td>Condition for termination of muting</td>
<td>Configuration for the condition for termination of muting.</td>
</tr>
<tr>
<td>Maximum muting period of time</td>
<td>This specifies how long the muting will continue.</td>
</tr>
<tr>
<td></td>
<td>Selectable time: 1 minute, 5 minutes, 10 minutes, not specified *1</td>
</tr>
<tr>
<td></td>
<td>Default: 5 minutes</td>
</tr>
<tr>
<td>Condition for termination of override</td>
<td>Configuration for the condition for termination of override.</td>
</tr>
<tr>
<td>Maximum override period of time</td>
<td>This specifies how long the override will continue.</td>
</tr>
<tr>
<td></td>
<td>Selectable time: 1 minute, 5 minutes, 10 minutes</td>
</tr>
<tr>
<td></td>
<td>Default: 1 minute</td>
</tr>
</tbody>
</table>

*1 Muted condition will be terminated approx. 5 minutes later when the time between muting inputs exceeds 3 seconds, even if "Not specified" is selected for maximum muting period and time between muting inputs.
### 6-3 Configuration tab

#### When "Suspension in teaching mode" is selected

**Note**

"Muting" and "Suspension in teaching mode" cannot be selected when the "Operation mode for OSSD3/4" is set to "Mode D".  
"Operation mode for OSSD3/4" (page 6-15)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition for initiation of suspension in teaching mode</td>
<td>Configuration for the condition for initiation of suspension in teaching mode.</td>
</tr>
</tbody>
</table>
| Time between teach mode input and teach ready input | Setting for the time between teach mode input and teach ready input, which are external inputs to be used for initiation of this suspension.  
Selectable time : 3 seconds, 5 seconds, 10 seconds  
Default : 3 seconds |
| Condition for termination of override      | Configuration for the condition for termination of override. |
| Maximum override period of time            | This specifies how long the override will continue.  
Selectable time : 1 minute, 5 minutes, 10 minutes  
Default : 1 minute |
This section describes how to configure non safety-related functions, such as warning zone and AUX. Refer to the following section for detailed information of each function.

- "2-13 AUX (auxiliary) output" (page 2-35)
- "2-14 Check input function" (page 2-43)

### Non Safety-related Functions

**Item** | **Description**
--- | ---
Detection in warning zone | Configuration for the detection in the warning zone.
Minimum detectable object size | Setting for the minimum detectable object size.
    | Selectable size: 30 mm (1.19 in.), 40 mm (1.58 in.), 50 mm (1.97 in.), 70 mm (2.76 in.), 150 mm (5.91 in.)
    | Default: 70 mm (2.76 in.)
Maximum warning distance | This shows the maximum warning distance. This cannot be set.
    | The distance varies depending on the minimum detectable object size setting.
    | Minimum detectable object size: 30mm (1.19in.), 40mm (1.58 in.), 50mm (1.97 in.), 70mm (2.76 in.), 150mm (5.91 in.)
    | Max distance: 4.5m (17.71in.), 6.0m (236.22in.), 7.5m (295.28in.), 10.0m (393.70in.)
Response time | Scan cycle A (General) Setting for the response time.
    | The scan cycle is consequently the same as the scan cycle for OSSD1/2, so it cannot be set here.
    | Scan cycle B Setting for the response time.

* Warning zone (A): Warning zone for OSSD1/2
* Warning zone (B): Warning zone for OSSD3/4
* Warning zone (B) is displayed only when the model is "SZ-04M" and "Mode D" is selected for [Operation mode for OSSD3/4].
# 6-3 Configuration tab

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State information output</strong></td>
<td>Place a check mark [ ] in the [Enable] box to output state information.</td>
</tr>
<tr>
<td><strong>Pulse width</strong></td>
<td>Setting for the pulse width for state information. This can only be set when the [Enable] box is checked [ ]. Selectable width: 20 ms, 40 ms, 80 ms, 100 ms, 200 ms, 300 ms Default: 20 ms</td>
</tr>
<tr>
<td><strong>In case of muting lamp failure</strong></td>
<td>Setting for how the OSSDs perform in case of muting lamp failure.</td>
</tr>
<tr>
<td><strong>(AUX output setting display)</strong></td>
<td>Assignment of a function to the AUX output.</td>
</tr>
<tr>
<td><strong>Check input</strong></td>
<td>Place a check mark [ ] in the [Enable] box to configure check input.</td>
</tr>
<tr>
<td><strong>Information display</strong></td>
<td>You can check the &quot;Turn off backlight&quot; check box [ ] to turn off the backlight on the information display on SZ series.</td>
</tr>
<tr>
<td><strong>[Wire color and assigned function] button</strong></td>
<td>You can click the [Wire color and assigned function] button to show the [Wire color and assigned function] dialog.</td>
</tr>
</tbody>
</table>

*1 This can only be set when the model is "SZ-04M" or "SZ-16V".
*2 This can only be set when AUX6 is assigned to "Muting lamp output".
*3 This can only be set when the model is "SZ-01S" or "SZ-04M". Additionally, this can only be set when [Automatic/Automatic] is selected for "Start/restart mode (interlock)" under [Safety functions 1] and [Safety functions 2].
*4 This cannot be set when the [Enable] check box for "Reference point monitor" under [Safety features 1] is checked.
*5 Backlight for LCD turns on at the start-up and the occurrence of error/alert regardless of this setting. It also turns on for 30 seconds while the key on SZ is operated.
Zone

Refer to the following section for detail information of each function.
- "2-3 Protection zone" (page 2-6)
- "2-4 Warning zone" (page 2-8)
- "2-9 Reference points monitoring function" (page 2-17)
- "2-10 Multi-OSSD function" (page 2-18)
- "2-11 Bank switching function" (page 2-20)
- "2-12 Temporary suspension of safety function" (page 2-27)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canvas</td>
<td>You can draw the zone (protection zone, warning zone) on this canvas.</td>
</tr>
<tr>
<td></td>
<td>You can use the &quot;Drawing Tool bar&quot; for zone configuration.</td>
</tr>
<tr>
<td>Zone display panel</td>
<td>You can select the zone to be configured with this panel and can also switch whether the zone in question is displayed or not.</td>
</tr>
<tr>
<td>Switching button for zone display panel</td>
<td>For switching whether the &quot;Zone display panel&quot; is display or not.</td>
</tr>
<tr>
<td>Drawing toolbar</td>
<td>You can draw the zone (protection zone, warning zone) on this canvas with this drawing tools.</td>
</tr>
<tr>
<td>Drawing properties</td>
<td>This shows information related to the drawing.</td>
</tr>
<tr>
<td>[Mouse position]</td>
<td>This shows the current coordinates for the mouse pointer.</td>
</tr>
<tr>
<td>[Figure information]</td>
<td>This shows information such as the size and angles of figures on the canvas.</td>
</tr>
</tbody>
</table>
6-3 Configuration tab

■ Canvas
The SZ Series is represented in the center of the canvas. The grid is also shown on canvas.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configurable area</td>
<td>The color of image on canvas is white for the configurable area. The configurable area varies depending on the configuration for safety functions.</td>
</tr>
<tr>
<td>Unconfigurable area 1</td>
<td>The color of image on canvas is light-Gray for unconfigurable area.</td>
</tr>
<tr>
<td>Unconfigurable area 2</td>
<td>The color of image on canvas is dark-Gray for unconfigurable area with no laser radiation from SZ. (Blind area)</td>
</tr>
<tr>
<td>Zone with the limited detection capability</td>
<td>The zone within the circle with the radius of 85mm from the center of the SZ (protection zone origin) is the zone with the limited detection capability.</td>
</tr>
</tbody>
</table>

"Zone with limited detection capability" (page 3-6)
### Zone display panel
The contents of the zone display panel vary depending on the model and the configuration.

![Zone display panel image]

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Zone name)</td>
<td>The zone shown varies depending on the model and the configuration.</td>
</tr>
<tr>
<td>Bank 1 to</td>
<td>This is shown if banks have been set. This is not shown when the model is “SZ-01S”.</td>
</tr>
<tr>
<td>View</td>
<td>You can check this box to show the drawn protection zone. You can uncheck this box to hide the drawn protection zone. You can click [View] to change all of the checkboxes at once.</td>
</tr>
<tr>
<td>Edit</td>
<td>The surrounding of the button turns to “green” in order to show that the zone is currently under edit, if you click the button in “Edit”. You can change the type of zone through the button in “Edit”. The color of the button corresponds to the color of the zone on the canvas. Multiple buttons in “Edit” cannot be selected at the same time.</td>
</tr>
</tbody>
</table>
### Drawing toolbar

The following tools can be used when drawing on the canvas.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Zoom in 1</td>
<td>Zooms in the canvas</td>
</tr>
<tr>
<td>(2) Zoom out 1</td>
<td>Zooms out the canvas</td>
</tr>
<tr>
<td>(3) Full display</td>
<td>Adjusts the screen scale in order to show the zone that is drawn on the canvas.</td>
</tr>
<tr>
<td>(4) [Ruler] tool</td>
<td>This shows the distance between the specified two points.</td>
</tr>
<tr>
<td>(5) [Specify the point] tool</td>
<td>Selects the user point, reference point or check point for the zone currently being edited. Drag to select multiple points.</td>
</tr>
<tr>
<td>(6) [Set the point] tool</td>
<td>Adds user point, reference point or check point to the border of the zone currently being edited.</td>
</tr>
<tr>
<td>(7) [Set the line segment] tool</td>
<td>Adds a line connecting two points, as well as the triangular area defined by the points on that line and the origin.</td>
</tr>
<tr>
<td>(8) [Delete the line segment] tool</td>
<td>Deletes from the area currently being edited an area defined by the two points on the selected line and the origin.</td>
</tr>
<tr>
<td>(9) [Set the rectangle] tool</td>
<td>Adds a rectangle with the two specified points at opposite vertices, as well as the area defined by these points and the origin.</td>
</tr>
<tr>
<td>(10) [Delete the rectangle] tool</td>
<td>Deletes from the area currently being edited a rectangle with the two selected points on opposing vertices and the area created by these points and the origin.</td>
</tr>
<tr>
<td>(11) [Add polygon] tool</td>
<td>Adds a polygon defined by multiple user points, as well as the area defined by these points and the origin.</td>
</tr>
<tr>
<td>(12) [delete polygon] tool</td>
<td>Deletes from the area currently being edited a polygon defined by multiple user points and the area created by these points and the origin.</td>
</tr>
<tr>
<td>(13) [Set the circle] tool</td>
<td>Adds a circle with a radius defined by specified points, as well as the area defined by these points and the origin.</td>
</tr>
<tr>
<td>(14) [Delete the circle] tool</td>
<td>Deletes from the area currently being edited a circle with a radius defined by specified points and the area created by these points and the origin.</td>
</tr>
<tr>
<td>(15) [Set the sector] tool</td>
<td>Adds a sector with an edge defined by two specified points and an internal angle specified by a third, as well as the area defined by these points and the origin.</td>
</tr>
<tr>
<td>(16) [Delete the sector] tool</td>
<td>Deletes a sector with an edge defined by two specified points and an internal angle specified by a third, as well as the area defined by these points and the origin.</td>
</tr>
<tr>
<td>(17) [Freehand drawing] tool</td>
<td>Adds a freehand shape, as well as the area defined by this shape and the origin.</td>
</tr>
<tr>
<td>(18) [Freehand deletion] tool</td>
<td>Deletes a freehand shape, as well as the area defined by this shape and the origin.</td>
</tr>
<tr>
<td>(19) Automatic drawing</td>
<td></td>
</tr>
<tr>
<td>(20) [Delete all] tool</td>
<td>Clears everything in the zone.</td>
</tr>
</tbody>
</table>
### 6-3 Configuration tab

<table>
<thead>
<tr>
<th>Icon name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(21) Undo</td>
<td>Undoes the previous operation.</td>
</tr>
<tr>
<td>(22) Redo</td>
<td>Redoes the last operation that was undone.</td>
</tr>
<tr>
<td>(23) Start real-time ranging</td>
<td>Displays the ranging state of the SZ Series in real time.</td>
</tr>
<tr>
<td>(24) Pause real-time ranging</td>
<td>Temporarily stops the real time ranging display.</td>
</tr>
<tr>
<td>(25) Finish real-time ranging</td>
<td>Clear the real time ranging display in the drawing panel.</td>
</tr>
<tr>
<td>(26) Bottom-hold real-time ranging</td>
<td>Holds real time ranging display at bottom.</td>
</tr>
<tr>
<td></td>
<td>- The bottom hold is updated by the green line in real time.</td>
</tr>
<tr>
<td></td>
<td>- This is only available when &quot;Real time ranging display -Start-&quot; is ON.</td>
</tr>
<tr>
<td>(27) Comments on the zone</td>
<td>Displays or hides the comments on the zone under the drawing panel (above the drawing properties). A memo of up to 100 characters can be recorded.</td>
</tr>
</tbody>
</table>

*1 Move the mouse cursor over the drawing panel and move mouse wheel forward to zoom in or backward to zoom out.

