KEYENCE

Safety Laser Scanner

SZ Series Ver.2

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

⚠ **Danger**

- 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

⚠ **Danger**

- 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 so 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

⚠ **Danger**

- 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

<table>
<tr><td>⚠ Danger</td><td>

- SZ must be installed in such a way that the screws do not loose due to vibration and/or shock. The screw loosen may cause the displacement of detection plane and SZ can not make a protection as intended. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.
- 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 and the SZ-16D cannot be used for this application because they do 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)

</td></tr>
</table>

- 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.
- 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

⚠ Danger

- 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 mulfunction.
- 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)
- EMC Directive (2004/108/EC)

EN Standards
- EN61496-1   Type 3 ESPE
- EN61496-3   Type 3 AOPDDR
- EN61508   SIL2
- EN62061   SIL2
- EN ISO13849-1   Category 3, PLd
- 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.

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5　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)

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Before Use

1-1 | 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 machie application, and for using the SZ appropriately based on that result.

Application for stationary installation
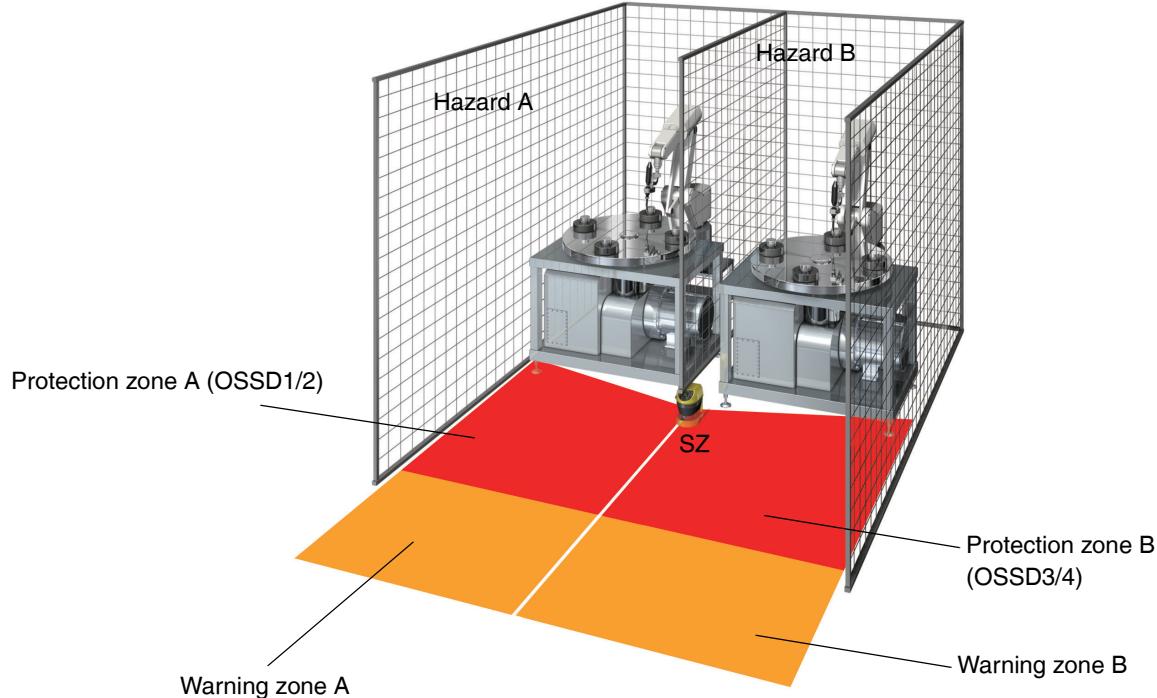
■ **Protection against hazardous area (Area protection: Horizontal detection plane) (SZ-01S, SZ-04M, SZ-16V, SZ-16D)**
If the SZ detects an object in the specified protection zone, OSSD goes to the OFF-state to stop the machine hazard. If the SZ detects an object in the specified warning zone, the warning information for the person approaching into the protection zone can be provided by the SZ before stopping the hazard.
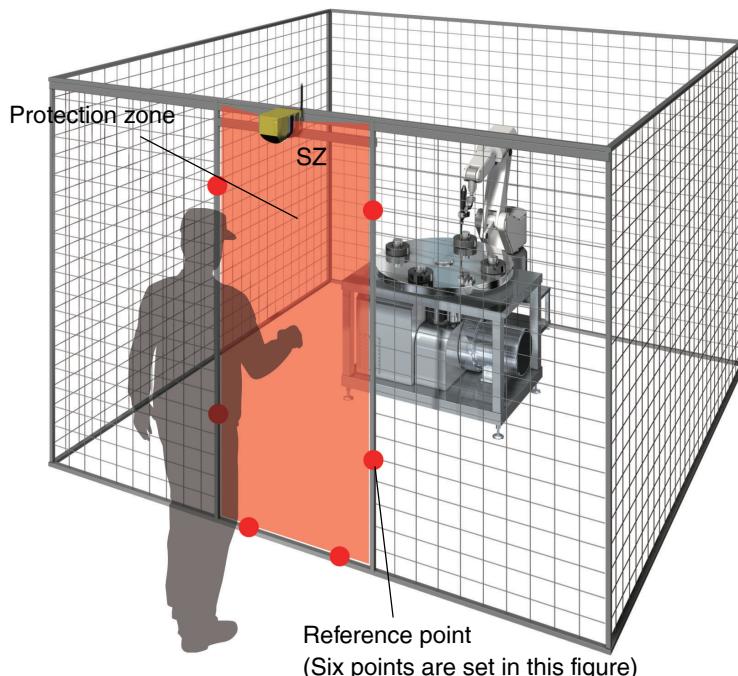
■ **One SZ can provide the protection against two different hazards (Area protection: Horizontal detection plane) (SZ-04M)**

You can specifty 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)**
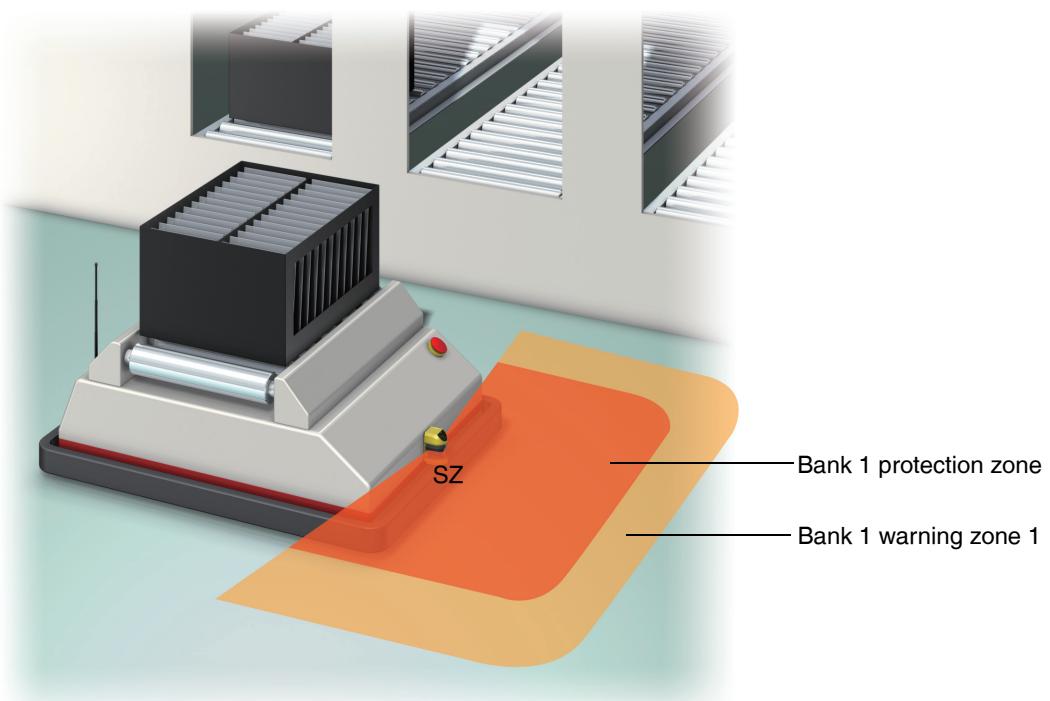
If the SZ detects someone passing through the specified protection zone, OSSD goes to the OFF-state to stop the machine hazard. However, the SZ has no chance to detect the person in hazardous area after passing through that zone. 📖 "2-9 Reference points monitoring function" (page 2-17).

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Application for movable installation

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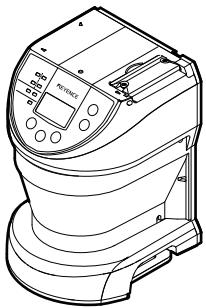
If the SZ detects on object, such as operator, in the specified protection zone, OSSD goes to the OFF-state to stop the AGV. The SZ can monitor whether there is an object in the specified protection zone through switching between the several protection zones based on the external signal.

SZ

Bank 1 protection zone

Bank 1 warning zone 1

1-2 Checking the package contents

SZ x 1

Instruction manual (English) x 1
Instruction manual (Japanese) x 1
Instruction manual (Chinese) x 1
Label for setting cover x1 (except the SZ-16D)

1-3 Options
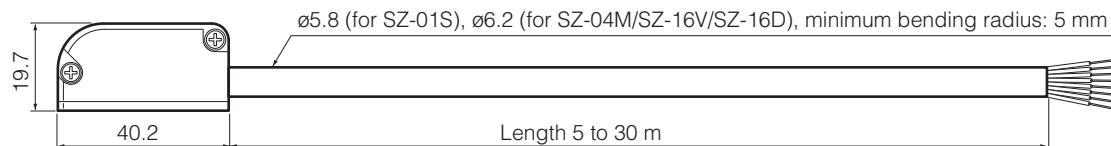
Connector cable

There are two types of cables: the connector cable for SZ-01S (8-wire cable) and the connector cable for SZ-04M/SZ-16V/SZ-16D (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 (0 V line). Do not connect the shielding wire to +24 V.
- For NPN output type cable, the shielding wire is connected to brown wire (+24 V line). Do not connect the shielding wire to 0 V.