*2 Points are the □ that appear at each corner of the shape drawn.

*3 Freehand shapes follow the movement of the mouse from the start of the left-dragging of the mouse to the end of it.

![Tip]
- Drag the mouse wheel to change the display position of the XY orientation. The mouse icon becomes 🔎 while dragging.
- When using the line, polygon, sector (main line) and ruler tools, holding the [Shift] key will restrict the lines drawn to horizontal and vertical.
- By clicking the line, square, polygon, sector, or ruler tool while pressing and holding the [Alt] key, the intersections of the grids in the drawing area are selected.
6-3 Configuration tab

Transfer

Once configuration is completed, the configuration data can be transferred to the SZ Series. Before transferring the configuration data, you should make sure that the computer (SZ Configurator) and the SZ Series are properly connected with a USB cable.

■ Procedure for transfer

This section explains the procedure for transferring the configuration data to the SZ Series.

1. Click the [Transfer] button on the sub-panel.
   The [Transfer] button cannot be clicked if configuration is not completed.

2. Click [OK] in the transfer settings dialog box.

3. If you are not logged into the SZ Series, the [Log-in] dialog box will appear. Enter your password to log in.
   ![Log-in dialog box]
   The default password is "1111". Change the default password.

Note

The configuration for safety-related functions and the others cannot be performed without the password (ex. when you forget a password). You must strictly keep the password.
   "When you forget the password" (page 6-56)
The configuration data will be transferred after a successful login.

After the configuration data is transferred, configuration data is read out from the SZ Series.

4 Click [OK] in the confirmation dialog to show the [Confirmation] dialog for the configuration data. Confirm the configuration and then click [Accept] if you find nothing different from your intention. If the [Accept] button is Grayed out and cannot be clicked, use the scroll bar to display all of the settings.

Note
Clicking the [Refuse] button will cancel the transfer. If this happens, all configuration data on the SZ Series will be erased.

Note
Do not disconnect the USB cable while transferring the configuration data.

Note
Do not remove the USB cable while transferring settings.
5 The [Confirmation] dialog for configured zone appears. Confirm the zone and then click [Accept] if you find nothing different from your intention.

If mode D or a bank is configured, the [Next] button will appear next to the zone name and the [Accept] button will be Grayed out.

The [Accept] button will become available once all the zones have been confirmed.

Note Clicking the [Not accept] button will cancel the transfer. If this happens, all configuration data on the SZ Series will be erased.

6 The confirmation dialog box appears. Click either the [Start monitoring] button or the [Back to configuration] button.

The confirmation dialog box appears when the configuration data have been transferred, and the SZ will begin operating in accordance with the new configuration.
Monitoring tab

Select the Monitoring tab to monitor the detection state of the SZ Series in real time.

**Note**

- Before selecting the Monitoring tab, make sure that the personal computer (SZ Configurator) and the SZ Series are properly connected with a USB cable.
- Monitoring cannot be possible if the configuration data on the SZ Configurator is different from the configuration data on the SZ series. Read the configuration data from the SZ Series or transfer the configuration data from the SZ Configurator.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display for SZ operation</td>
<td>This shows the operating state of the SZ.</td>
</tr>
<tr>
<td>Monitoring panel</td>
<td>This shows the ranging information of the SZ in real time.</td>
</tr>
<tr>
<td>Toolbar</td>
<td>Zooms in and out on the Monitoring panel, and measures distance.</td>
</tr>
<tr>
<td>OSSD display</td>
<td>This shows the state of OSSD.</td>
</tr>
<tr>
<td>Protection zone</td>
<td>The protection zone set in the SZ Configurator is shown.</td>
</tr>
<tr>
<td>Warning zone 1/2</td>
<td>This is shown if a warning zone 1/2 set in the SZ Configurator.</td>
</tr>
<tr>
<td>Ranging information</td>
<td>This shows the ranging result of the SZ Series in real time (Blue line).</td>
</tr>
</tbody>
</table>

* Warning range 2 can be set only when the SZ Series model is "SZ-16V".
6-5  Operation menu

File (F)

This section explains how to save the setting file used by the SZ Configurator to the computer and load it from the computer.

■ New
You can select [New(N)] under the [File(F)] menu.
The [Model selection] dialog appears. You can select the model of the SZ Series.

Shortcut Key: Ctrl + N

■ Open
You can select [Open(O)] under the [File(F)] menu.
The [Open] dialog appears. You can select an SZ configuration file (*.szd).

Shortcut Key: Ctrl + O

■ Close
This closes the configuration file currently being edited.
If editing a configuration file, a save confirmation dialog appears.

Note
Closing the configuration file will not automatically log you out if you are logged in. You must log out separately.

■ Save
You can select [Save(S)] under the [File(F)] menu.
This saved the configuration file currently being edited.

Shortcut Key: Ctrl + S

If this is the first time for this configuration to be saved, the [Save as...] dialog will appear.

■ Save as...
You can select [Save as(A)] under the [File(F)] menu.
The [Save As] dialog appears. You can select a name for the file and then save the file.
■ Change model
You can select [Change model (M)] under the [File (F)] menu.
The [Model selection] dialog appears.
You can change the model from SZ-01S to SZ-04M, or from SZ-04M to SZ-01S.
This does not provide the option to change SZ-16V to SZ-01S or SZ-04M.

■ Print
You can select [Print(P)] under the [File(F)] menu.
The [Print] dialog appears so as to perform the setting on print condition.
If you click [Print] button, you can get the printed document including the following information.

- File Name
- Information on "Property", such as Title/Department, Name of the person responsible and comment.
- Information on "Configuration", such as Date of configuration, software version, Model and serial number.
- Configuration parameters

Shortcut Key: Ctrl + P

■ Recent files
This shows the five files most recently opened in the SZ Configurator.

■ Exit
You can select [Exit(X)] under the [File(F)] menu.
This exits the SZ Configurator.
If currently editing a file, a save confirmation dialog appears.
6-5 Operation menu

**Edit(E)**

This shows a menu for zone configuration.

<table>
<thead>
<tr>
<th><strong>Note</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The [Edit(E)] menu is only available when the [Configuration] sub panel of the [Zone] tab is selected.</td>
</tr>
</tbody>
</table>

- **Undo**
  
  This undoes the previous operation.

  **Shortcut Key:** Ctrl + Z

- **Redo**
  
  You can redo the last operation that was undone.

  **Shortcut Key:** Ctrl + Y

- **Copy zone**
  
  You can select [Copy zone(C)] under the [Edit(E)] menu.
  This copies the zone currently being edited to the clipboard.

  **Shortcut Key:** Ctrl + C

- **Paste zone**
  
  You can select [Paste zone(P)] under the [Edit(E)] menu.
  This pastes a zone copied with "Copy zone" to the selected location.

  **Shortcut Key:** Ctrl + V
### Scaling zone

You can select [Scaling zone(S)] under the [Edit(S)] menu. The [Scaling zone] dialog appears.

![Scaling zone dialog](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling ratio</td>
<td>You can change the scale of the current zone by specifying a percentage. You should click the up and down buttons in the input box to change the scaling ratio of the zone. If the scaling ratio is entered manually, click the [Preview] button to confirm the change of the zone scale. Setting Range : 0 to 200 (%) Default : 100</td>
</tr>
<tr>
<td>(Slide bar)</td>
<td>You can change the scaling ratio via the slide bar. The size of the zone under editing is changed corresponding to the movement of side bar.</td>
</tr>
<tr>
<td>[Preview] button</td>
<td>You can input the scaling ratio directly into the input box. Draws the zone according to the specified scaling ratio.</td>
</tr>
<tr>
<td>[Execute] button</td>
<td>You can reflect the specified scaling ratio to the zone size.</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>This cancels the change in scaling ratio and returns to the previous size.</td>
</tr>
</tbody>
</table>
6-5 Operation menu

■ Automatic drawing
The purpose of the automatic drawing function is to just draw the zone automatically based on the surrounding situation of the SZ, such as a protective guarding.

Example of the drawing for the protection zone with the automatic drawing function

![Diagram of automatic drawing]

If there is nothing beyond the maximum distance, the maximum protection or warning distance is drawn.

Even if there is something beyond the maximum distance, the maximum protection or warning distance is drawn.

The zone drawn with the automatic drawing function is just an informative zone, which is automatically drawn by the SZ Configurator based on the surrounding situation of the SZ, such as a protective guarding. Therefore, you must confirm whether the zone drawn with the automatic drawing is just as you intended, if you want to configure the actual protection zone according to the zone drawn with automatic drawing. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.

You can select [Automatic drawing(A)] under the [Edit(E)] menu. The "Automatic Drawing" dialog box appears.

Alternate procedure: Click the button on the drawing toolbar.
6-5 Operation menu

Configuration through SZ Configurator (SZ-H1S)

1. **Automatic Drawing Procedure**

   1. Select [Automatic drawing(A)] from the [Edit(E)] menu.
      The "Automatic Drawing" dialog box appears.
      This explains how to configure automatic drawing.

   2. Click the [Start automatic drawing] button to start automatic drawing.
      Based on the actual ranging information through the SZ series, the SZ Configurator automatically draws the zone. The "Automatic drawing is in execution" dialog box appears when it is started.

      While "Automatic drawing is in execution" dialog is being appeared, the zone that is automatically drawn is always updated in real time.

   3. Click the [Finish] button to fix the drawing of zone.
      If you click the [Finish] button, updating in real time stops, and then the confirmation dialog appears.
      If you click the [Cancel] button in that confirmation dialog, the SZ Configurator stops the automatic drawing, and then restores the zone.

---

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>space</td>
<td>Based on the actual ranging information through the SZ series, the SZ Configurator automatically draws the zone, taking into account the specified space from the surrounding obstacles. You can use the up and down buttons of the input box, or input the value (space) directly. Setting Range: 0 to 500 (mm) Default : 100</td>
</tr>
<tr>
<td>[Default] button</td>
<td>You can reset the value in the input box to its default (100).  You can check this box to activate auto drawing after deleting a current zone. Default : ON</td>
</tr>
<tr>
<td>Delete the current specified zone before starting automatic drawing.</td>
<td>You can check this box to activate auto drawing after deleting a current zone. Default : ON</td>
</tr>
<tr>
<td>Smoothing</td>
<td>You can check this box to reduce the number of user points so as to make the drawing easy to see (adjust). Default : OFF</td>
</tr>
<tr>
<td>[Start automatic drawing] button</td>
<td>Start automatic drawing.</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>Cancels automatic drawing and closes the [Automatic drawing] dialog.</td>
</tr>
</tbody>
</table>
4 Click the [OK] button to complete the automatic drawing.
The zone generated by the automatic drawing will be reflected in the configuration data.
If you click [Cancel] button in that confirmation dialog, the SZ configurator stops the automatic drawing,
and then restores the zone.