Shape

ø5.8 (for SZ-01S), ø6.2 (for SZ-04M/SZ-16V/SZ-16D), minimum bending radius: 5 mm

19.7

40.2   Length 5 to 30 m

Brown, blue: AWG24 (nominal cross-sectional area 0.22 mm^2)
Other colors: AWG26 (nominal cross-sectional area 0.14 mm^2)

Nomenclature for connector cable

SZ-P 5 P S

(1)   (2) (3) (4)

(1) Basic designation for the SZ connector cable

(2) Length	5: 5 m	10: 10 m	20: 20 m	30: 30 m
(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 or SZ-16D		

■ **SZ-01S**

Model	Output type of OSSD	Length	No. of internal wires
SZ-P5PS	PNP	5 m	8
SZ-P10PS		10 m	
SZ-P20PS		20 m	
SZ-P30PS		30 m	
SZ-P5NS	NPN	5 m	
SZ-P10NS		10 m	
SZ-P20NS		20 m	
SZ-P30NS		30 m	

■ **SZ-04M/SZ-16V/SZ-16D**

Model	Output type of OSSD	Length	No. of internal wires
SZ-P5PM	PNP	5 m	18
SZ-P10PM		10 m	
SZ-P20PM		20 m	
SZ-P30PM		30 m	
SZ-P5NM	NPN	5 m	
SZ-P10NM		10 m	
SZ-P20NM		20 m	
SZ-P30NM		30 m	

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Before Use
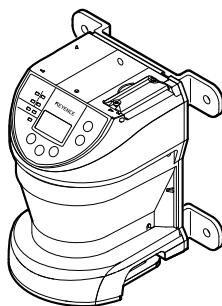
Mounting bracket

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).
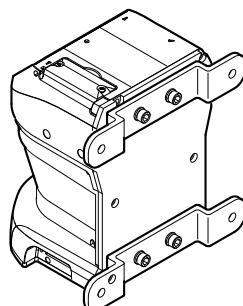
■ Horizontal mounting bracket (Model: OP-86935)

Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 4

<Front view>   <Rear view>
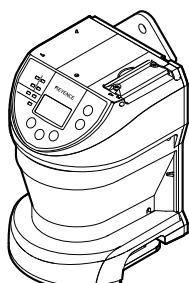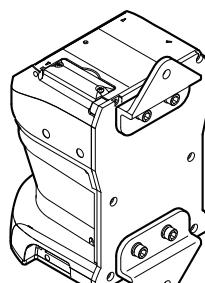
■ Vertical mounting bracket (Model: OP-86936)

Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 4

<Front view>   <Rear view>
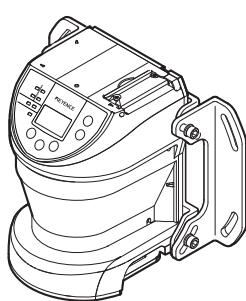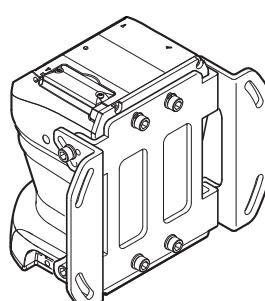
■ Horizontal mounting bracket with angle alignment (Model: OP-86937)

Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8

<Front view>   <Rear view>
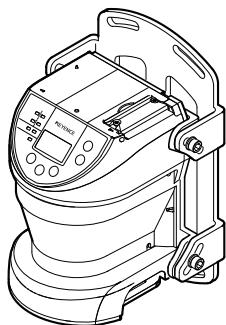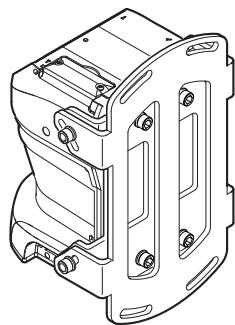
■ **Vertical mounting bracket with angle alignment (Model: OP-86938)**

Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8

<Front view>   <Rear view>
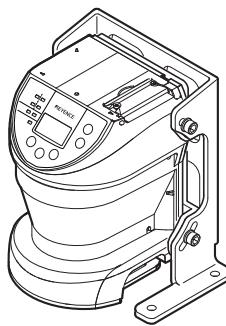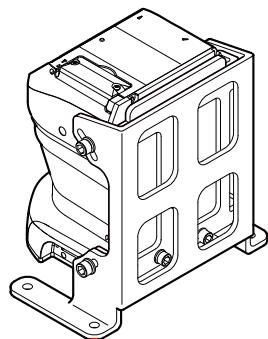
■ **L-shaped mounting bracket with angle alignment (Model: OP-86939)**

Hexagon socket bolt (M5, length: 10 mm, width across flats: 4 mm) x 8

<Front view>   <Rear view>

1

Before Use

Other

■ Configuration Software <Safety Device Configurator>
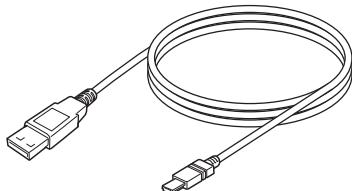
The configuration software can be downloaded from the KEYENCE website.

http://www.keyence.com

If you can not access the internet, call the nearest KEYENCE office.
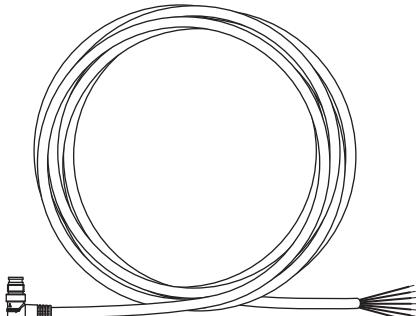
■ USB cable (Model: OP-86941)

This is the USB cable used for connecting the SZ to the PC. Cable length is 5 m.

■ RS-422A Communication Cable (Model: SZ-C5D)

Connector cable for RS-422A communication via the SZ-16D.
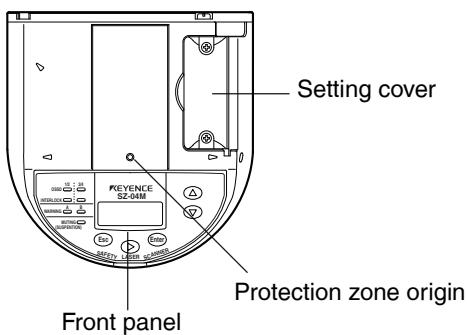
1-4 Part description
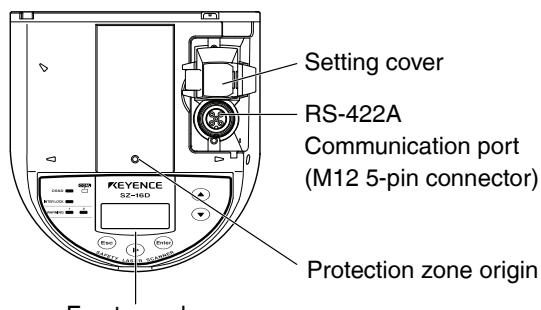
Top view

● **SZ-01S/SZ-04M/SZ-16V**

Setting cover

Protection zone origin

Front panel

● **SZ-16D**

Setting cover

RS-422A Communication port (M12 5-pin connector)

Protection zone origin

Front panel

Front view

Detection plane

Window

Lower window

Side view

Connector cable
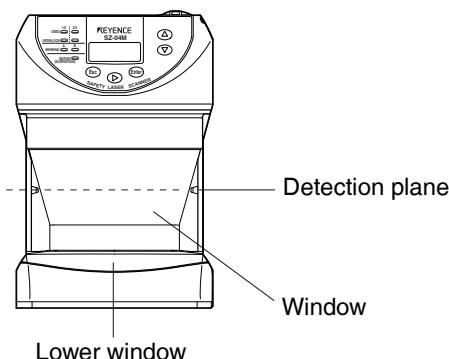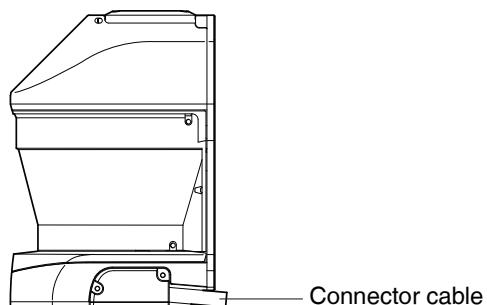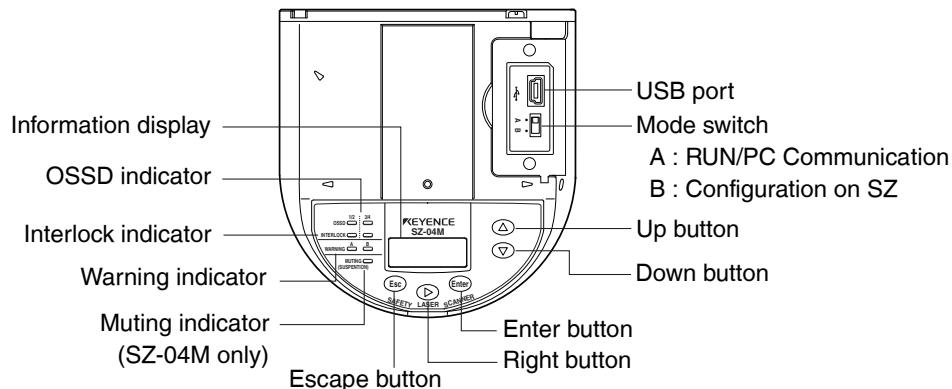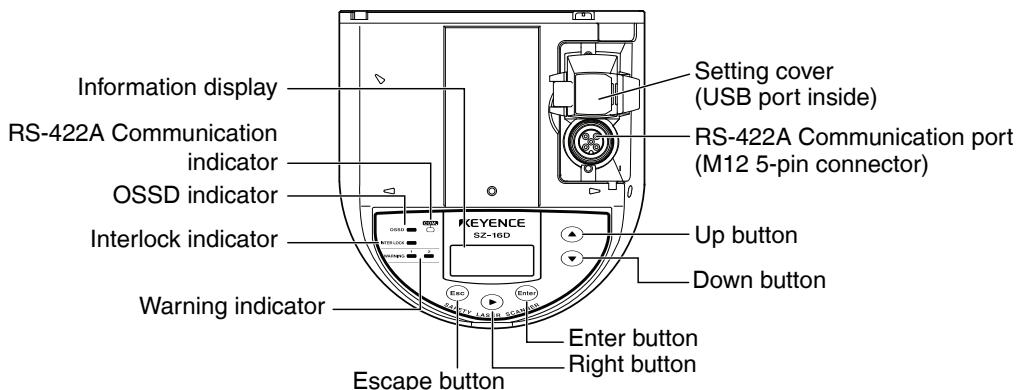
Details

● **SZ-01S/SZ-04M/SZ-16V**

Information display

OSSD indicator

Interlock indicator

Warning indicator

Muting indicator (SZ-04M only)

Escape button

USB port

Mode switch
A : RUN/PC Communication
B : Configuration on SZ

Up button

Down button

Enter button

Right button

● **SZ-16D**

Information display

RS-422A Communication indicator

OSSD indicator

Interlock indicator

Warning indicator

Escape button

Setting cover (USB port inside)

RS-422A Communication port (M12 5-pin connector)

Up button

Down button

Enter button

Right button

2

Functions and Features

2-1 | Functions and features

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 four different types of models of SZ, which depends on the availability of functions; SZ-01S, SZ-04M, SZ-16V, and SZ-16D.

In this chapter, the following four symbols are used for your reference. The definition is as follows.

S — Function available with SZ-01S

M — Function available with SZ-04M

V — Function available with SZ-16V

D — Function available with SZ-16D

Note
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 "Configuration of Others" (page 5-17). For the information about initialization with SZ-16V, see "5-3 Manual configuration for SZ-16V" (page 5-20). Initialization from the main body is not possible with the communication type.

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

\<Configuration for each function\> ✓: Available -: Not available

Function		Manual configuration on SZ	SZ configurator	Reference page
Configuration for safety-related function[*1]				
	Protection zone	✓ (Configuration is limited.)	✓	2-6
	Minimum detectable object size for protection zone	✓	✓	2-6
	Response time for protection zone	✓	✓	2-11
	Scan cycle	-	✓	2-11
	Interlock	✓ (Configuration is limited.)	✓	2-12
	Restart delay (On-delay)	-	✓	2-15
	EDM	✓	✓	2-16
	Reference points monitoring	-	✓	2-17
	Multi-OSSD	-	✓	2-18
	Bank switching	-	✓	2-20
	Muting	-	✓	2-27
	Suspension in teaching mode	-	✓	2-30
	Override	-	✓	2-32
Configuration for Non safety-related function[*1]				
	Warning zone	✓ (Configuration is limited.)	✓	2-8
	Minimum detectable object size for warning zone	✓	✓	2-8
	Response time for warning zone	✓	✓	2-11
	AUX output	✓ (Configuration is limited.)	✓	2-35
	State Information Output	-	✓	2-41
	Muting lamp output	-	✓	2-40
	Check input	-	✓	2-43
Configuration for others				
	Password change	✓[*2]	✓	5-17, 5-20
	Initialization	✓[*2]	✓	5-17, 5-20
	Turn off backlight	-	✓	6-24
	Adjustment of LCD contrast	✓	-	5-17, 5-20

*1 SZ-16V and the SZ-16D cannot be set from the main body.
*2 SZ-16D cannot be set from the main body.

<List of functions for each model> ✓: Available -: Not available

Function	SZ-01S	SZ-04M	SZ-16V/SZ-16D
Detection in protection zone	✓ 1 zone	✓ 1 zone*1	✓ 1 zone
Detection in warning zone	✓ 1 zone	✓ 1 zone*1	✓ 2 zones
Bank switching	-	✓ 4 Banks*1	✓ 16 Banks
Minimum detectable object size	✓ 30 / 40 / 50 / 70 / 150 mm		
Response time	✓ 60 - 480 ms (Scan cycle A) / 66 - 528 ms (Scan cycle B)		
Interlock	✓		
EDM	✓		
Reference points monitoring	✓	✓	-
Multi-OSSD	-	✓	-
Muting	-	✓	-
Suspension in teaching mode	-	✓	-
Override	-	✓	-
AUX output	✓ 2 outputs	✓ 6 outputs	✓ 4 outputs
State Information Output	-	✓	✓
Muting lamp output	-	✓	-
Check input	✓	✓	-
RS-422A Communication	-	-	✓ SZ-16D only

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

The number of the banks also varies depending on the configuration on the Multi-OSSD function.
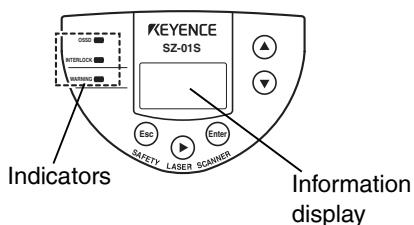
📖 "2-10 Multi-OSSD function" (page 2-18)

2-2 Information display and indicators

☐ **SZ-01S**

Indicators   Information display

☐ **SZ-04M**

Indicators   Information display

☐ **SZ-16V**

Indicators   Information display
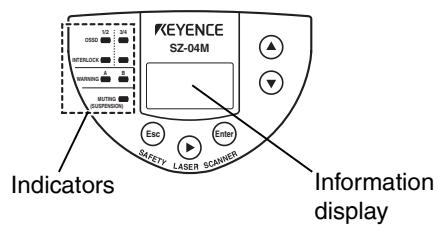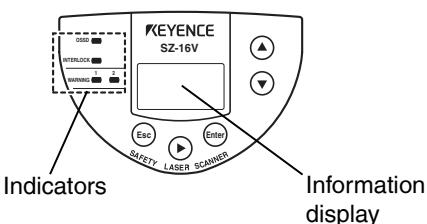
☐ **SZ-16D**
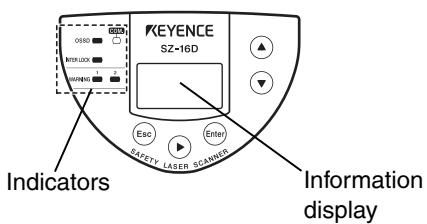
Indicators   Information display

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)

> **Reference** 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** (S)

Description on label	Assigned function	Description	Reference page
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 Light OFF: Other than above	📖 "2-7 Interlock" (page 2-12)
WARNING	Warning zone indicator	Light in orange: Detected in the warning zone Light OFF: Other than above	📖 "2-4 Warning zone" (page 2-8)

■ SZ-04M (M)

Description on label	Assigned function	Description	Reference page
OSSD 1/2	OSSD1/2 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)
OSSD 3/4	OSSD3/4 indicator	Light in green: OSSD3/4 is in the ON-state Light in red: OSSD3/4 is in the OFF-state	▢ "Multi-OSSD function" (page 2-18)
INTERLOCK 1/2	Interlock indicator	Light in yellow: OSSD1/2 is in the Interlock condition Light OFF: Other than above	▢ "2-7 Interlock" (page 2-12)
INTERLOCK 3/4	Interlock indicator	Light in yellow: OSSD3/4 is in the Interlock condition Light OFF: Other than above	
WARNING A	Warning zone A indicator	Light in orange: Detected in warning zone A Light OFF: Other than above	▢ "2-4 Warning zone" (page 2-8)
WARNING B	Warning zone B indicator	Light in orange: Detected in warning zone B Light OFF: Other than above	
MUTING	Muting indicator	Light in orange: In the state (1) or (2) below: (1) Muting function works. (2) Suspension in teaching mode works. Blinking in orange: Override function works. Light OFF: Other than above	▢ "2-12 Temporary suspension of safety function" (page 2-27)

■ SZ-16V (V)

Description on label	Assigned function	Description	Reference page
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 Light OFF: Other than above	▢ "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	

■ SZ-16D (D)

Description on label	Assigned function	Description	Reference page
OSSD	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)
COM.	RS-422A Communication indicator	Blinking in green: RS-422A communicates Light OFF: Other than above	"SZ-16D Communication Manual"
INTERLOCK	Interlock indicator	Light in yellow: Interlock condition Light OFF: Other than above	▢ "2-7 Interlock" (page 2-12)
WARNING 1	Warning zone 1 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 2 indicator	Light in orange: Detected in warning zone 2 Light OFF: Other than above	

2-3 Protection zone (S) (M) (V) (D)

When the SZ detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state.

⚠ **Danger**

- 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. 📖 "3-3 Safety distances" (page 3-7)
- 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)**

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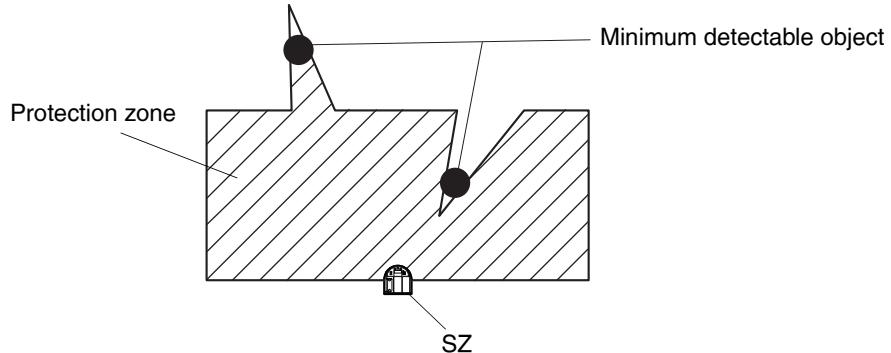
As shown in the following table, the maximum protection distance varies depending on the minimum detectable object size.

Minimum detectable object size (mm)		Ø30	Ø40	Ø50	Ø70	Ø150
Maximum distance (m)	-5° to 185°	1.8	2.4	3.0	4.2	
	-45° to -5°	1.2	1.6	2.0	2.8	
	185° to 225°					

⚠ **Danger**   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.

Note   Even if the object is smaller than the minimum detectable object size, it may be detected. But this is not guaranteed.

2-4 Warning zone (S) (M) (V) (D)

A warning zone can be configured separately from the protection zone. You can prevent the unnecessary stop of 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.
📖 "2-13 AUX (auxiliary) output" (page 2-35)

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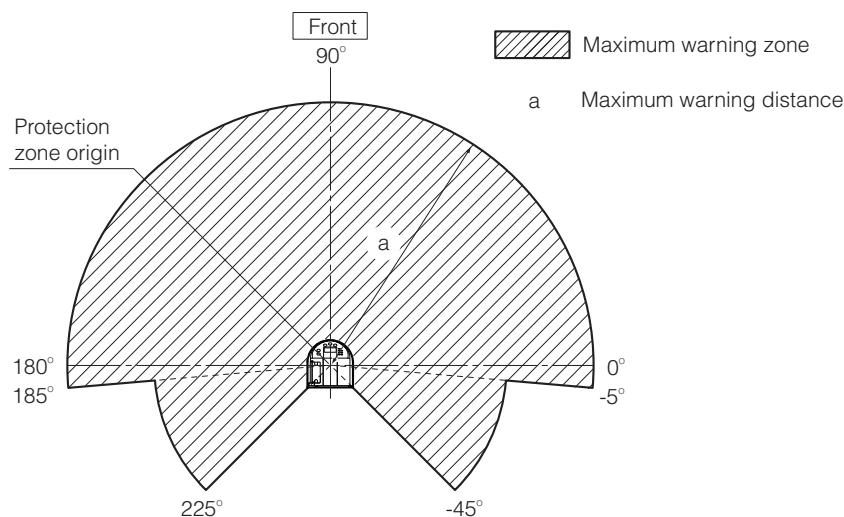
Note OSSD does not go to the OFF-state even if the SZ detects an object in the warning zone

Reference You can configure the warning zone through both the SZ Configurator and the manual configuration on the SZ. But, you can only configure the quadrate and rectangular warning zone through the manual configuration. If the warning zone you want to configure is not quadrate or rectangular, you must use the SZ Configurator for configuration of warning zone.
📖 "Chapter 5 Manual Configuration on the SZ" (page 5-1)

■ **Warning zone (top view)**
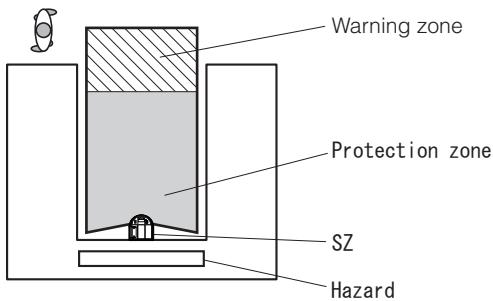
■ **Minimum detectable object size and maximum warning distance**
As shown in the following table, the maximum warning distance varies depending on the minimum detectable object size.

Minimum detectable object size (mm)		Ø30	Ø40	Ø50	Ø70	Ø150
Maximum distance (m)	-5° to 185°	4.5	6.0	7.5	10	
	-45°to -5°	3.0	4.0	5.0	7.0	
	185° to 225°					

2

■ **Example of warning zone**

Warning zone

Protection zone

SZ

Hazard

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. "2-13 AUX (auxiliary) output" (page 2-35)
- When using the multi-zone sets (banks) type as well as the communication type, "warning zone 1" and "warning zone 2" can be set separately. 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)

2

Functions and Features

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.
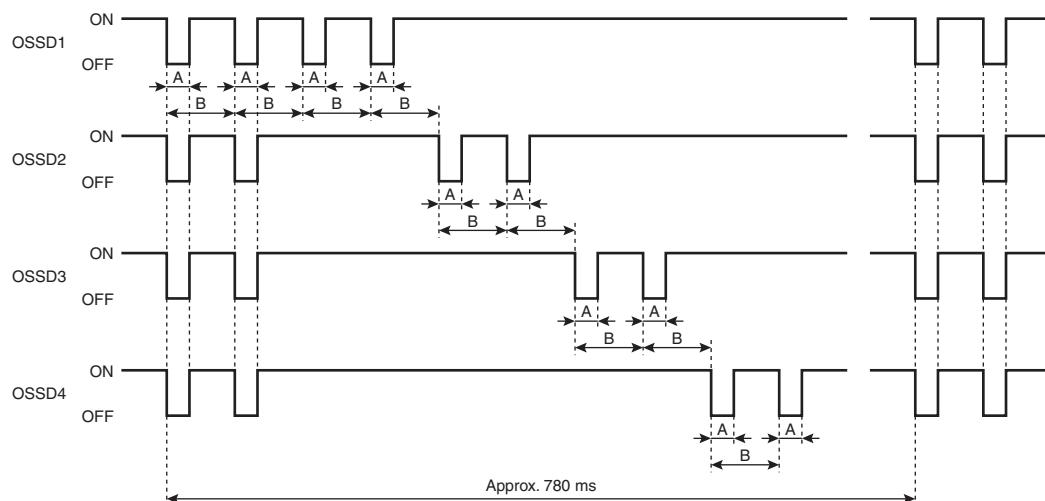
⚠️ **Danger**

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 the SZ-01S, SZ-16V and SZ-16D, they have OSSD1 and OSSD2, which are a pair of safety outputs that perform the output of same state.
- For the SZ-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 📖 "2-8 External device monitoring function (EDM)" (page 2-16).