Rotation of all zones
You can select [Rotation of all zones(O)...] under the [Edit(E)] menu.
The [Rotation of all zones] dialog appears.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>You can specify the angle to rotate all zones on the canvas. Press the up and down buttons in the input box to change the angle of rotation. If the angle is entered manually, click the [Preview] button to rotate the zones.</td>
</tr>
<tr>
<td>Setting Range</td>
<td>-180 to 180 (Degree)</td>
</tr>
<tr>
<td>Default</td>
<td>0.00</td>
</tr>
<tr>
<td>(Slide bar)</td>
<td>You can change the angle of rotation via the slide bar. The all zones are rotated corresponding to the movement of slide bar.</td>
</tr>
<tr>
<td>[Preview] button</td>
<td>You can input the value of angle directly into the input box. All zones are rotated with the specified angle.</td>
</tr>
<tr>
<td>[Execute] button</td>
<td>You can change the setting data to reflect the specified angle of rotation.</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>This cancels the change in the angle of rotation and returns to the previous state.</td>
</tr>
</tbody>
</table>
Displacement of all zones

Select [Displacement of all zones(M)...] under the [Edit(E)] menu. The [Displacement of all zones] dialog appears.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal direction</td>
<td>You can specify a distance to displace all zones on the canvas horizontally.</td>
</tr>
<tr>
<td></td>
<td>Press the up and down buttons in the input box to change the distance displaced.</td>
</tr>
<tr>
<td></td>
<td>If the distance is entered manually, click the [Preview] button to displace the zones.</td>
</tr>
<tr>
<td>Setting Range</td>
<td>-1000 to 1000 (mm)</td>
</tr>
<tr>
<td>Default</td>
<td>0</td>
</tr>
<tr>
<td>(Slide bar)</td>
<td>You can displace the distance horizontally via the slide bar.</td>
</tr>
<tr>
<td></td>
<td>The all zones are displaced corresponding to the movement of slide bar.</td>
</tr>
<tr>
<td>Vertical direction</td>
<td>You can specify a distance to displace all zones on the canvas vertically.</td>
</tr>
<tr>
<td></td>
<td>Press the up and down buttons in the input box to change the distance displaced.</td>
</tr>
<tr>
<td></td>
<td>If the distance is entered manually, press the [Execute] button to displace the zones.</td>
</tr>
<tr>
<td>Setting Range</td>
<td>-1000 to 1000 (mm)</td>
</tr>
<tr>
<td>Default</td>
<td>0</td>
</tr>
<tr>
<td>(Slide bar)</td>
<td>You can displace the distance vertically via the slide bar.</td>
</tr>
<tr>
<td></td>
<td>The all zones are displaced corresponding to the movement of slide bar.</td>
</tr>
<tr>
<td>[Preview] button</td>
<td>You can input the value of distance (displacement) directly into the input box for horizontal direction and/or vertical direction. All zones are displaced with the specified distance.</td>
</tr>
<tr>
<td>[Execute] button</td>
<td>You can change the setting data to reflect the specified distance(displacement).</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>This cancels the change in the distance(displacement) and returns to the previous state.</td>
</tr>
</tbody>
</table>

Danger

Displacement of all zones may result in shape changes of the zone corresponding to the new relationships between the origin and each point. You must make sure that displaced zones are as intended. If not, you must make any necessary adjustments.
### Operation menu

#### View(V)

- **Configuration Mode**
  You can select [Configuration mode(C)] under the [View(V)] menu.
  The [Configuration] tab in the configuration will be active.

- **Monitoring Mode**
  You can select [Monitoring mode(M)] under the [View(V)] menu.
  The [Monitoring] tab in the configuration will be active.

- **Zoom**
  This is a setting for the display of the monitoring panel and of the canvas.

  - **Zoom in**
    You can select [Zoom in(I)] under [Zoom(Z)] on the [View(V)] menu.
    Zooms the canvas or monitoring panel.
    
    Alternate procedure:
    - Click the button on the drawing toolbar.
    - Move the mouse cursor over the drawing panel or monitor panel and move mouse wheel forward.

  - **Zoom out**
    You can select [Zoom out(O)] under [Zoom(Z)] on the [View(V)] menu.
    Zooms out the canvas or monitoring panel.
    
    Alternate procedure:
    - Click the button on the drawing toolbar.
    - Move the mouse cursor over the drawing panel or monitor panel and move mouse wheel backward.

  - **Full display**
    You can select [Display full(A)] under [Zoom(Z)] on the [View(F)] menu.
    You can adjust the screen scale in order to fully display the zone and ranging information on the canvas or monitoring panel.
    
    Alternate procedure:
    - Click the button on the drawing toolbar.
6-5 Operation menu

■ Turn canvas
You can select [Turn canvas(T)...] from the [View(V)] menu. The [Turn canvas] dialog appears. You can change the direction (angle) of SZ Series on the canvas and the monitoring panel.

Note
The "Undo" function cannot be used to restore the canvas direction.

![Turn canvas dialog]

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>You can specify the angle to rotate the SZ series on the canvas or monitoring panel. Click the up and down buttons in the input box to change the angle of rotation in the [Turn canvas] dialog. Setting Range : -179 to 180 (Degree) Default : 0</td>
</tr>
<tr>
<td>(Left rotation)</td>
<td>Each click of this icon makes the left rotation with 45 degrees.</td>
</tr>
<tr>
<td>(Right rotation)</td>
<td>Each click of this icon makes the right rotation with 45 degrees.</td>
</tr>
<tr>
<td>[OK] button</td>
<td>You can reflect the specified angle to the display of the canvas or monitoring panel.</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>This cancels &quot;Turn canvas&quot;</td>
</tr>
</tbody>
</table>

■ Grid
This is a setting for the grid on the monitoring panel and the canvas.

■ View
You can select [Visible(V)] under [Grid(G)] on the [View(V)] menu. The grid is displayed on both monitoring panel and canvas.

Checked : The grid is displayed.
Unchecked : The grid is not displayed.
6-5 Operation menu

● Grid interval
You can select [Grid Interval(I)...] under [Grid(G)] on the [View(V)] menu.
The "Grid interval" dialog box appears.
You can specify the grid interval on the canvas and monitoring panel.

   Note
The "Undo" function cannot be used to restore to the grid interval.

Setting Range : 100 to 2000 (mm)
Default : 500

● Cartesian coordinates
You can select [Cartesian coordinates(C)] under [Grid(G)] on the [View(V)] menu.
The canvas and monitoring panel are displayed as Cartesian coordinates.

● Polar coordinates
You can select [Polar coordinates(P)] under [Grid(G)] on the [View(V)] menu.
The canvas and monitoring panel are displayed as polar coordinates.

■ Unit
This is a setting for the units on the monitoring panel and the canvas.

● mm
You can select [mm(M)] under [Unit(U)] on the [View(V)] menu.
The canvas and monitoring panel are displayed in units of "mm".

● inch
You can select [inch(I)] under [Unit(U)] on the [View(V)] menu.
The canvas and monitoring panel are displayed in units of "inches".
6-5 Operation menu

■ Real-time ranging
Displays the ranging information in real time on the canvas.

| Note | You should make sure that the personal computer (SZ Configurator) and the SZ Series device are properly connected with a USB cable. |

- **Start**
  You can select [Start(S)] under [Real-time ranging(R)] on the [View(V)] menu. The ranging information of the SZ Series is displayed on the canvas in real time.

  Alternate procedure : Click the button on the drawing toolbar.

- **Pause**
  You can select [Pause(P)] under [Real-time ranging(R)] on the [View(V)] menu. Temporarily stops the real-time ranging.

  Alternate procedure : Click the button on the drawing toolbar.

- **Clear**
  You can select [Clear(C)] under [Real-time ranging(R)] on the [View(V)] menu. Clears the real-time ranging information on the canvas.

  Alternate procedure : Click the button on the drawing toolbar.

- **Bottom hold**
  You can select [Bottom-hold(B)] under [Real-time ranging(R)] on the [View(V)] menu. Both-hold can be set to the real-time ranging.
  You can see the result of bottom-hold. by a green line.

  Alternate procedure : Click the button on the drawing toolbar.

■ Light Interference / High-reflective background
You can select [Light Interference / High-reflective background (L)] under the [View(V)] menu.
You can switch whether the light interference / high-reflective background is displayed or not.

| Note | This can be selected during real-time ranging or during monitoring. |
6-5 Operation menu

- **All points**
  You can select [All points(A)] under the [View(V)] menu. This shows user points and setting points for all beams on the drawing panel during zone configuration.

- **Zone display panel**
  You can select [Zone display panel(P)] under the [View(V)] menu. You can switch whether the zone display panel is displayed or not.

  Alternate procedure: Click the button on the top of the canvas.

- **Comments on the zone**
  You can select [Comments on the zone(O)] under the [View(V)] menu. You can switch whether the zone memo is displayed or not.

  Alternate procedure: Click the button on the drawing toolbar.

- **Wire color and assigned function**
  You can select [Wire color and assigned function(W)] under the [View(V)] menu. The [Wire color and assigned function] dialog box appears.

![Wire color and assigned function dialog box]

Reference: The contents on this dialog box varies depending on the model and the configuration.
**Image on canvas(I)**

- **Visible**
  You can select [Visible(V)] under the [Image on canvas(I)] menu. You can switch whether the image on the canvas or monitoring panel is displayed or not.

  **Note**
  This is only available when an image has been set on the canvas and monitoring panel.

- **Setting**
  You can select [Setting(S)] under the [Image on canvas(I)] menu. The "Image on canvas" window appears. You can set the image on the canvas and monitoring panel.

---

**Item** | **Description**
---|---
[Import the file] button | You can specify the image file for putting on the canvas and monitoring panel. The file types that can be displayed\(^1\) are BMP (*.bmp), JPEG (*.jpg) and TIFF (*.tif).
[Clear] button | You can clear the image displayed.
(Zoom In) | Zooms in on the preview area.
(Zoom Out) | Zooms out on the preview area.
[Scaling] button | You can change the scale of image in the preview area.
[Positioning] button | You can move the image in the preview area.
[Left rotation] | Each click of this icon makes the left rotation with 45 degrees.
[Right rotation] | Each click of this icon makes the right rotation with 45 degrees.
### 6-5 Operation menu

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>You can specify the angle to rotate the image in the preview area.</td>
</tr>
<tr>
<td></td>
<td>Setting Range : -180 to 180 (Degree)</td>
</tr>
<tr>
<td></td>
<td>Default : 0</td>
</tr>
<tr>
<td>[Reverse] button</td>
<td>You can invert the image used as the background in the preview area about horizontal axis.</td>
</tr>
<tr>
<td>Transparency</td>
<td>The transparency of the image can be changed with the slide bar.</td>
</tr>
<tr>
<td></td>
<td>The setting of 100% makes the image fully transparent, and then it becomes invisible.</td>
</tr>
<tr>
<td></td>
<td>You can horizontally reverse the image in the preview area.</td>
</tr>
<tr>
<td>[OK] button</td>
<td>You can reflect the specified image to the canvas and monitoring panel.</td>
</tr>
<tr>
<td>[Cancel] button</td>
<td>This cancels the image setting.</td>
</tr>
</tbody>
</table>

**1** Images greater than 4000 pixels x 4000 pixels cannot be imported.
6-5 Operation menu

Monitoring tools(M)

Note
The monitoring tool can only be selected during monitoring.

I/O monitoring
You can select [I/O monitoring(I)] under the [Monitoring tools(M)] menu. This shows I/O information (I/O monitoring) on the monitoring panel.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>This shows the wire color, function and ON/OFF state of the input.</td>
</tr>
<tr>
<td></td>
<td>The contents on this varies depending on the model, configuration and input state.</td>
</tr>
<tr>
<td>Output</td>
<td>This shows the wire color, function and ON/OFF state of the output.</td>
</tr>
<tr>
<td></td>
<td>The contents on this varies depending on the model, configuration and output state.</td>
</tr>
<tr>
<td>[Close] button</td>
<td>Closes the I/O monitoring.</td>
</tr>
<tr>
<td>[AUX output test] button</td>
<td>Turns OSSD OFF and tests AUX output. OSSD goes to the OFF-state in order to execute the AUX output test.</td>
</tr>
</tbody>
</table>
AUX output test

You can click the [AUX output test] button to display the [AUX output test] dialog.

Note

OSSD goes to and keeps the OFF-state during the AUX output test.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>State information output 1/2*1</td>
<td>SZ series output the pulsed signal according to the specified state. Possible setting: 1 Normal operation / 2 Muted or override condition / 3 Interlock condition / 4 Switch to bank1 / 5 Switch to bank2 / 6 Switch to bank3 / 7 Switch to bank4 / 8 Waiting for bank input / 9 Alert for window / 10 Alert for light interference or high-reflective background / 11 Alert for muting lamp / 12 OSSD error / 13 EDM Error / 14 Reset error / 15 Bank input error / 16 Window error / 17 Check point error / 18 Muting lamp error / 19 Window calibration error / 20 System error / 21 State in configuration / 22 Configuration data error / 23 MI Error</td>
</tr>
<tr>
<td>[ON] / [OFF] button *2</td>
<td>You can turn the specified AUX output to the ON-state or OFF-state. Output will not be generated until the [Output] button is clicked.</td>
</tr>
<tr>
<td>[Output for] button</td>
<td>Output is generated for each AUX according to the setting.</td>
</tr>
<tr>
<td>[Finish test] button</td>
<td>You can finish the AUX output test. Click the [Finish test] button to display a confirmation dialog. Click the [Finish test] button in the dialog box to restore the state of all AUX outputs. OSSD also goes back to the normal operation.</td>
</tr>
</tbody>
</table>

*1 When using an SZ-04M, this will only be displayed when the non-safety functions AUX1/2 are set to state information output 1/2.

*2 If neither [ON] nor [OFF] has been selected, the output will be OFF.
6-5 Operation menu

■ OSSD OFF history

You can select [OSSD OFF history(O)] under the [Monitoring tools(M)] menu. This shows an OSSD OFF history on the monitoring panel.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection button for detected position</td>
<td>Monitoring panel highlights the detected position for the specified event in the OSSD OFF history.</td>
</tr>
<tr>
<td>(Number)</td>
<td>This is the history No. of the event in the OSSD OFF history. “1” is assigned to the most recent event in the OSSD OFF history. On the other hand, “20” is assigned to the oldest event. OSSD OFF history has maximum 20 events in their history.</td>
</tr>
<tr>
<td>Time at OFF-state</td>
<td>The time that OSSD goes to the OFF-state is displayed. (Time of occurrence)</td>
</tr>
<tr>
<td>[Event]</td>
<td>OSSD OFF : OSSD 1/2 goes to the OFF-state in case of SZ-01S and SZ-16V. OSSD 1/2 OFF : OSSD 1/2 goes to the OFF-state in case of SZ-04M. OSSD 3/4 OFF : OSSD 3/4 goes to the OFF-state in case of SZ-04M.</td>
</tr>
<tr>
<td>[Reason for the event]</td>
<td>The reason for the event (OSSD OFF) is displayed.</td>
</tr>
<tr>
<td>[Detected position]</td>
<td>The coordinates of position that the event (OSSD OFF) occurred are displayed.</td>
</tr>
<tr>
<td>[Detected period of time]</td>
<td>The period of time that the event (OSSD OFF) continued are displayed.</td>
</tr>
<tr>
<td>[Time at ON-state]</td>
<td>The time that OSSD goes back to the ON-state is displayed. (Time of occurrence)</td>
</tr>
<tr>
<td>[Close] button</td>
<td>&quot;OSSD still in the OFF-state&quot; is displayed if the OSSD still keeps the OFF-state.</td>
</tr>
<tr>
<td>[Update] button</td>
<td>Closes the OSSD OFF history display.</td>
</tr>
</tbody>
</table>

**Note**

OSSD OFF history is cleared if the power turns OFF.
### Error information

You can select [Error Information(E)] under the [Monitoring tools(M)] menu. This shows the information for the current error on the monitor display.

Alternate procedure : Click the [Error] button, which is only displayed during an error.

**Error information**

**Item**

<table>
<thead>
<tr>
<th>(Number)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time at error</td>
<td>The time that error occurred is displayed. (Time of occurrence)</td>
</tr>
<tr>
<td>[Error No.]</td>
<td>The number of the error is displayed.</td>
</tr>
<tr>
<td>[Error name]</td>
<td>The name of the error is displayed.</td>
</tr>
<tr>
<td>Occurred at [d.h.m.s] from power-on</td>
<td>The period of time from the power-on to the occurrence of the error is displayed.</td>
</tr>
<tr>
<td>[Close] button</td>
<td>Closes the error information display.</td>
</tr>
<tr>
<td>[Update] button</td>
<td>Updates the error information.</td>
</tr>
</tbody>
</table>

**Note**

Error information is cleared if the power turns OFF.

### Clear OSSD OFF history

You can select [Clear OSSD OFF history(C)] under the [Monitoring tools(M)] menu. This clears the OSSD OFF history. Turning the power off also clears the history.
You should make sure that the computer (SZ Configurator) and the SZ Series device are properly connected with a USB cable.

Read out the configuration data from SZ
You can select [Read out the configuration data from SZ (R)] under the [Communication(C)] menu. SZ Configurator reads out the configuration data from the SZ Series, and shows it on itself.

Alternate procedure: Click the button on the drawing toolbar.

Transfer the configuration data to SZ
You can select [Transfer the configuration data to SZ (T)] under the [Communication(C)] menu. SZ Configurator transfers configuration data from the personal computer to the SZ Series.

Alternate procedure:
- Click the button on the drawing toolbar.
- Click the [Transfer] button on the sub panel belonging to the [Configuration] tab.

Refer to "Transfer" (page 6-30) for more information about transferring configuration data.

Verification
You can select [Verification(V)] under the [Communication(C)] menu. You can check the configuration currently being edited against the configuration data on the SZ Series. The results are shown in the [Verification] window when matching is completed.
6-5 Operation menu

■ Initialization
You can select [Initialization(I)] under the [Communication(C)] menu.
This initializes the SZ Series.

Note
Initialization causes return to factory defaults of all configurations and deletion of the OSSD OFF history and the error information.

● Initialization procedure

1 Select [Initialization(I)] under the [Communication(C)] menu.
The initialization confirmation dialog box appears.
Click the [OK] button.

2 The [Log-in] dialog appears. The password is required to log in.
If you are already logged in, step 2 will not occur and initialization will begin.

If initialization is completed correctly, a confirmation dialog appears. Click [OK].
You should make sure that the computer (SZ Configurator) and the SZ Series device are properly connected with a USB cable.

■ Log-in
You can select [Log-in(I)] under the [Communication(C)] menu. This will log you in to the SZ Series. This cannot be selected if you are already logged in.

Alternate procedure: Click the button on the drawing toolbar.

■ Log-out
You can select [Logout(O)] under the [Communication(C)] menu. This will log you out of the SZ Series. This cannot be selected if you are already logged out.

Alternate procedure: Click the button on the drawing toolbar.

■ Password change
You can select [Password change(C)] under the [Password(P)] menu. This is only available when logged in to the SZ Series. The [Password change] dialog appears. You can change the password.

The default password is "1111".

Enter the new password.

The password must meet the following characteristics.

<table>
<thead>
<tr>
<th>Length</th>
<th>4 to 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable characters</td>
<td>Alphabet and hyphen (-)</td>
</tr>
</tbody>
</table>
6-5 Operation menu

■ When you forget the password
You can select [When you forget the password(F)...] from the [Password(P)] menu.
This is only available when logged out of the SZ Series.
The [Reference code] will be displayed in the [When you forget the password] dialog. Contact your nearest KEYENCE office with this code to receive a [Password for initialization].

■ Language (L)
You can change the language of the SZ Configurator.

■ Japanese
You can select [Japanese] under the [Language(L)] menu.
You can change the language of the SZ Configurator to Japanese.

■ English
You can select [English] under the [Language(L)] menu.
You can change the language of the SZ Configurator to English.

■ Help(H)

■ SZ User’s Manual
You can select [SZ Users Manual(M)] under the [Help(H)] menu.
You can see the SZ user’s manual as a PDF.

■ About SZ Configurator
You can select [About SZ Configurator(A)...] under the [Help] menu.
This displays the version information for the SZ Configurator.
Inspection and Maintenance

7-1 Inspection .............................................. 7-2
7-2 Initial inspection ..................................... 7-3
7-3 Daily inspection ...................................... 7-6
7-4 Regular (periodical) inspection .................... 7-8
7-5 Cleaning the window ............................... 7-9
7-1 Inspection

You are fully responsible for performing the risk assessment on your machine application, taking into account performing maintenance and inspections, which are critical factors for appropriate risk assessment. In addition, it is a responsibility for the responsible personnel to train the machine operators regarding inspection and maintenance of the machine and the SZ. Note that the following inspection items comprise only a bare minimum inspection. KEYENCE Corporation strongly recommends including the necessary checking items into this checklist based on the judgment of the responsible personnel since additional criteria may be necessary depending on both the machine to which the SZ is installed and the laws, rules, regulations and standards in the country or region in which the SZ is used/installed. You must keep the inspection result along with the machine log.

---

Danger

Do not use the machine on which the SZ is installed if the SZ does not operate according to any of the inspection items as listed below. Failure to follow this warning results in a significant harm to the machine operators, including serious injury or death.
Initial inspection

When the installation of the SZ is completed, the responsible personnel must verify the operation of the SZ in accordance with the checklist shown below.

(1) Pre-check for installation conditions
- The SZ is installed without loose fixture screws, in accordance with the specification of tightening torque in this manual.
- The machine under SZ control can stop running when the OSSD is in the OFF-state.
- The SZ is installed so that the machine operator cannot go into or approach the hazardous area or hazards without passing through the protection zone of the SZ.
- The SZ is installed so that the machine operator cannot go into or approach the hazardous area or hazards without passing through any of the protection zone of the SZ belonging to the bank switching function.
- The interlock reset mechanism is installed so that it cannot be operated if there are any personnel within the hazardous area.
- The device to activate the override is installed so that it cannot be operated if there are any personnel within the hazardous area.
- Minimum safety distance is ensured, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ is installed.
- The SZ is installed at a location free from light interference, for example an incandescent lamp or a halogen lamp. "Light interference" (page 3-3).
- When two or more SZ are installed nearby, the countermeasures against mutual interference are taken based on the description of "Mutual interference" (page 3-3).
- The muting devices fulfill the conditions specified in this manual and the requirements of the laws, rules, regulations and standards in the country or region in which the SZ and those devices are used. "Muting function" (page 2-27).
- The devices used to activate the override fulfill the conditions specified in this manual and the requirements of the laws, rules, regulations and standards in the country or region in which the SZ and those devices are used. "Override function" (page 2-32).
- All conditions specified in this manual are fulfilled when enabling the suspension in teaching mode. "Suspension in teaching mode" (page 2-30).
- The reference points monitoring function is enabled in case of access protection. Additionally, two or more reference points are set on one structure so as to ensure the detection of its position change.