■ **Time chart for self-diagnosis pulse**

A : approx. 20 µs (If a capacitive load is connected, max. 200 µs can apply.)   B : approx. 30 ms

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.

2

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.
 "3-3 Safety distances" (page 3-7)

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

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

[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 throught 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.
   "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 the configuration software" (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 OSSD3/4, you can configure the interlock function to both OSSD 1/2 and OSSD 3/4.
> ▯ "2-10 Multi-OSSD function" (page 2-18)

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).
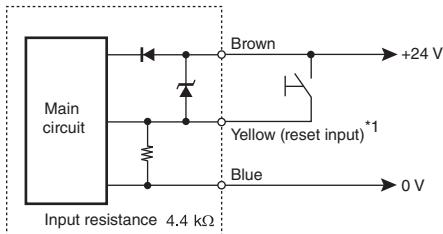
It is necessary to perform the reset operation when the SZ detects no object in the protection zone, in order that the machine starts operation. Because of reset operation, the OSSD goes to the ON-state, and then interlock condition is terminated.
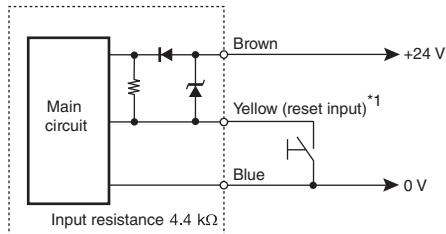
> **Reference**
> - There are three options on the configuration of start/restart through the SZ Configurator: Automatic/Automatic, Manual/Automatic, Manual/Manual. 📖 "Chapter 6 Configuration through the configuration software" (page 6-1)
> - There are two options on the configuration of start/restart through the manual configuration on the SZ: Automatic/Automatic and Manual/Manual. 📖 "Chapter 5 Manual Configuration on the SZ" (page 5-1)

■ Input circuit and wiring

For PNP output type cable   For NPN output type cable
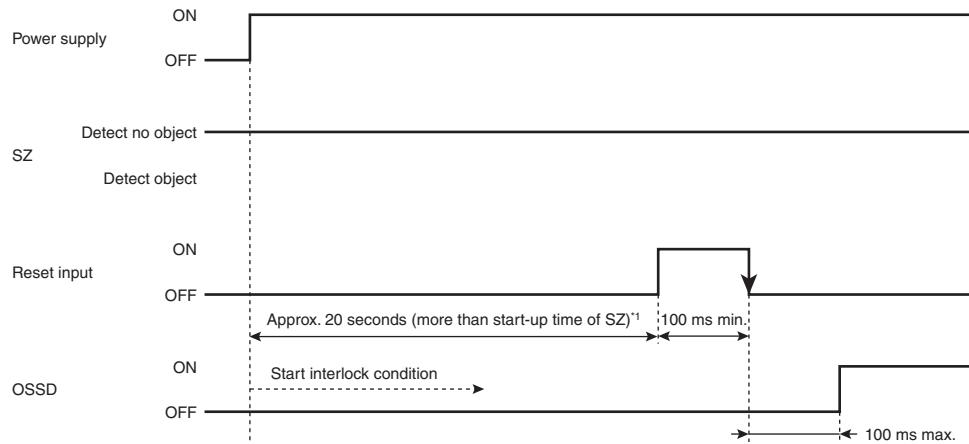
*1
- When the Mode D is applied as the operation mode for OSSD3/4, the reset input wire for OSSD 1/2 is yellow and the reset input wire for OSSD 3/4 is yellow/black.
- In case of "Manual/Manual" on the configuration of start/restart, the switch with N.O. type should be used for reset operation.
- In 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.

2

Functions and Features

■ Time chart (Restart from interlock condition)

*1 If the main body of the SZ is not Ver.2 or newer, it will take approximately 50 seconds.

⚠ Danger

- Be sure to absolutely confirm that there is nobody in the hazardous zone before the inter-lock condition is terminated (i.e. the machine system restarts) by the interlock reset mecha-nism. 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)
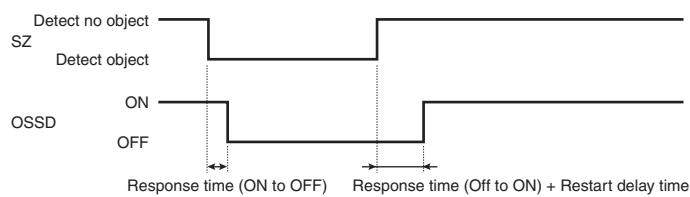
In case of "Automatic" on the configuration of restart mode, restart delay (ON-delay) can be applied to the SZ.

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)

```
                  Detect no object ─────┐          ┌──────────────────────────
          SZ                            │          │
                  Detect object         └──────────┘

                          ON ────┐                 ┌──────────────────────────
          OSSD                   │                 │
                         OFF     └─────────────────┘

                        Response time (ON to OFF)   Response time (Off to ON) + Restart delay time
```

> **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)

2-8 External device monitoring function (EDM) ⓢ Ⓜ Ⓥ Ⓓ
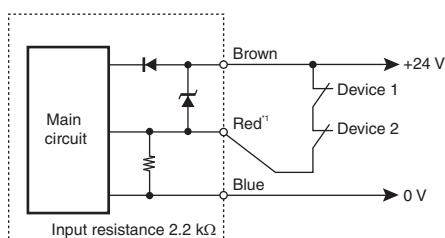
The SZ can monitor the state of external device, such as safety relay or contactor, that is connected to the OSSD in order to detect the failure on that external device. This function is the external device monitoring function (EDM function).

Wiring between the SZ and external device (N.C. contact) must be performed according to the following figures.
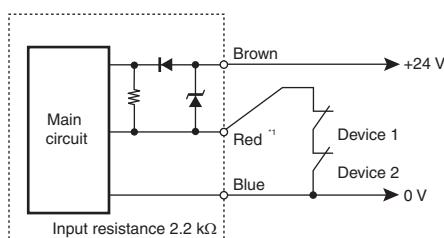
EDM input must be open-circuit if the EDM is not applied to the SZ.

■ Input circuit and wiring

For PNP output type cable
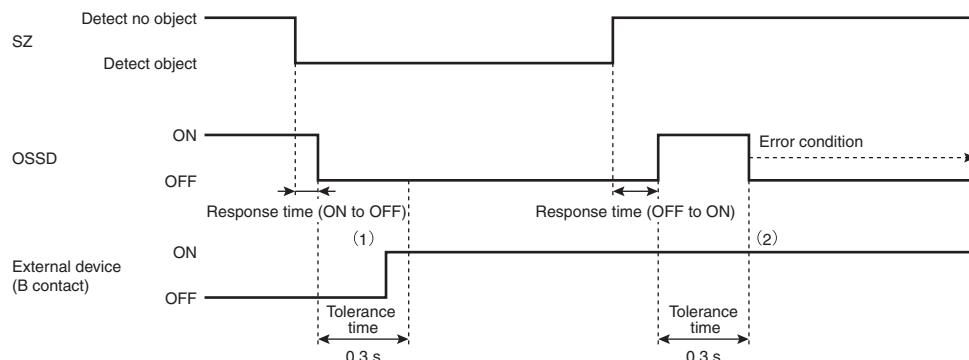
For NPN output type cable

*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 (0.3s).
📖 "8-2 Troubleshooting" (page 8-5)

Reference ▶ • When the OSSD3/4 are enabled, EDM can also be applied to the OSSD 3/4. 📖 "2-10 Multi-OSSD function" (page 2-18)

• For more details about the EDM error, see 📖 "Error state" (page 8-2).

2-9 Reference points monitoring function (S) (M)

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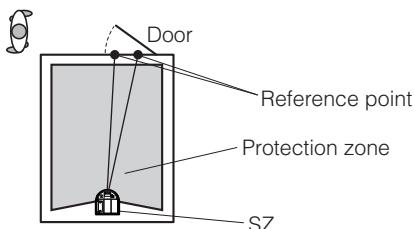
> **Reference** • SZ configurator must be used to apply the reference points monitoring to the SZ.
> • Maximum 30 reference points can be set.

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.
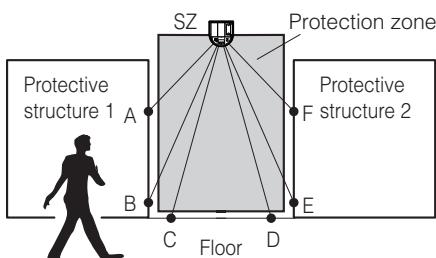
Examples of applications for detection for access protection

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 ±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.
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 OSSD3/4, 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.

Reference⃞   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

2

Functions and Features

■ **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 OSSD1/2. Therefore, all of parameters related to OSSDs, including the protection zone, can be different from OSSD 1/2. For information about the items that can be set, 📖 "When "Mode D" is selected" (page 6-17). 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.

📖 "2-3 Protection zone" (page 2-6)
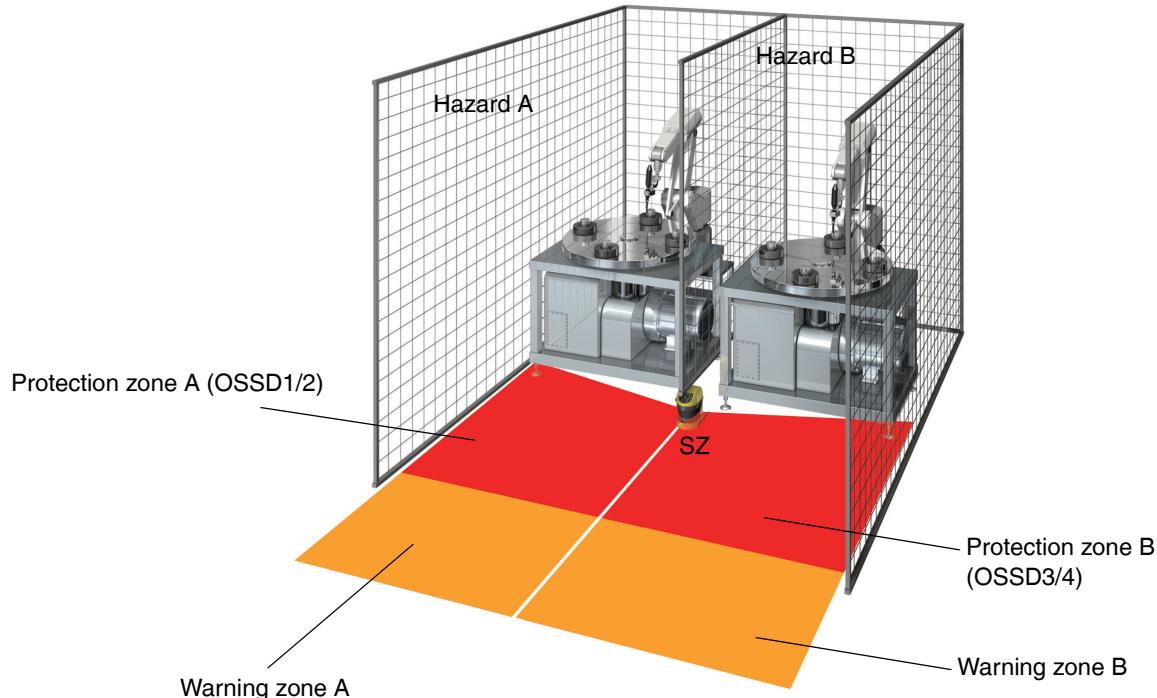
● **Example of protection zones A and B**

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.

2-11 Bank switching function (M)(V)(D)

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.

	SZ-01S	SZ-04M [*1]	SZ-16V/SZ-16D
Maximum number of banks	1	4 (2)	16
Number of protection zones per one bank	1	1 (2)	1
Number of warning zones per one bank	1	1 (2)	2

*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.
📖 "2-10 Multi-OSSD function" (page 2-18)

Reference

SZ configurator must be used to apply the bank switching function to the SZ.
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.