(2) Pre-check for wiring
- The SZ power supply is 24 V DC, fulfilling the conditions for the power supply as specified in this manual. See "4-2 Power supply" (page 4-3).
- For the wiring between the SZ and a safety-related part of a machine control system, both OSSD 1 and OSSD 2 is wired to a safety-related part of a machine control system. Similarly, both OSSD 3 and OSSD 4 is also wired to a safety-related part of a machine control system if you assign a function for OSSD 3/4.
- The polarity of the power supply is not reversed.
- The shielded wire is grounded. (0 V line is grounded in case of PNP output type cable, while +24 V line is grounded in case of NPN output type cable.)
- In case of using PNP output type cable, the OSSD is not short-circuited to +24 V, and the load is between the OSSD and 0 V.
- In case of using NPN output type cable, the OSSD is not short-circuited to 0 V, and the load is between the OSSD and +24 V.
- All of the AUX outputs are not used as a safety output for safety-related part of a control system.
7-2 Initial inspection

- There is no damage to the cable insulation. Additionally, the protection against the disconnection or short-circuit of cable, which might be caused by crushing or being caught in a machine, is taken into account.
- Any non-safety related functions described in this manual should not be used as a safety related machine control.

(3) Pre-check test while the machine is stopped
You should perform the following pre-check test with the test piece in order to make sure the operation of the SZ while the machine is stopped. In this case, you should supply the power only to the SZ. Test piece should match the minimum detectable object size you chose.

- The OSSD indicator lights in red when the test piece is present in the specified protection zone. This test must be performed for the whole specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone. If the muting function is applied to a part of the protection zone, this test must be performed during muted condition for the whole specified protection zone, except for muting zone.
- The OSSD indicator lights in red when the SZ detects the test piece at the intended detection plane (height) while the test piece vertical to the detection plane moves in the protection zone.
- The OSSD indicator lights in red due to an error caused by the open-circuit of the EDM input while the test piece is present in the protection zone. This is only applicable if the EDM function is applied.
- The OSSD indicator lights in green when the SZ starts normal operation after power on (when "Now Loading" is changed to "Normal Operation" on the information display) and detects no object in the protection zone with "Automatic/Automatic" for the configuration of start/restart mode.
- The OSSD indicator continues to light in red and the interlock indicator lights in yellow, when the SZ detects the test piece in the protection zone with "Manual/Manual" for the configuration of start/restart mode. Continuously, the OSSD indicator lights in green and the interlock indicator lights off in the event of reset operation, if the SZ detects no object in the protection zone at that time.
- The OSSD indicator lights in red and the interlock indicator lights in yellow when the SZ detects the test piece in the protection zone with "Manual/Manual" for the configuration of start/restart mode. Continuously, the OSSD indicator continues to light in red and the interlock indicator lights off when the test piece is removed from the protection zone.
- The OSSD indicator lights in green after the specified delay time has been passed if the restart delay (ON-delay) function is applied to the SZ.
- The SZ does not go to the muted condition even if the muting inputs are activated in accordance with the specified sequence and time difference, when the SZ detects an object in the protection zone other than muting zone. This is only applicable if the muting function is applied.
- The SZ does not go to the muted condition if the muting inputs are activated with different sequence from the specified one. The SZ does not also go to the muted condition if the muting inputs are activated exceeding the specified time difference. These are only applicable if the muting function is applied.
- The muted condition is terminated if the specified muting period of time has been passed. This is only applicable if the muting function is applied.
- The SZ does not go to the suspension in teaching mode even if the teach input and teach ready input are activated in accordance with the specified sequence and time difference, when the SZ detects an object in the protection zone. This is only applicable if the suspension in teaching mode is applied.
- The SZ does not go to the suspension in teaching mode if the teach input is activated after the activation of teach ready input. The SZ also does not go to the suspension in teaching mode if the teach input and
teach ready input are activated exceeding the specified time difference. This is only applicable if the suspension in teaching mode is applied.

- The override condition is terminated if the specified override period of time has been passed. This is only applicable if the override function is applied.
- The protection zone can be switched according to the signal combination of bank inputs in case of bank switching function.
- "Bank error" occurs if the protection zone is switched according to the unspecified sequence. This is only applicable if the bank sequence monitoring function is applied.
- If there is an unprotected space between the protection zone and the protective structure, test piece is always detected by the SZ when it goes through that space. This is only applicable if the SZ is used for the access protection (the application where the angle of the approach exceeds ±30° to the detection plane).
- The OSSD indicator lights in red when the protective structure moves exceeding the tolerance of reference point. This is only applicable if the SZ is used for the access protection (the application where the angle of the approach exceeds ±30° to the detection plane).

(4) Pre-check test while the machine operates
The purpose of this pre-check test is to make sure that the machine (hazards) stops its operation. This test must be performed after you completely make sure that there is nobody in the hazardous zone.

- Machine (hazard) stops its operation if the test piece is present in the specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone.
- The machine (hazard) still stops its operation as long as the test piece is present in the specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone.
- The machine (hazard) stops its operation when the power for the SZ is disconnected.
- The machine (hazard) stops its operation when the interlock indicator lights in yellow.
- The response time for overall safety-related control system (from the intrusion of test piece in the protection zone to the machine stop) is less than overall response time (T) used for the calculation of safety distance.
The daily inspection for the SZ operation and the machine operation should be performed based on the following check items.

(1) Pre-check for installation conditions
- The SZ is installed so that the machine operator cannot go into or approach the hazardous area or hazards without passing through the protection zone of the SZ.
- The SZ is installed so that the machine operator cannot go into or approach the hazardous area or hazards without passing through any of the protection zone of the SZ belonging to the bank switching function.
- The SZ is installed at a location free from light interference, for example an incandescent lamp and a halogen lamp.
- There is no damage to the cable insulation.
  Additionally, the protection against the disconnection or short-circuit of cable, which might be caused by crushing or being caught in a machine, is taken into account.

(2) Pre-check test while the machine is stopped
You should do the following pre-check test with the test piece in order to make sure the operation of the SZ while the machine is stopped. In this case, you should supply the power only to the SZ.
Test piece should match the minimum detectable object size you chose.
- The OSSD indicator lights in red when the test piece is present in the specified protection zone. This test must be performed for the whole specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone. If the muting function is applied to a part of the protection zone, this test must be performed during muted condition for the whole specified protection zone, except for muting zone.
- The OSSD indicator lights in red when the SZ detects the test piece at the intended detection plane (height) while the test piece vertical to the detection plane moves in the protection zone.
- The OSSD indicator lights in green when the SZ starts normal operation after power on (when "Now Loading" is changed to "Normal Operation" on the information display) and detects no object in the protection zone with "Automatic/Automatic" for the configuration of start/restart mode.
- The OSSD indicator lights in red and the interlock indicator lights in yellow, when the SZ detects the test piece in the protection zone with "Manual/Manual" for the configuration of start/restart mode. Continuously, the OSSD indicator lights in red and the interlock indicator lights off when the test piece is removed from the protection zone.
- The OSSD indicator lights in green after the specified delay time has been passed if the restart delay (ON-delay) function is applied to the SZ.
- The SZ does not go to the muted condition even if the muting inputs are activated in accordance with the specified sequence and time difference, when the SZ detects an object in the protection zone other than the muting zone. This is only applicable if the muting function is applied.
- The SZ does not go to the muted condition if the muting inputs are activated with different sequence from the specified one. The SZ does not also go to the muted condition if the muting inputs are activated exceeding the specified time difference.
The SZ does not go to the suspension in teaching mode even if the teach input and teach ready input are activated in accordance with the specified sequence and time difference, when the SZ detects an object in the protection zone. This is only applicable if the suspension in teaching mode is applied.

- The protection zone can be switched according to the signal combination of bank inputs.
- If there is an unprotected space between the protection zone and the protective structure, test piece is always detected by the SZ when it goes through that space. This is only applicable if the SZ is used for the access protection (the application where the angle of the approach exceeds ±30° to the detection plane).
- The OSSD indicator lights in red when the protective structure moves exceeding the tolerance of reference point. This is only applicable if the SZ is used for the access protection (the application where the angle of the approach exceeds ±30° to the detection plane).

(3) Pre-check test while the machine operates

The purpose of this pre-check test is to make sure that the machine (hazards) stops its operation. This test must be performed after you completely make sure that there is nobody in the hazardous zone.

- Machine (hazard) stops its operation if the test piece is present in the specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone.
- The machine (hazard) still stops its operation as long as the test piece is present in the specified protection zone. If the bank switching function is applied to the SZ, this test must be performed for the whole and every specified protection zone.
- The machine (hazard) stops its operation when the power for the SZ is disconnected.
- The machine (hazard) stops its operation when the interlock indicator lights in yellow.
7-4 Regular (periodical) inspection

The responsible personnel must perform a regular inspection at least once every six months. Additionally, you should perform the regular inspection if you make any change to the configuration on the SZ and on the machine on which the SZ is installed.

Regular (periodical) inspection items include the following, in addition to the “7-3 Daily inspection” (page 7-6).

(1) Additional inspection items

- The SZ is installed without loosening the screws for fixture, in accordance with the specification of tightening torque in this manual.
- The screw on the connector cable is fastened tightly to the SZ.
- The SZ does not have any change on its position. (Safety distance is ensured, and the detection plane is not changed.)
- The shielded wire is securely grounded.
- All of wires are correctly connected to external device, and the connection is securely performed.
- There is sufficient life left in terms of how many times the safety relay has been opened and closed.
- There is no damage to the SZ that may impair the performance of its protective IP65 structure.
- The surface of the window is not dirty or damaged.
- The OSSD indicator lights in red due to an error caused by the open-circuit of the EDM input while the test piece is present in the protection zone. This is only applicable if the EDM function is applied.
- The muted condition is terminated if the specified maximum muting period of time has been passed.
- The override condition is terminated if the specified maximum override period of time has been passed.
- The bank error occurs if the bank is switched according to unspecified sequence in case where the bank sequence monitoring is applied to the SZ.
7-5 Cleaning the window

The SZ window is a critical part of the detection system. You must clean the window whenever there is dust or pollution on it. You should wipe off the pollution in the area indicated by the diagonal lines with a soft cloth moistened with a mild detergent that will not corrode polycarbonate.

Note

- OSSD might go to the OFF-state if the window has a scratch, because the SZ falsely detects that scratch as the object approaching into the protection zone. Be sure to take care that the window has no scratch on it.
- Be careful static electricity while cleaning because of avoiding dust collection. You should use a cloth that will be hard to generate static electricity when rubbed on polycarbonate.

Reference

Detection capability might be decreased due to the attenuation of light if the window has a pollution. OSSD goes to the OFF-state before the pollution on the window leads to loss of detection capability because the SZ has a function to monitor the pollution on the window. Furthermore, OSSD might go to the OFF-state if the window has a pollution because the SZ detects that pollution as the object approaching into the protection zone. Be sure to keep clean on the window to avoid unnecessary OFF-state of OSSD.
7-5 Cleaning the window

MEMO
Troubleshooting

8-1  Self-diagnosis ............................ 8-2
8-2  Troubleshooting ........................... 8-5
8-1 Self-diagnosis

The SZ periodically execute the self-diagnosis against the failure at the start-up and during the normal operation. If the SZ detects any failures through self-diagnosis, the SZ has either an error or an alert based on the type of failure, and indicates such information on the information display in addition to the AUX outputs.

### Error state

The SZ goes to the error state if it detects the failure having impact to the safety-related function. In this situation, the OSSD goes to the OFF-state, and an error information is indicated on the information display and is output to the external.

You can check the state of the SZ through the indicator on the front panel, the information display, and the AUX outputs. In case of error state, the interlock indicator blinks in yellow and the information display indicates the factor on the failure. You can refer to "Troubleshooting" to remove the failure. If you want to have error information and the state of the SZ through the AUX outputs, see [2-13 AUX (auxiliary) output] (page 2-35).

You can also check the state of the SZ and the error information through the SZ Configurator, if you connect the SZ to the personal computer.