	Bank input 1	Bank input 2	Bank input 3	Bank input 4
Bank 1	ON	OFF	OFF	OFF
Bank 2	OFF	ON	OFF	OFF
Bank 3	OFF	OFF	ON	OFF
Bank 4	OFF	OFF	OFF	ON

Table 2-11 (A)

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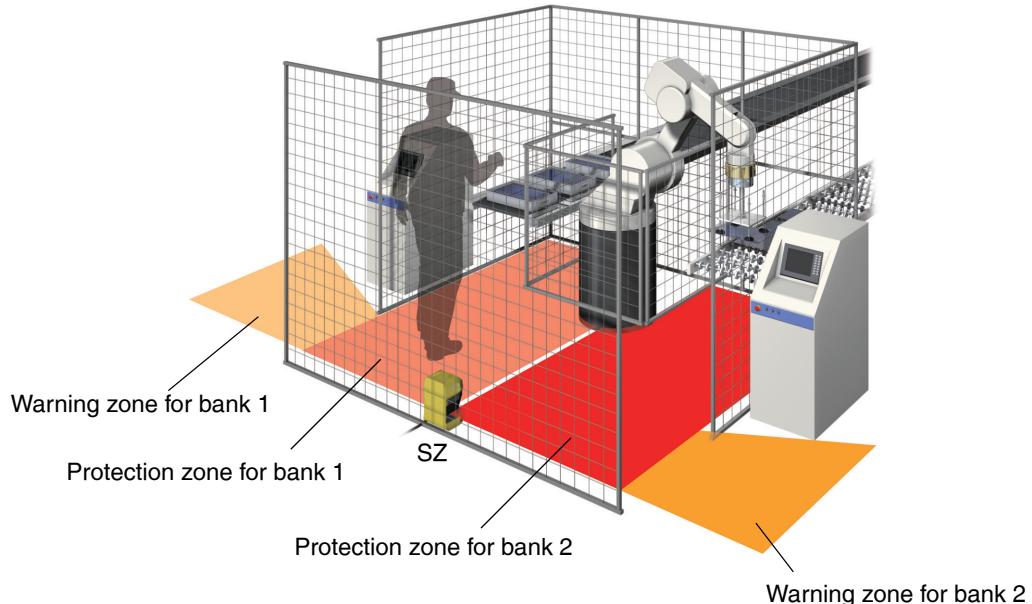
Bank switching works only if a certain bank input is in the ON-state and the other bank inputs are in the OFF-state. Bank No. is the same as the bank input No. that is in the ON-state.

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 📖 "Error state" (page 8-2).
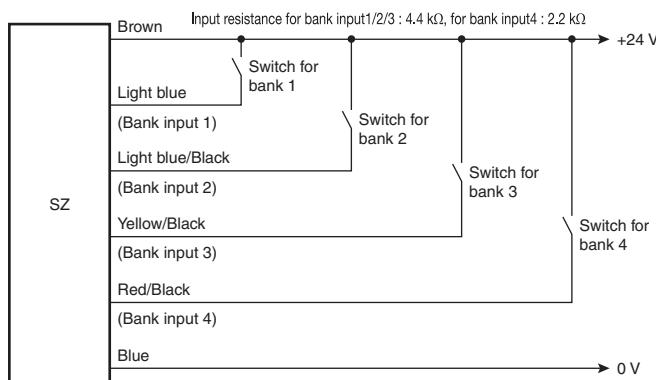
■ **Application example in a robot cell**

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.

Warning zone for bank 1

Protection zone for bank 1

SZ

Protection zone for bank 2

Warning zone for bank 2
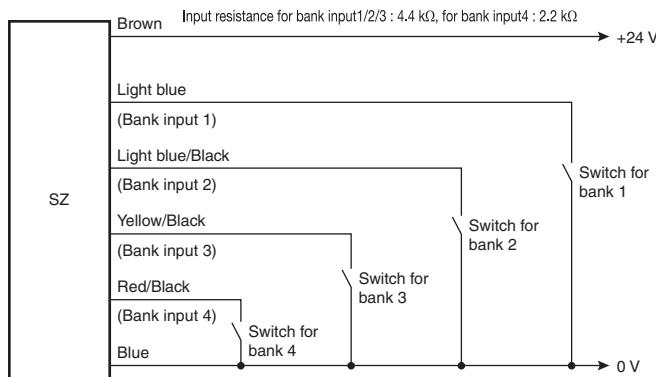
■ **Wiring for SZ-04M**

For PNP output type cable

Input resistance for bank input1/2/3 : 4.4 kΩ, for bank input4 : 2.2 kΩ

Brown
+24 V

Switch for bank 1

Light blue

(Bank input 1)

Switch for bank 2

Light blue/Black

(Bank input 2)

Switch for bank 3

Yellow/Black

(Bank input 3)

Switch for bank 4

Red/Black

(Bank input 4)

Blue
0 V

SZ

For NPN output type cable

Input resistance for bank input1/2/3 : 4.4 kΩ, for bank input4 : 2.2 kΩ

Brown
+24 V

Light blue

(Bank input 1)

Switch for bank 1

Light blue/Black

(Bank input 2)

Switch for bank 2

Yellow/Black

(Bank input 3)

Switch for bank 3

Red/Black

(Bank input 4)

Switch for bank 4

Blue
0 V

SZ

■ Time chart for SZ-04M

T1: Delay time for the bank input

(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).

Reference ⬚ You can select the delay time for bank inputs (T1).
Option is "0.02", "0.05", "0.1", "0.25", "0.5", "1.0", "2.5" and "5.0. (Initial condition of 0.1 seconds. 0.02 seconds and 0.05 seconds can only be chosen with a SZ Configurator Ver.2.0 or newer.)

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. ⬚ "2-12 Temporary suspension of safety function" (page 2-27)
• For the SZ-04M, the maximum number of banks varies depending on the function assigned to OSSD3/4. ⬚ "Multi-OSSD function" (page 2-18)

⚠ **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.

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In case of SZ-16V and SZ-16D

For the SZ-16V and SZ-16D, 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 and SZ-16D switches the banks based on the signal state (ON/OFF) of eight bank inputs.

	Bank input A	Bank input B	Bank input C	Bank input D	Bank input a	Bank input b	Bank input c	Bank input d
Bank 0	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Bank 1	ON	OFF	OFF	OFF	OFF	ON	ON	ON
Bank 2	OFF	ON	OFF	OFF	ON	OFF	ON	ON
Bank 3	ON	ON	OFF	OFF	OFF	OFF	ON	ON
Bank 4	OFF	OFF	ON	OFF	ON	ON	OFF	ON
Bank 5	ON	OFF	ON	OFF	OFF	ON	OFF	ON
Bank 6	OFF	ON	ON	OFF	ON	OFF	OFF	ON
Bank 7	ON	ON	ON	OFF	OFF	OFF	OFF	ON
Bank 8	OFF	OFF	OFF	ON	ON	ON	ON	OFF
Bank 9	ON	OFF	OFF	ON	OFF	ON	ON	OFF
Bank 10	OFF	ON	OFF	ON	ON	OFF	ON	OFF
Bank 11	ON	ON	OFF	ON	OFF	OFF	ON	OFF
Bank 12	OFF	OFF	ON	ON	ON	ON	OFF	OFF
Bank 13	ON	OFF	ON	ON	OFF	ON	OFF	OFF
Bank 14	OFF	ON	ON	ON	ON	OFF	OFF	OFF
Bank 15	ON	ON	ON	ON	OFF	OFF	OFF	OFF

Table 2-11 (B)

| Reference | 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.
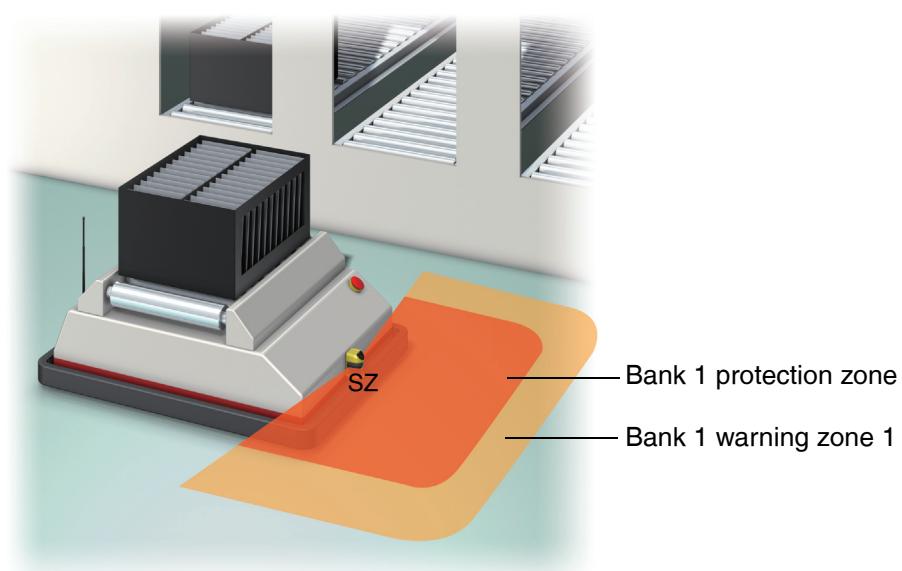
| Note | • The SZ does not start operation if the signal combination of bank inputs is different from the combination as shown in Table 2-11 (B) at start-up, because the SZ goes to the state of "Waiting for bank input". The SZ starts operation if the signal combination of bank inputs becomes the same 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.
• For more information about the bank error, see ▭ "Error state" (page 8-2).
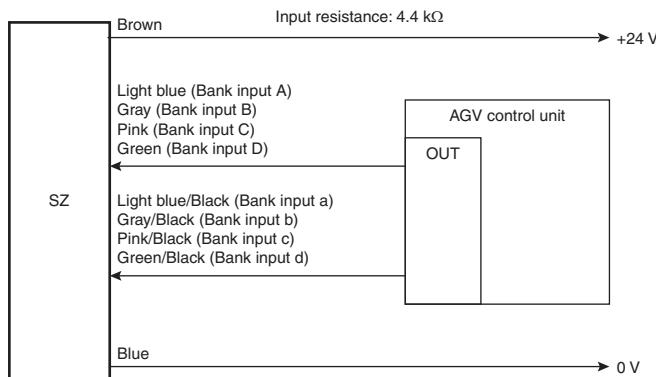
■ Application example for AGV (automated guided vehicle)

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.

SZ

Bank 1 protection zone

Bank 1 warning zone 1
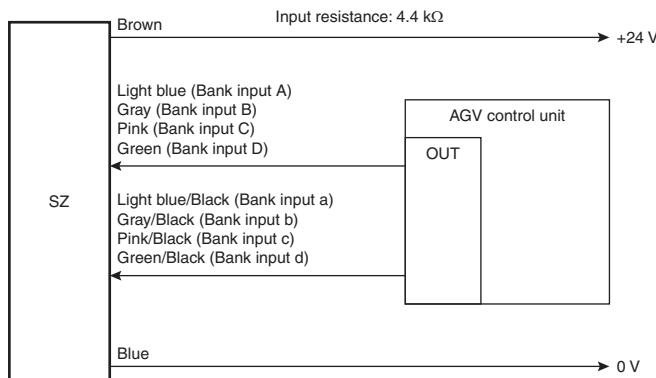
■ Wiring for SZ-16V and SZ-16D

For PNP output type cable

Brown — Input resistance: 4.4 kΩ — +24 V

Light blue (Bank input A)
Gray (Bank input B)
Pink (Bank input C)
Green (Bank input D)

AGV control unit

OUT

SZ

Light blue/Black (Bank input a)
Gray/Black (Bank input b)
Pink/Black (Bank input c)
Green/Black (Bank input d)

Blue — 0 V

For NPN output type cable

Brown — Input resistance: 4.4 kΩ — +24 V

Light blue (Bank input A)
Gray (Bank input B)
Pink (Bank input C)
Green (Bank input D)

AGV control unit

OUT

SZ

Light blue/Black (Bank input a)
Gray/Black (Bank input b)
Pink/Black (Bank input c)
Green/Black (Bank input d)

Blue — 0 V

■ Time chart for SZ-16V and SZ-16D

T1: Delay time for the bank input

100 ms max.