#### Indication or output on the error information

- **Information display**: It indicates the factor on the failure.
  - [8-2 Troubleshooting] (page 8-5)
- **AUX outputs**: AUX output in question goes to the OFF state in case of error if you assign "error output" or "error/alert output" to the AUX output.
  - [2-13 AUX (auxiliary) output] (page 2-35)
- **State information**: The SZ outputs the error information signal if you assign "state information" to the AUX output.
  - [State Information Output] (page 2-41)
- **SZ Configurator**: It indicates the error information on the monitoring panel.
  - [Error information] (page 6-52)

#### Restoration from the error state

It depends on the factor on the failure. See [8-2 Troubleshooting] (page 8-5).

- The SZ automatically goes back to the normal operation if you remove the factor on the failure.
- The SZ goes back to the normal operation with reset operation if you remove the factor on the failure.
- The SZ goes back to the normal operation with restoring the power if you remove the factor on the failure.
<Time chart for reset operation>
In case where the SZ goes back to the normal operation with reset operation.

● "Automatic start mode"

<table>
<thead>
<tr>
<th>Time chart for reset operation</th>
<th>Detect no object</th>
<th>Detect object</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD ON</td>
<td>OFF</td>
<td>Error occurs</td>
</tr>
<tr>
<td>OSSD OFF</td>
<td>ON</td>
<td>Error state</td>
</tr>
</tbody>
</table>

● "Manual start mode"

<table>
<thead>
<tr>
<th>Time chart for reset operation</th>
<th>Detect no object</th>
<th>Detect object</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD ON</td>
<td>OFF</td>
<td>Error occurs</td>
</tr>
<tr>
<td>OSSD OFF</td>
<td>ON</td>
<td>Error state</td>
</tr>
</tbody>
</table>

Note
When the Mode D is applied as the operation mode for OSSD3/4, the following sequence is applied. 2 reset operation is required if the SZ goes back to the normal operation with reset operation.
1) At first, you must perform the reset operation on OSSD 1/2 (yellow wire).
2) Then, you must perform the reset operation on OSSD 3/4 (yellow/black wire).
Alert state

The SZ goes to the alert state if it detects either the failure having impact to the operation or the external interference. In this situation, alert error information is indicated on the information display and is output to the external. (OSSD keeps normal operation.)

You can prevent the unnecessary machine stop because you can find the countermeasure before the OSSD goes to the OFF-state during the normal operation, if you find the alert state on the SZ.

You can check the state of the SZ through the information display and the AUX outputs. In case of alert state, the information display indicates the factor on the alert. You can refer to "Troubleshooting" to remove the factor on the alert. If you want to have the alert information and the state of the SZ through the AUX outputs, see "2-13 AUX (auxiliary) output" (page 2-35).

You can also check the state of the SZ and the alert information through the SZ Configurator, if you connect the SZ to the personal computer.

### Indication or output on the alert information

- **Information display**: It indicates the factor on the alert.
  - [8-2 Troubleshooting](page 8-5)
- **AUX outputs**: AUX output in question goes to the OFF state in case of alert if you assign "alert output" or "error/alert output" to the AUX output.
  - [2-13 AUX (auxiliary) output](page 2-35)
- **State information**: The SZ outputs the alert information signal if you assign "state information" to the AUX output.
  - [State Information Output](page 2-41)
- **SZ Configurator**: It indicates the alert information on the monitoring panel.

The SZ automatically goes back to the normal operation if you remove the factor on the alert. For more details, see [8-2 Troubleshooting](page 8-5).
You can confirm the state of the SZ through the information display in case of error or alert. You should resolve the problem with the information on that display if the SZ does not operate as intended.

**Indication on information display**

The following table shows the information on the information display, the state of the SZ, and explanation. It also shows the number of pulse for state information output.

If you have any problem (error or alert) on the SZ, the following table must be helpful for you.

### Note

- The SZ may recognize a problem due to the several self-diagnosis functions. In this case, you can see several error information on the information display. You should remove exact problem since these information are possibility.
- The SZ may recognize the consequent problem after it detects one problem. In this case, you can see several error information on the information display. You should remove exact problem since these information are possibility.

### Reference

- The SZ cannot indicate several error information on the information display at the same time. If you find the "▲" or "▼" on the upper right on the information display, it means that the SZ has another error information. You should press "▲" or "▼" button to scroll the display.
- The restoration from error state depends on the error information.
  - Error 1: The SZ automatically goes back to the normal operation if you remove the factor on the error.
  - Error 2: The SZ goes back to the normal operation with reset operation if you remove the factor on the error.
  - Error 3: The SZ goes back to the normal operation with restoring the power if you remove the factor on the error.
- "B:Configuration on SZ", see "Chapter 5 Manual Configuration on the SZ" (page 5-1).

### Indication on information display

<table>
<thead>
<tr>
<th>Information on the display</th>
<th>Color of display</th>
<th>State</th>
<th>The number of pulses for state information</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing in display</td>
<td>-</td>
<td>Normal operation</td>
<td>-</td>
<td>No power supply</td>
<td>You should check the wiring. [4-5 Examples of wiring] (page 4-9) You should check the rating of power supply to the SZ. You should check whether the power is enough. [9-2 Specifications] (page 9-3)</td>
</tr>
<tr>
<td>Broken</td>
<td></td>
<td>Normal operation</td>
<td></td>
<td>&quot;Turn off backlight&quot; has been configured.</td>
<td>If you want to turn on the backlight, you should change the configuration through the SZ Configurator. [Non Safety-related Functions] (page 6-23)</td>
</tr>
<tr>
<td>Broken</td>
<td></td>
<td></td>
<td></td>
<td>The SZ may be broken.</td>
<td>You should replace the SZ.</td>
</tr>
<tr>
<td>KEYENCE SZ Series Safety Laser Scanner</td>
<td>Lighting in red</td>
<td>Broken</td>
<td></td>
<td>The OSSD keeps the OFF-state due to the detection of an error through the self-diagnosis at start-up unless you see &quot;Now Loading&quot; after this information. The SZ may be broken in this case.</td>
<td>You should replace the SZ unless you see &quot;Now Loading&quot; after this information.</td>
</tr>
</tbody>
</table>

**Countermeasure**

- You should check the wiring. [4-5 Examples of wiring] (page 4-9)
- You should check the rating of power supply to the SZ. You should check whether the power is enough. [9-2 Specifications] (page 9-3)
- You should wait for normal operation.
- You should replace the SZ.
- You should replace the SZ unless you see "Now Loading" after this information.
**8-2 Troubleshooting**

<table>
<thead>
<tr>
<th>Information on the display</th>
<th>Color of display</th>
<th>State</th>
<th>The number of pulses for state information</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Now Loading</strong></td>
<td>Blinking in red</td>
<td>Normal operation</td>
<td>-</td>
<td>This is indicated for approx. 50 seconds before starting normal operation. The SZ is under loading.</td>
<td></td>
</tr>
<tr>
<td><strong>Waiting For Configuration</strong></td>
<td>Lighting in red</td>
<td>Normal operation</td>
<td>22</td>
<td>The configuration is not completed</td>
<td></td>
</tr>
<tr>
<td><strong>Under Configuration</strong></td>
<td>Blinking in red</td>
<td>Normal operation</td>
<td>21</td>
<td>(1) The configuration through the SZ Configurator is being transferred or initialized. (2) AUX output test is in execution.</td>
<td></td>
</tr>
<tr>
<td><strong>Normal Operation</strong></td>
<td>Lighting in green, red, or orange (^1)</td>
<td>Normal operation</td>
<td>1</td>
<td>The SZ is under normal operation. The OSSD is in the ON-state if the display lights in green, while the OSSD is in the OFF-state if the display lights in red. For the SZ-04M, if either OSSD 1/2 or OSSD 3/4 is in the ON-state and the other OSSD is in the OFF-state, the display lights in orange.</td>
<td>If the OSSD goes to the OFF-state when nothing is present in the protection zone, see &quot;Troubleshooting on the OSSD operation&quot; (page 8-12).</td>
</tr>
<tr>
<td><strong>Normal Operation Bank(^*)</strong></td>
<td>Lighting in green, red, or orange (^1)</td>
<td>Normal operation</td>
<td>4-7</td>
<td>It indicates the bank number in case of enabling the bank switching function. Asterisk (*) is the bank number.</td>
<td>&quot;2-11 Bank switching function&quot; (page 2-20)</td>
</tr>
<tr>
<td><strong>Normal Operation Check Input</strong></td>
<td>Lighting in red</td>
<td>Normal operation</td>
<td>1</td>
<td>The OSSD is in the OFF-state due to the check input.</td>
<td>&quot;2-14 Check input function&quot; (page 2-43)</td>
</tr>
<tr>
<td><strong>Normal Operation ON Delay</strong></td>
<td>Lighting in red</td>
<td>Normal operation</td>
<td>1</td>
<td>The OSSD is in the OFF-state due to restart delay (ON-delay).</td>
<td>The OSSD automatically goes to the ON-state after the configured delay time is passed. &quot;Restart Delay (ON-delay)&quot; (page 2-15)</td>
</tr>
<tr>
<td><strong>Muting</strong></td>
<td>Lighting in green</td>
<td>Normal operation</td>
<td>2</td>
<td>The SZ is under the temporary suspension of safety function due to muting, override, or suspension in teaching mode.</td>
<td>&quot;2-12 Temporary suspension of safety function&quot; (page 2-27)</td>
</tr>
<tr>
<td><strong>Muting Detection</strong></td>
<td>Lighting in green</td>
<td>Normal operation</td>
<td>2</td>
<td>The SZ is under the temporary suspension of safety function due to muting, override, or suspension in teaching mode. The OSSD is still in the ON-state even if the SZ detects an object in the protection zone or if the structure moves exceeding the specified tolerance for reference points monitoring function.</td>
<td>&quot;2-12 Temporary suspension of safety function&quot; (page 2-27)</td>
</tr>
</tbody>
</table>
## Interlock

<table>
<thead>
<tr>
<th>Information on the display</th>
<th>Color of display</th>
<th>State</th>
<th>The number of pulses for state information</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interlock</td>
<td>Lighting in red, or orange</td>
<td>Normal operation</td>
<td>3</td>
<td>The SZ is under interlock condition. The SZ detects an object in the protection zone or that the structure moves exceeding the specified tolerance for reference points monitoring function.</td>
<td>You should perform the reset operation in order to terminate the interlock condition when the SZ detects no object in the protection zone or the structure on the reference points. [2-7 Interlock](page 2-12)</td>
</tr>
<tr>
<td>Interlock Reset Ready</td>
<td>Lighting in red</td>
<td>Normal operation</td>
<td>3</td>
<td>The SZ is under interlock condition. You can perform the reset operation to restart the SZ because the conditions for terminating the interlock are met.</td>
<td>You should perform the reset operation in order to terminate the interlock condition. [2-7 Interlock](page 2-12) For the SZ-04M, you should perform the reset operation for OSSD 1/2 and/or OSSD 3/4 respectively in order to terminate the interlock condition when the Mode D is applied as the operation mode for OSSD 3/4.</td>
</tr>
<tr>
<td>Interlock RST Ready1/2</td>
<td>Lighting in red, or orange</td>
<td>Normal operation</td>
<td>3</td>
<td>The OSSD 1/2 is under interlock condition. You can perform the reset operation to restart the SZ because the conditions for terminating the interlock are met.</td>
<td>You should perform the reset operation for OSSD 1/2 in order to terminate the interlock condition. [2-7 Interlock](page 2-12)</td>
</tr>
<tr>
<td>Interlock RST Ready3/4</td>
<td>Lighting in red, or orange</td>
<td>Normal operation</td>
<td>3</td>
<td>The OSSD 3/4 is under interlock condition. You can perform the reset operation to restart the SZ because the conditions for terminating the interlock are met.</td>
<td>You should perform the reset operation for OSSD 3/4 in order to terminate the interlock condition. [2-7 Interlock](page 2-12)</td>
</tr>
<tr>
<td>Alert Window Pollution</td>
<td>Lighting in green, red, or orange</td>
<td>Alert</td>
<td>9</td>
<td>Alert: Window pollution There is pollution or damage on the window. The OSSD may go to the OFF-state if you leave this situation as it is.</td>
<td>You should perform the cleaning according to [7-5 Cleaning the window](page 7-9)</td>
</tr>
<tr>
<td>Alert Light Interference</td>
<td>Lighting in green, red, or orange</td>
<td>Alert</td>
<td>10</td>
<td>Alert: Light interference The SZ has light interference, such as incandescent lamp, fluorescent lamp, stroboscopic light, or photoelectric sensor. Or, the SZ has mutual interference between SZs. The OSSD may go to the OFF-state as unintended.</td>
<td>You should take a countermeasure according to &quot;Light interference&quot; (page 3-3), &quot;Mutual interference&quot; (page 3-3)</td>
</tr>
<tr>
<td>Alert Muting Lamp</td>
<td>Lighting in green, red, or orange</td>
<td>Alert</td>
<td>11</td>
<td>Alert: Muting lamp failure The SZ has a problem on the muting lamp connected to the AUX 6. (Disconnection, broken, or overcurrent.) The OSSD keeps normal operation.</td>
<td>You should check the wiring between the AUX6 and muting lamp, and whether the muting lamp is broken or not. You should also check the rating/specification of muting lamp. [2-40 Muting lamp output](page 2-40)</td>
</tr>
<tr>
<td>Alert AUX Over current</td>
<td>Lighting in red, or orange</td>
<td>Alert</td>
<td>-</td>
<td>Alert: AUX Over current The SZ detects an overcurrent on the AUX output. All of AUX outputs go to the OFF-state after the SZ detects this situation. The OSSD keeps normal operation.</td>
<td>You should check the wiring between the AUX and the load, and whether the loads are broken or not. You should also check the current on AUX outputs. [9-2 Specifications](page 9-3)</td>
</tr>
</tbody>
</table>
8-2 Troubleshooting