(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).

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

Option is "0.02", "0.05", "0.1", "0.25", "0.5", "1.0", "2.5" and "5.0. (Initial condition of 0.1 seconds. 0.02 seconds and 0.05 seconds can only be chosen with a SZ Configurator Ver.2.0 or newer.)

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.

Bank sequence monitoring (M)(V)(D)

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.
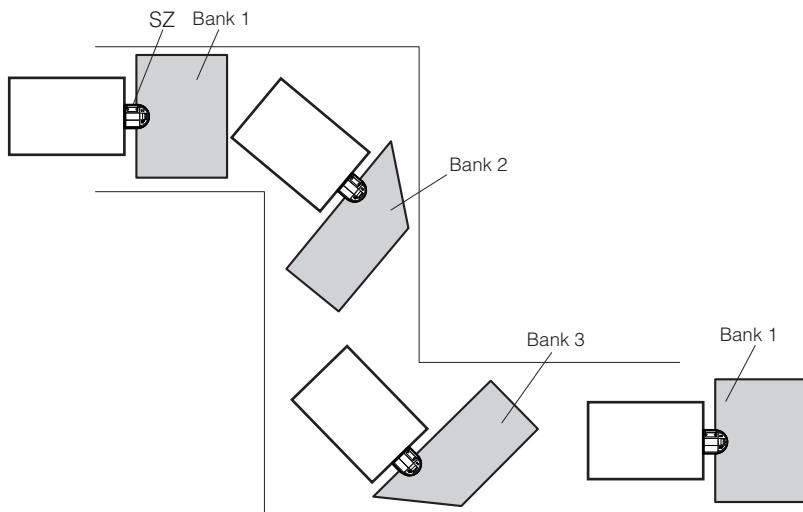
Reference SZ configurator must be used to apply the bank sequence monitoring function to the SZ.
For more information about the bank error, see "Error state" (page 8-2).

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 (V)(D)

For the SZ-16V and SZ-16D, 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.

Reference 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).

2-12 Temporary suspension of safety function ⬭M

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.

Reference ► • 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

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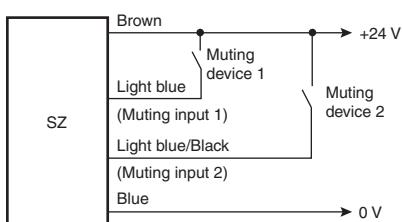
The muting input terminals on the SZ must be connected to the muting devices if you want to use the muting function.
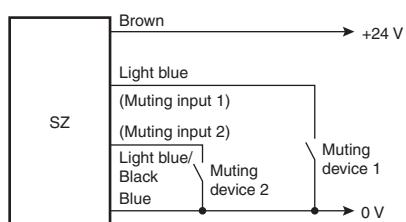
■ **Input circuit and wiring**

For PNP output type cable
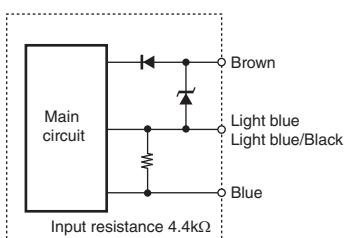
For NPN output type cable
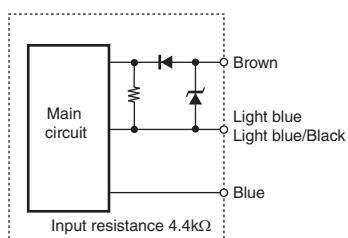
The input circuit for muting input 1 and 2 is as follows.

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" (page 2-43)
- 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
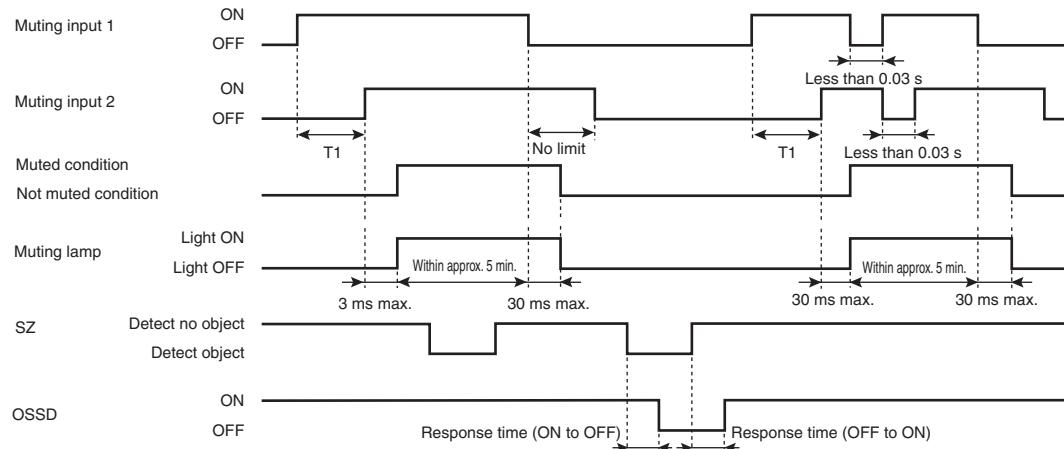
⚠ **Danger**　The responsible personnel must perform the risk assessment based on the machine application in order to appropriately determine the risk if "Not specified" is selected for the maximum muting period of time. Failure to follow this warning may result in a significant harm to the machine operators, 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)

T1: Within 0.04 to 3 seconds

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).
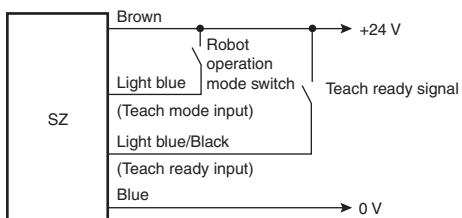
The SZ is connected to both the signal from switch to change the operation mode to teaching mode and the signal from the robot indicating that the robot is in the teaching mode.

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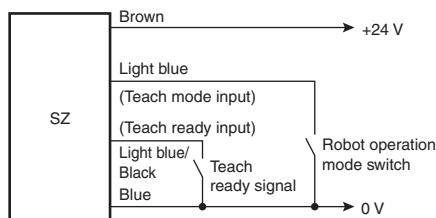
The whole of protection zone goes to the suspended condition during the suspension in teaching mode. (It is not possible to suspend the safety function to a part of the protection zone.)

Input circuit and wiring

For PNP output type cable   For NPN output type cable
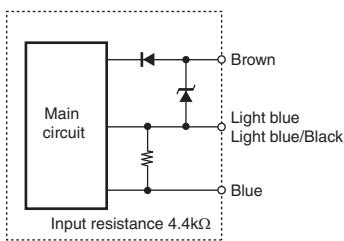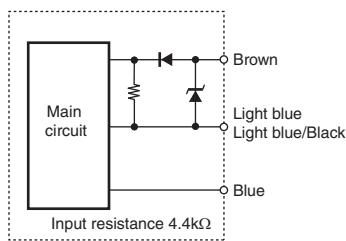
The input circuit for teach mode input and teach ready input is as follows.

For PNP output type cable   For NPN output type cable

■ 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 (Unit:second).

- 0.04 to 3.0 (default)
- 0.04 to 5.0
- 0.04 to 10.0

2
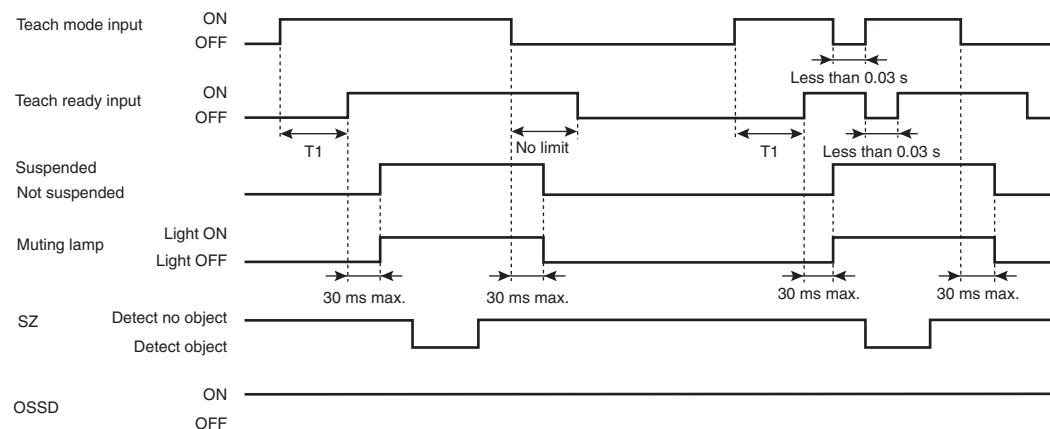
■ Conditions for termination of suspension in teaching mode

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. ☐ "2-14 Check input function" (page 2-43)
- The power supply is interrupted or restored.

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

■ Time chart

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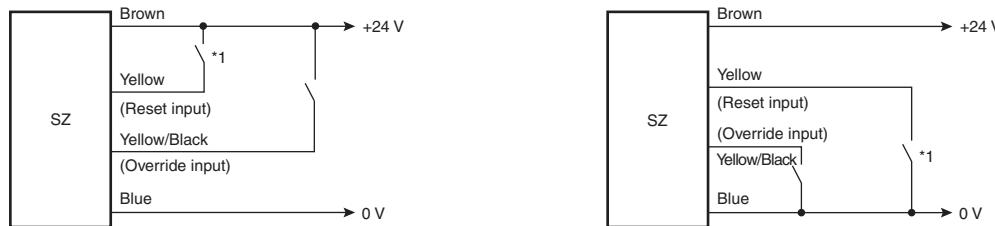
The override is a helpful function suitable for such a situation.

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 cableFor NPN output type cable

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

For PNP output type cableFor NPN output type cable

*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.

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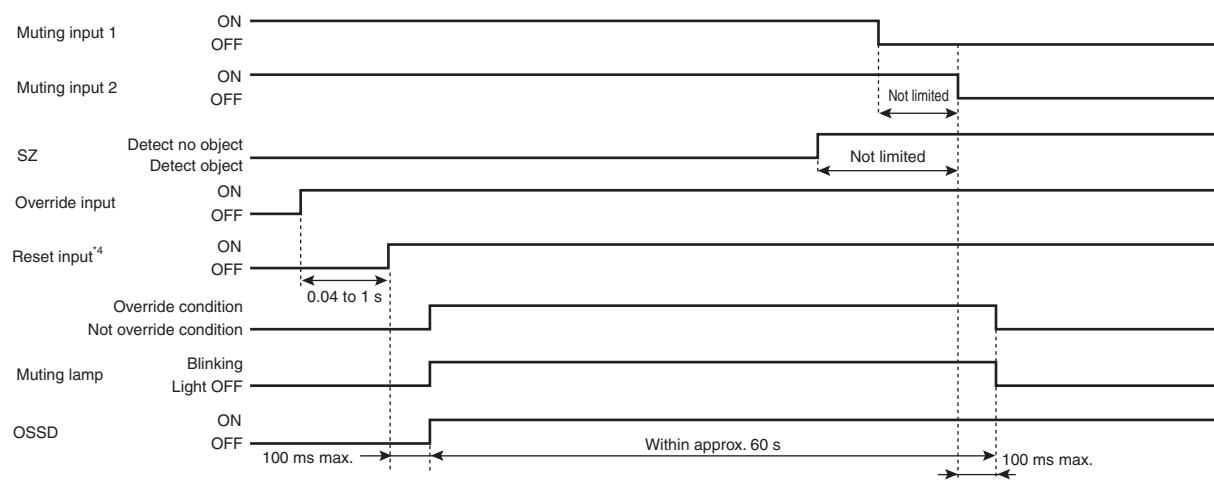
Reference You can select the maximum override period of time.
Option is "1 minute", "5 minutes" and "10 minutes". (Default: 1 minute)

■ **Time chart (Initial settings when the Muting Function is used)**

Muting input 1	ON / OFF	
Muting input 2	ON / OFF	Not limited
SZ	Detect no object / Detect object	Not limited
Override input	ON / OFF	
Reset input*4	ON / OFF	0.04 to 1 s
	Override condition / Not override condition	
Muting lamp	Blinking / Light OFF	
OSSD	ON / OFF	100 ms max. / Within approx. 60 s / 100 ms max.