<table>
<thead>
<tr>
<th>Information on the display</th>
<th>Color of display</th>
<th>State</th>
<th>The number of pulses for state information</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert</td>
<td>Lighting in green, red, or orange*1</td>
<td>Alert</td>
<td>10</td>
<td>Alert: High-reflective background There is a high reflective background behind the specified protection zone, which has impact to the detection capability.</td>
<td>High reflective background must not be positioned within 1.5 m from the boundary of the protection zone. You must remove the background itself or reduce the reflectance. Unless you can take the above-mentioned countermeasures, 200mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance. “High reflective background” (page 3-5)</td>
</tr>
<tr>
<td>Waiting For Bank Input</td>
<td>Blinking in red</td>
<td>Normal operation , or Error 1</td>
<td>8</td>
<td>The signal combination of bank inputs does not meet the specification.</td>
<td>You should check the signal combination of bank inputs. The SZ automatically goes back to the normal operation if the signal combination of bank inputs meets the specification. “2-11 Bank switching function” (page 2-20)</td>
</tr>
<tr>
<td>Error1 OSSD1 Error</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>12</td>
<td>OSSD 1 Error (1) OSSD 1 is short-circuited to the other wire, or the wiring is wrong. (2) OSSD 1 has a surge voltage due to inductive load. (3) OSSD 1 is influenced by the EMC environment. (4) OSSD 1 is broken.</td>
<td>(1) You should check the wiring on OSSD 1. “4-5 Examples of wiring” (page 4-9) (2) You should use the load with a surge absorber function, or apply the surge protection to the load. (3) You should check the wiring and EMC environment in the surrounding. (4) You should replace the SZ.</td>
</tr>
<tr>
<td>Error2 OSSD2 Error</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>12</td>
<td>OSSD 2 Error (1) OSSD 2 is short-circuited to the other wire, or the wiring is wrong. (2) OSSD 2 has a surge voltage due to inductive load. (3) OSSD 2 is influenced by the EMC environment. (4) OSSD 2 is broken.</td>
<td>(1) You should check the wiring on OSSD 1. “4-5 Examples of wiring” (page 4-9) (2) You should use the load with a surge absorber function, or apply the surge protection to the load. (3) You should check the wiring and EMC environment in the surrounding. (4) You should replace the SZ.</td>
</tr>
<tr>
<td>Error3 OSSD3 Error</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>12</td>
<td>OSSD 3 Error (1) OSSD 3 is short-circuited to the other wire, or the wiring is wrong. (2) OSSD 3 has a surge voltage due to inductive load. (3) OSSD 3 is influenced by the EMC environment. (4) OSSD 3 is broken.</td>
<td>(1) You should check the wiring on OSSD 1. “4-5 Examples of wiring” (page 4-9) (2) You should use the load with a surge absorber function, or apply the surge protection to the load. (3) You should check the wiring and EMC environment in the surrounding. (4) You should replace the SZ.</td>
</tr>
<tr>
<td>Error4 OSSD4 Error</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>12</td>
<td>OSSD 4 Error (1) OSSD 4 is short-circuited to the other wire, or the wiring is wrong. (2) OSSD 4 has a surge voltage due to inductive load. (3) OSSD 4 is influenced by the EMC environment. (4) OSSD 4 is broken.</td>
<td>(1) You should check the wiring on OSSD 1. “4-5 Examples of wiring” (page 4-9) (2) You should use the load with a surge absorber function, or apply the surge protection to the load. (3) You should check the wiring and EMC environment in the surrounding. (4) You should replace the SZ.</td>
</tr>
<tr>
<td>Information on the display</td>
<td>Color of display</td>
<td>State</td>
<td>The number of pulses for state information</td>
<td>Description</td>
<td>Countermeasure</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------</td>
<td>-------</td>
<td>--------------------------------------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>OSSD Over current</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>12</td>
<td>OSSD Overcurrent Error Overcurrent occurs on any of OSSD1 to 4.</td>
<td>You should check the wiring between OSSD and the load, and whether the load is broken or not. [4-5 Examples of wiring](page 4-9). You should also check the rating/specification of the load. [9-2 Specifications](page 9-3).</td>
</tr>
<tr>
<td>EDM Error (OSSD1/2)</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>13</td>
<td>EDM Error for OSSD 1/2 In case of NPN output type cable, the SZ with positive grounding is connected to the PC with negative grounding through the USB cable.</td>
<td>(1) You should make sure the wiring on EDM. [2-8 External device monitoring function (EDM)](page 2-16), [4-5 Examples of wiring](page 4-9). (2) You should make sure the external device. If it is broken, you should replace it. (3) You should make an open-circuit on EDM input with an insulation, in case of EDM function not applied.</td>
</tr>
<tr>
<td>EDM Error (OSSD3/4)</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>13</td>
<td>EDM Error for OSSD 3/4 In case of EDM function not applied</td>
<td>(1) You should check the wiring on EDM. [2-8 External device monitoring function (EDM)](page 2-16), [4-5 Examples of wiring](page 4-9). (2) You should check the external device. If it is broken, you should replace it. (3) You should make an open-circuit on EDM input with insulation, in case of EDM function not applied.</td>
</tr>
<tr>
<td>Reset Error (OSSD1/2)</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>14</td>
<td>Reset input Error for OSSD 1/2 The reset input is in the OFF-state at start-up even if the configuration of restart mode is &quot;Automatic&quot;.</td>
<td>You should check the wiring of reset input and the configuration on restart mode. [2-7 Interlock](page 2-12), [4-5 Examples of wiring](page 4-9).</td>
</tr>
<tr>
<td>Reset Error (OSSD3/4)</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>14</td>
<td>Reset input Error for OSSD 3/4 The reset input is in the OFF-state at start-up even if the configuration of restart mode is &quot;Automatic&quot;.</td>
<td>You should check the wiring of reset input and the configuration on restart mode. [2-7 Interlock](page 2-12), [4-5 Examples of wiring](page 4-9).</td>
</tr>
</tbody>
</table>
## Troubleshooting

<table>
<thead>
<tr>
<th>Information on the display</th>
<th>Color of display</th>
<th>State</th>
<th>The number of pulses for state information</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error10</td>
<td>Blinking in red</td>
<td>Error 2</td>
<td>15</td>
<td>Bank Error</td>
<td>(1) You should check the wiring on the signal combination of bank inputs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) The bank switching was not performed during the specified bank transition time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3) You should check the bank sequence and the configuration of bank sequence monitoring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2-11 Bank switching function](page 2-20) [2-20 “Bank sequence monitoring” (page 2-26)]</td>
</tr>
<tr>
<td>Error11</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>16</td>
<td>Window Error</td>
<td>You should perform cleaning according to [2-5 Cleaning the window](page 7-9).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If you experience continuous errors after cleaning, you should replace the window. In this case, you should consult the nearest KEYENCE office.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Error 3</td>
<td></td>
<td>Window may be broken. Or it may not be correctly positioned.</td>
<td>You should replace the window. In this case, you should consult the nearest KEYENCE office.</td>
</tr>
<tr>
<td>Error12</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>17</td>
<td>Check Point Error</td>
<td>You should check whether the SZ or the structure on the check points is displaced or not.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2-44 “Check point monitoring” (page 2-44)]</td>
</tr>
<tr>
<td>Error13</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>18</td>
<td>Muting Lamp Error</td>
<td>You should check the wiring between the AUX6 and muting lamp, and whether the muting lamp is broken or not. You should also make sure the rating/specification of muting lamp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2-40 “Muting lamp output” (page 2-40)]</td>
</tr>
<tr>
<td>Error14</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>18</td>
<td>Muting Lamp Error (Overcurrent)</td>
<td>You should check the wiring between the AUX6 and muting lamp, and whether the muting lamp is broken or not. You should also check the rating/specification of muting lamp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2-40 “Muting lamp output” (page 2-40)]</td>
</tr>
<tr>
<td>Error15</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>19</td>
<td>Calibration Error</td>
<td>You should consult the nearest KEYENCE office.</td>
</tr>
<tr>
<td>Error16</td>
<td>Blinking in red</td>
<td>Error 1</td>
<td>23</td>
<td>MI Error</td>
<td>You should remove the object with extreme low reflectance located closest position from the SZ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1) You should check the wiring and EMC environment in the surrounding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) You should take a countermeasure to [3-3 “Light interference” (page 3-3), or [3-3 “Mutual interference” (page 3-3).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3) You should avoid strong vibration or shock.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4) You should perform the configuration again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(5) You should replace the SZ.</td>
</tr>
</tbody>
</table>

### Error**

<table>
<thead>
<tr>
<th>Error** SYSTEM Error</th>
<th>Blinking in red</th>
<th>Error 2 or Error 3</th>
<th>20</th>
<th>System Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1) The SZ is under EMC environment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) The SZ has light interference.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3) The SZ has strong vibration or shock.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4) The power is disconnected during configuration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(5) The SZ is broken.</td>
</tr>
</tbody>
</table>

*1 The information display lights in green if the OSSD is in the ON-state. It lights in red if the OSSD is in the OFF-state. For the SZ-04M, if either OSSD 1/2 or OSSD 3/4 is in the ON-state and the other OSSD is in the OFF-state, the information display lights in orange.
## Troubleshooting on the OSSD operation

<table>
<thead>
<tr>
<th>Situation</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light interference may occur.</td>
<td>You should take a countermeasure according to the description in “Light interference” (page 3-3). You can check the situation of light interference through the SZ Configurator: View(V) (page 6-42).</td>
<td></td>
</tr>
<tr>
<td>Mutual interference due to another SZ may occur.</td>
<td>You should take a countermeasure according to the description in “Mutual interference” (page 3-3).</td>
<td></td>
</tr>
<tr>
<td>The SZ may detect the floor or the surrounding (background) because the SZ is installed with some inclination.</td>
<td>You should adjust the SZ installation angle and position so that the SZ does not detect the floor or the surrounding (background).</td>
<td></td>
</tr>
<tr>
<td>The background is close to the boundary of the specified protection zone.</td>
<td>The SZ detect the surroundings (background). You should move it away from the specified protection zone. “2-3 Protection zone” (page 2-6). If the surroundings are high reflective background, you should take into account the additional safety distance. “High reflective background” (page 3-5).</td>
<td></td>
</tr>
<tr>
<td>The position of the SZ or the surroundings (background) has been changed.</td>
<td>You should restore the position of the SZ or the surroundings (background). You should perform the configuration on the protection zone again.</td>
<td></td>
</tr>
<tr>
<td>The structure on the reference points is not present or is not located within the specified tolerance.</td>
<td>You should check the position of the structure on the reference points and the tolerance. You should change the configuration on the reference points, if necessary.</td>
<td></td>
</tr>
<tr>
<td>Laser shutdown function is activated.</td>
<td>You should switch the bank. “Laser Shutdown” (page 2-26).</td>
<td></td>
</tr>
<tr>
<td>The SZ has a pollution on the window.</td>
<td>You should perform the cleaning according to “7-5 Cleaning the window” (page 7-9).</td>
<td></td>
</tr>
<tr>
<td>The SZ detects particles in the air, such as dust, spatter or moisture.</td>
<td>You should take a countermeasure that the particles in the air do not go into the protection zone.</td>
<td></td>
</tr>
</tbody>
</table>

The OSSD goes to the OFF-state when nothing is present in the protection zone.
## Troubleshooting on the communication

<table>
<thead>
<tr>
<th>Situation</th>
<th>Description</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>You cannot communicate with the SZ. (You cannot log-in.)</td>
<td>USB cable is not connected to the SZ, or is disconnected.</td>
<td>You should check the USB cable and USB port on your personal computer.</td>
</tr>
<tr>
<td></td>
<td>The power is not supplied to the SZ.</td>
<td>You should supply the power to the SZ.</td>
</tr>
<tr>
<td></td>
<td>Mode switch is in the “B: Configuration on SZ”.</td>
<td>You should change the mode switch to “A: Run / PC Communication”.</td>
</tr>
<tr>
<td></td>
<td>USB driver is not installed into your computer.</td>
<td>You should click the “DPInst” file USB driver is installed into your personal computer. “DPInst” file is located in the folder that the SZ Configurator is installed. (C:\Program Files\KEYENCE\SZ Configurator\Driver)</td>
</tr>
<tr>
<td></td>
<td>In case of NPN output type cable, the SZ with positive grounding is connected to the PC with negative grounding through the USB cable.</td>
<td>In case of NPN output type cable used, either the SZ or the PC should not be grounded prior to the connection through the USB cable. The brown wire and shielded wire is necessary to be grounded in order to start normal operation.</td>
</tr>
<tr>
<td>You cannot transfer the configuration.</td>
<td>The specified model in the SZ Configurator mismatches the actual SZ model.</td>
<td>You should check the SZ model through the “Property” in the Sub panel. If the model mismatches, you should select “Chage model (M)” on “File (F)” from menu bar in order to select the correct model.</td>
</tr>
<tr>
<td></td>
<td>All configurations are not completed.</td>
<td>You should check the configuration.</td>
</tr>
<tr>
<td></td>
<td>The specified protection zone or warning zone is configured beyond the specification.</td>
<td>You should check the configuration on the protection zone, warning zone, and minimum detectable object size.</td>
</tr>
<tr>
<td></td>
<td>The power is not supplied to the SZ.</td>
<td>You should supply the power to the SZ.</td>
</tr>
<tr>
<td>You cannot perform the monitoring on the SZ.</td>
<td>The specified model in the SZ Configurator mismatches the actual SZ model.</td>
<td>You should match the models between the specified one in the SZ Configurator and the actual one before starting the monitoring. You should transfer the configuration if you want to monitor the SZ operation according to the configuration through the SZ Configurator. On the other hand, you should read out the configuration in the SZ if you want to monitor the SZ operation according to the current configuration in the SZ. In this case, all setting under configuration on the SZ Configurator is deleted.</td>
</tr>
<tr>
<td></td>
<td>The configuration is not completed.</td>
<td>You should start monitoring after you transfer the configuration to the SZ.</td>
</tr>
</tbody>
</table>
Specifications and Dimensions

9-1 Model ................................................. 9-2
9-2 Specifications ...................................... 9-3
9-3 Dimensions ......................................... 9-5
9-1 Model

SZ-01 S

(1) (2) (3)

< Nomenclature >
(1) Basic designation: SZ
(2) Number of banks: One-digit or two-digit numbers.
(3) Type identification: S: Simple function type, M: Multi-function type, V: Multi-bank type
## Specifications

### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>SZ-01S</th>
<th>SZ-04M</th>
<th>SZ-16V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum detectable object size</td>
<td>Diameter 30, 40, 50, 70, 150 mm (depends on the setting)</td>
<td>Reflectance 1.8% min., Speed 1.6 m/s max.</td>
<td></td>
</tr>
<tr>
<td>Detectable angle</td>
<td>270° (−45° to 225°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time (ON to OFF)</td>
<td>General scan cycle (Scan cycle A) 60 ms (2 scans) to 480 ms (16 scans)</td>
<td>Specific scan cycle (Scan cycle B) 66 ms (2 scans) to 528 ms (16 scans)</td>
<td></td>
</tr>
<tr>
<td>Response time (OFF to ON)</td>
<td>General scan cycle (Scan cycle A)</td>
<td>Specific scan cycle (Scan cycle B) Response time (ON to OFF) + 125 ms</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size Diameter:</td>
<td>4.2 m (−6° to 185°)</td>
<td>2.8 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 50mm</td>
<td>3.0 m (−6° to 185°)</td>
<td>2.0 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 40mm</td>
<td>2.4 m (−6° to 185°)</td>
<td>1.6 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 30mm</td>
<td>1.8 m (−6° to 185°)</td>
<td>1.2 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 70 / 150mm</td>
<td>10.0 m (−5° to 185°)</td>
<td>7.0 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 50mm</td>
<td>7.5 m (−5° to 185°)</td>
<td>5.0 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 40mm</td>
<td>6.0 m (−5° to 185°)</td>
<td>4.0 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Minimum detectable object size: 30mm</td>
<td>4.5 m (−5° to 185°)</td>
<td>3.0 m (−45° to −5°, 185° to 225°)</td>
<td></td>
</tr>
<tr>
<td>Maximum warning zone *1</td>
<td>Non safety-related</td>
<td>100 mm</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Type, wavelength</td>
<td>Infrared laser diode, 905 nm</td>
<td></td>
</tr>
<tr>
<td>Laser class</td>
<td>Class 1 IEC / EN 60825-1 : 2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1 CFR 21 1040.10, 1040.11 (Laser Notice No.50)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1 JIS C6802 : 2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power voltage</td>
<td>24 V DC ±10% (Ripple P-P 10% or less) When using a converter power supply 24 V DC ±20%/±30%: When using a battery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Max. 9.5 W (without load) Max. 10.5 W (without load)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 9.5 W (without load) Max. 50 W (with load) Max. 43 W (with load)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 10.5 W (without load)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 39 W (with load)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSSD output</td>
<td>PNP or NPN (selectable according to the connector cable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>2 outputs</td>
<td>4 outputs</td>
<td>2 outputs</td>
</tr>
<tr>
<td>Max. load current</td>
<td>500 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual voltage (during ON)</td>
<td>Max. 2.5 V (with a cable length of 5 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF-state voltage</td>
<td>Max. 2.0 V (with a cable length of 5 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leakage current</td>
<td>Max. 1 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. capacitive load</td>
<td>2.2 μF (with a load resistance of 100 Ω)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load wiring resistance</td>
<td>Max. 2.5 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input (safety-related)</td>
<td>Input resistance</td>
<td>4.4 kΩ (for Input 1) 2.2 kΩ (for Input 2)</td>
<td></td>
</tr>
<tr>
<td>4.4 kΩ (for Input 1, 3, 4, and 5) 2.2 kΩ (for Input 2 and 6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 kΩ (for Input 1 and 3 to 10) 2.2 kΩ (for Input 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non safety-related output (AUX output)</td>
<td>Output type</td>
<td>2 outputs</td>
<td>6 outputs</td>
</tr>
<tr>
<td>PNP / NPN totem-pole output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. load current</td>
<td>50 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual voltage (during ON)</td>
<td>Max. 2.5 V (with a cable length of 5 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muting lamp output (AUX6 output can be assigned for the muting lamp output)</td>
<td>Can be connected to the incandescent lamp (24 V DC, 1 to 5.5 W) and LED lamp (load current 10 to 230 mA)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specifications and Dimensions

9-2 Specifications

<table>
<thead>
<tr>
<th>Environmental resistance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure protection</td>
<td>IP65 (IEC60529)</td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>-10 to +55°C (No freezing)</td>
</tr>
<tr>
<td>Storage ambient temperature</td>
<td>-25 to +60°C (No freezing)</td>
</tr>
<tr>
<td>Operating relative humidity</td>
<td>35% to 85% RH (No condensation)</td>
</tr>
<tr>
<td>Storage relative humidity</td>
<td>35% to 96% RH</td>
</tr>
<tr>
<td>Surrounding light</td>
<td>Incandescent lamp: 1500 lx or less.</td>
</tr>
<tr>
<td>Vibration</td>
<td>10 to 55 Hz, 0.7 mm compound amplitude, 20 sweeps each in X, Y, and Z directions</td>
</tr>
<tr>
<td>Shock</td>
<td>100 m/s² (Approx. 10 G) 16 ms pulse, in X, Y, Z directions 1,000 times each axis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Main unit case</td>
<td>Aluminum die casting, SPHC (Bottom)</td>
</tr>
<tr>
<td>Window</td>
<td>Polycarbonate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable length</th>
<th>20 m or less*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved standards</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMC</th>
<th>EMI</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>EIC61496-1, IEC61496-1, UL 61496-1</td>
<td>EN60950 Class A, IEC Part106B Class A</td>
</tr>
<tr>
<td>EMI</td>
<td>EIC61496-1, IEC61496-1, UL 61496-1 (Type 3 ESPE)</td>
<td>EN61010-106B, IEC61010-1 (Type 3 AOPDDR)</td>
</tr>
<tr>
<td></td>
<td>EIC61496-1, IEC61496-1, UL 61496-1 (Type 3 ESPDR)</td>
<td>ENISO13489-1:2005 (PL b, Category 3)</td>
</tr>
</tbody>
</table>

*1 20% or more reflectance is necessary for the minimum detectable object in the warning zone.

*2 If there is a high reflective background within 1.5 m from the boundary of the protection zone, 200 mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance.

*3 The total load current of the OSSD output and the AUX output must be 1.5 A or less in case of the converting equipment for power supply, while it must be 1.0 A (0.5 A with 5 m of cable length) or less in case of the battery.

*4 This also takes into account the situations when power is either off or disconnected.

*5 The wiring resistance between the OSSD output and the connected equipment (excluding the resistance of the cable) must be 2.5 Ω or less to ensure operation. However, it must be 1.0 Ω or less if the load current is 300 mA or more.

*6 The SZ should not be installed so as to have light interference within ±5° to the detection plane.

*7 It must be 10 m or less if the power is supplied by the battery.
9-3 Dimensions

SZ main unit

![Diagram showing dimensions and details of SZ main unit]

Protection zone origin
Detectable angle
Protection plane

(Unit: mm)

4xM5x0.8
Depth: 9

Specifications and Dimensions
When using the mounting bracket

- Horizontal mounting bracket (Model: OP-86935)

- Vertical mounting bracket (Model: OP-86936)
- Horizontal mounting bracket with angle alignment (Model: OP-86937)

- Vertical mounting bracket with angle alignment (Model: OP-86938)
• L-shaped mounting bracket with angle alignment (Model: OP-86939)

(Unit: mm)
## Revision History

<table>
<thead>
<tr>
<th>Date of printing</th>
<th>Version</th>
<th>Revision contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2009</td>
<td>Official release</td>
<td></td>
</tr>
</tbody>
</table>
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(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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