*4 If the start/restart mode setting is Auto/Auto, then the reset input logic is reversed.

2-13 AUX (auxiliary) output Ⓢ Ⓜ Ⓥ Ⓓ

Overview of the AUX output

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.

	SZ-01S	SZ-04M	SZ-16V/SZ-16D
AUX output	2 outputs	6 outputs	4 outputs

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

✓: Available   -: Not available
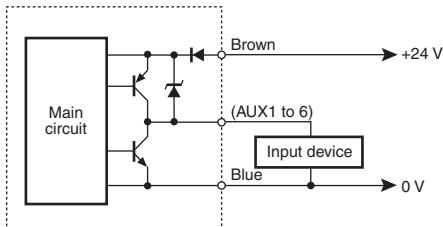
	SZ-01S	SZ-04M	SZ-16V/SZ-16D
Error	✓	✓	✓
Alert	✓	✓	✓
Error or alert	✓	✓	✓
OSSD state	✓	✓	✓
Detection in protection zone	✓	✓	✓
Detection in warning zone	✓	✓	✓
Interlock-reset-ready output	✓	✓	✓
State information	-	✓	✓
Muted or override condition	-	✓	-
Muting lamp	-	✓	-

⚠ **Danger** 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.
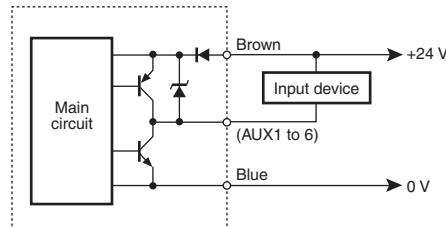
Output circuit and wiring

For connecting a PNP input device

For connecting an NPN input device

Output rating: 50 mA or lessOutput 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.
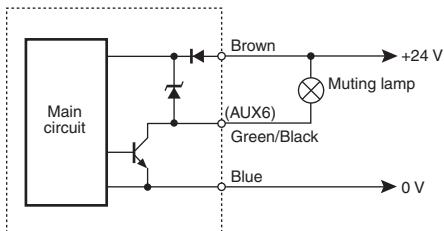
2

When muting lamp output is assigned to AUX 6

For information about the lamp to be connected, see 📖 "Muting lamp output" (page 2-40).

Note	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.

Reference📖 The configuration for the AUX output through the manual configuration on the SZ is limited. For information about the available information, see 📖 "Configuration of Non-safety Function" (page 5-12).
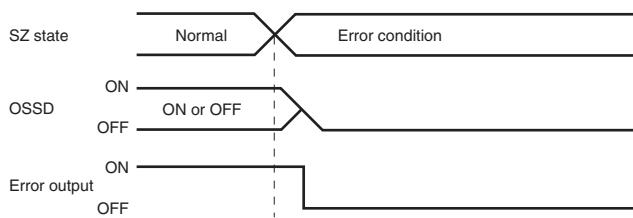
Error output ⟨ S ⟩⟨ M ⟩⟨ V ⟩⟨ D ⟩

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.
📖 "Error state" (page 8-2)

■ Time chart

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).

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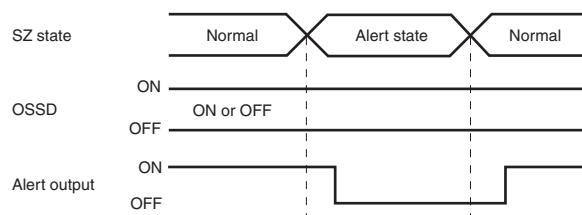
You can make sure whether there is an alert in the SZ or not.
The alert output goes to the OFF-state if the SZ detects any of the following condition.
- Light pollution on the window
- Light interference
- High-reflective background
- Overcurrent on AUX
- Muting lamp failure (disconnection or overcurrent)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

■ **Time chart**

| SZ state | Normal | Alert state | Normal |

OSSD: ON / OFF — ON or OFF

Alert output: ON / OFF

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 (S) (M) (V) (D)

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).
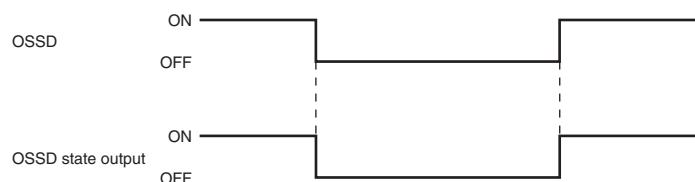
OSSD state output (S) (M) (V) (D)

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 OSSD3/4, 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**

OSSD: ON / OFF

OSSD state output: ON / OFF

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).

Output for detection in protection zone ⬭S⬭ ⬭M⬭ ⬭V⬭ ⬭D⬭

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 📖 "2-9 Reference points monitoring function" (page 2-17)
- In case where the check input goes to the ON-state 📖 "2-14 Check input function" (page 2-43)
- In case where the SZ is in the error state 📖 "Error state" (page 8-2)

| 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.
"2-10 Multi-OSSD function" (page 2-18) |

| 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).
• When the Mode D is applied as the operation mode for OSSD3/4, two outputs for detection in protection zone, "detection in protection zone A" and "detection in protection zone B", can be set individually.
📖 "Multi-OSSD function" (page 2-18) |
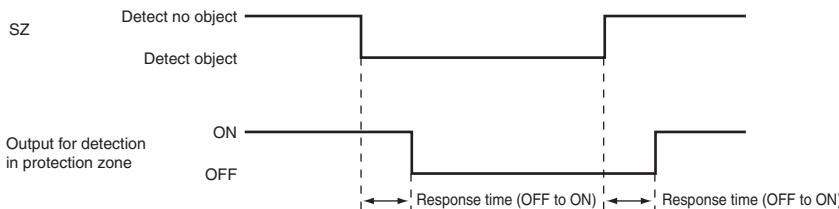
■ Time chart

| 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). |

Output for detection in the warning zone ⬭S⬭ ⬭M⬭ ⬭V⬭ ⬭D⬭

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 📖 "2-14 Check input function" (page 2-43)
- In case where the SZ is in the error state 📖 "Error state" (page 8-2)

| 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)
• In case of SZ-16V and SZ-16D, two outputs for detection in warning zone, "detection in warning zone 1" and "detection in warning zone 2", can be set individually. |

The time chart is the same for 📖 "Output for detection in protection zone" (page 2-38).
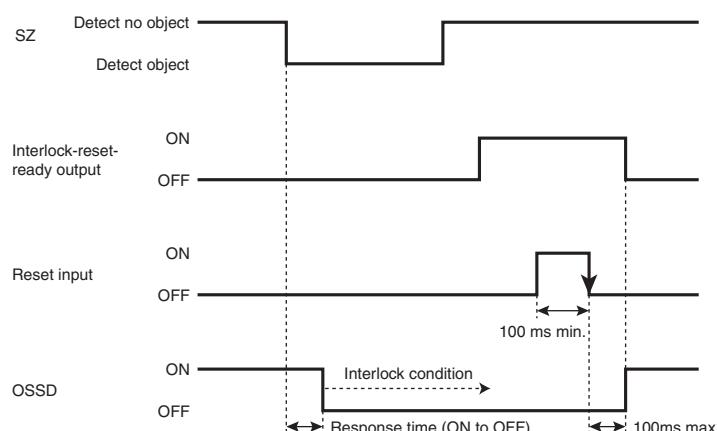
Interlock-reset-ready output (S) (M) (V) (D)

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)
  ☐ "2-9 Reference points monitoring function" (page 2-17)
• The check input is in the OFF-state ☐ "2-14 Check input function" (page 2-43)
• The SZ is not in the error state ☐ "Error state" (page 8-2)
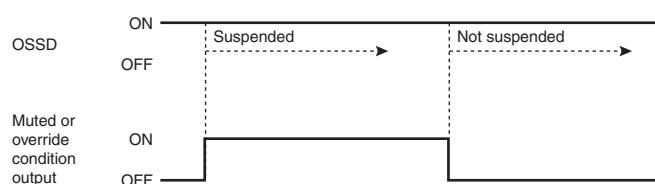
■ Time chart

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).

Muted or override condition output (M)

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

Note

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

2

Muting lamp output (M)

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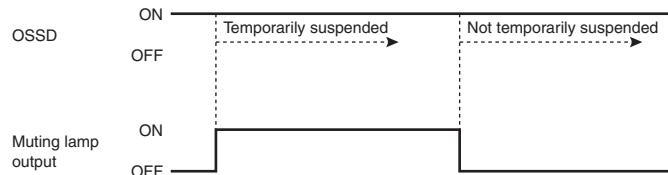
You can define the performance of SZ under the muting lamp failure as either error (muting lamp error) or alert. The SZ goes to the error state in case of muting lamp failure in accordance with the default configuration.

| Note	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.

■ Time chart

For information about output circuit and the wiring method, see ☐ "Overview of the AUX output" (page 2-35).

State Information Output M V D

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.

Number of pulses from the state information output 2	SZ-04M	SZ-16V/SZ-16D
1	Normal operation	
2	Override condition Muted condition Suspension in teaching mode state	-
3	Interlock condition	
4	Switch to bank1	Bank switching[1]
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 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	
24	Communication monitoring error (only for the SZ-16D)	

*1 For the SZ-16V and SZ-16D, 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.
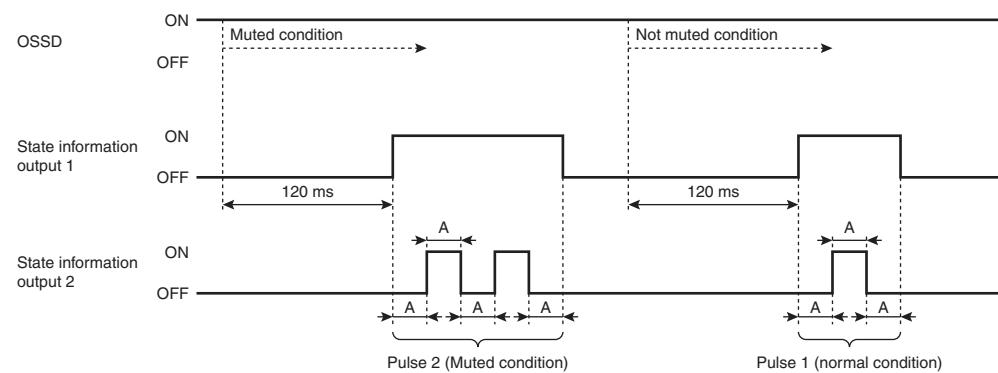
Reference For more information about the error state, see "Error state" (page 8-2). For more information about the alert state, see "Alert state" (page 8-4).

■ **Time chart**

In case of muted condition (Same as in case of override and suspension in teaching mode)

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.

2-14 Check input function (S) (M)

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.
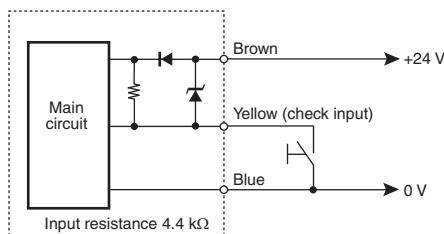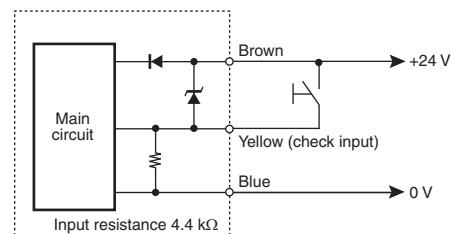
Note In case of "Manual/Automatic" or "Manual/Manual" on the configuration of start/restart, you have no chance to apply the check input function to the SZ.
📖 "2-7 Interlock" (page 2-12)

■ Input circuit and wiring

For PNP output type cableFor NPN output type cable
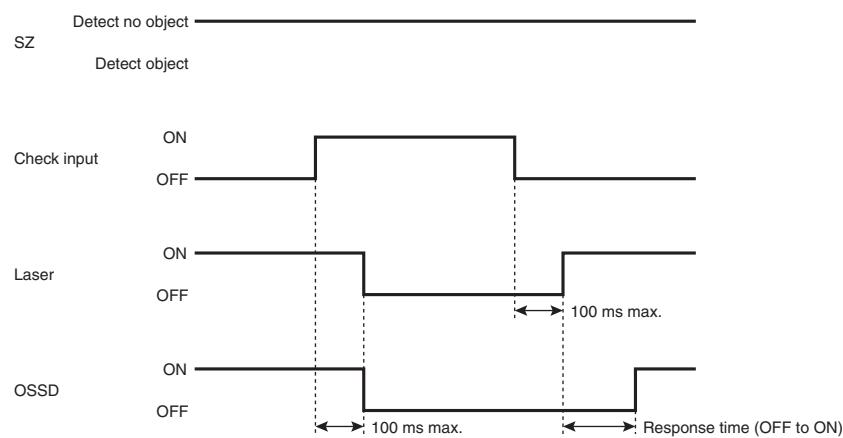
Reference SZ configurator must be used to apply the check input function to the SZ.

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

Reference When trying to stop the laser projection of the multi-bank type (SZ-16V) and the communication type (SZ-16D), see 📖 "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.
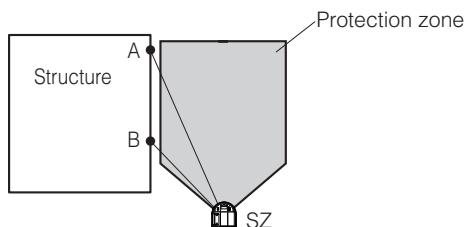
The check input function has three of following features.

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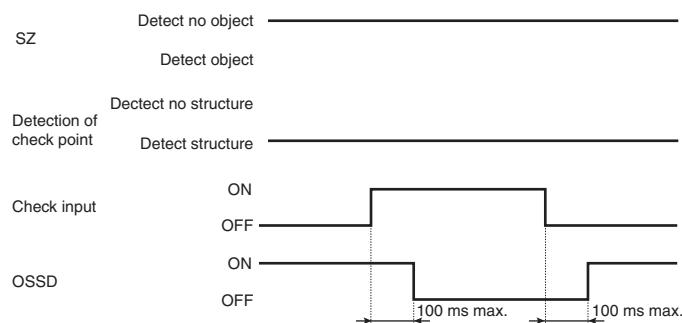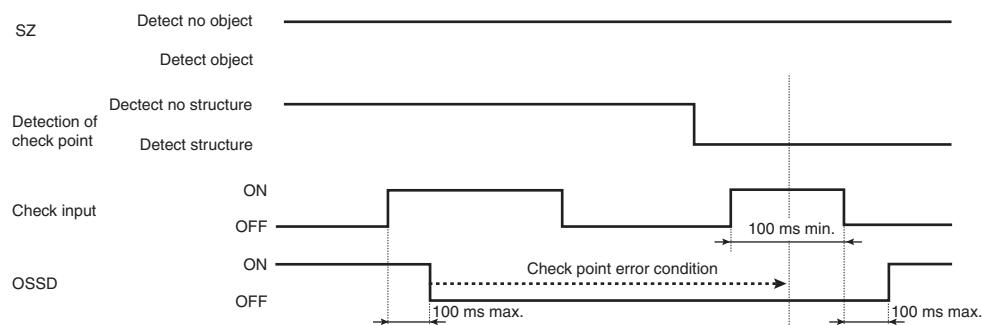
Reference
- SZ configurator must be used to apply the check input function to the SZ.
- Maximum 30 check points can be set.
- For more information about the error state, see 📖 "Error state" (page 8-2).

■ 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"

2-15 Monitoring function Ⓢ Ⓜ Ⓥ Ⓓ

You can monitor the state of SZ operation through the information display on the SZ or the SZ Configurator.
✓: Available   -: Not available

Function	SZ	SZ configuration software	
I/O monitoring	✓	✓	You can check the ON/OFF state on each inputs and AUX outputs.
Wiring check	✓	✓	You can check the pin No., color and function on connector cable.
Protection zone monitoring	✓*1	✓	You can check whether the SZ detects an object in the protection zone.
Warning zone monitoring	✓*1	✓	You can check whether the SZ detects an object in the warning zone.
OSSD OFF History	✓	✓	You can check the time and reason for the OSSD OFF. Maximum 20 events can be checked in the history after power-on.
Real-time ranging	-	✓	You can check the surrounding structures detected by SZ in real time.
AUX output test	-	✓	You can check the operation of AUX output through the switching between ON-state and OFF-state with the simulation basis.

*1 The multi-bank type (SZ-16V) and the communication type (SZ-16D) cannot be monitored from the main body.

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.

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

RS-422A Communication Function Ⓓ

Using the RS-422A communication, information such as the measuring distance data, the OSSD output ON/OFF status, or the error status from within the measuring range of the SZ-16D can be received. Also, the warning area can be changed..
The SZ-16D has a maximum of 4 multi-drop connections.
For details on the communication function of the RS-422A, refer to the "SZ-16D communication manual".
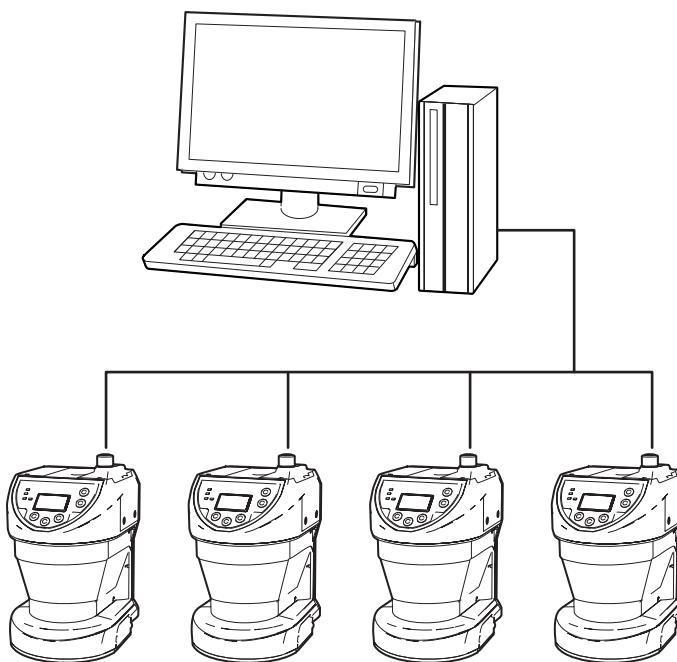
⚠ **Danger** All of the data received from the communication of the RS-422A cannot be used from the safety control system. When used in error, there is a possibility that the operator of the device may be threatened with major injury or even death.

Note If using the USB port, information such as the measuring distance information (measured distance data) from within the measuring range of the SZ-16D, the OSSD output ON/OFF status, or the error condition will not be received. Also, the warning range cannot be changed. For models other than the SZ-16D, the RS-422A communication function is not possible.

External devices such as the computer

SZ-16D (Up to 4 units can have a multi-drop connection)

3

Installation to a Machine

3-1 Precaution at installation

⚠ **Danger**

- 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.
  📖 "3-3 Safety distances" (page 3-7)
- 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 setensure 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)
- 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 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.
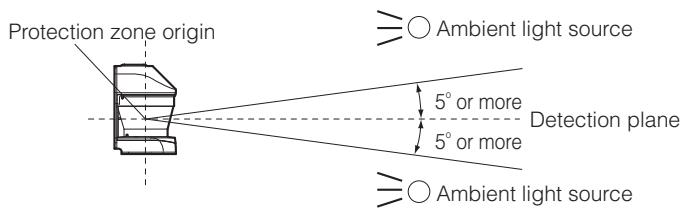
3-2 Hint on installation

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.
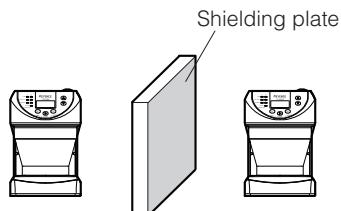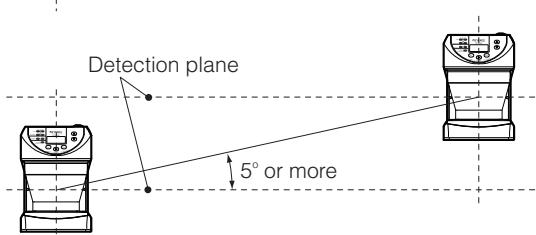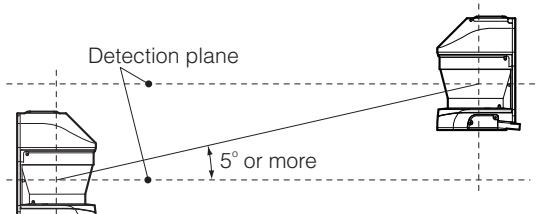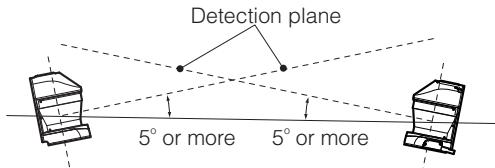
Mutual interference

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.

Detection plane

5° or more

Detection plane

5° or more

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

Detection plane

5° or more   5° or more

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)
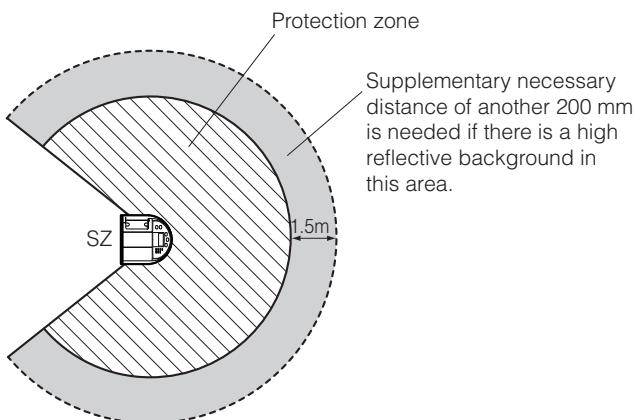
⚠ **Danger**   You must calculate the minimum safety distance again in order to reinstall the SZ with appropriate safety distance if you want to apply the above countermeasure .

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.

Protection zone

Supplementary necessary distance of another 200 mm is needed if there is a high reflective background in this area.

SZ

1.5m

⚠ **Danger** | 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).
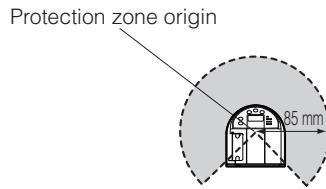
Reference📑 Examples of high reflective backgrounds
- Metallic glossy surface
- Retro-reflective sheet
- Retro-reflective plate etc…

3

Installation to a Machine

Zone with limited detection capability

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

Protection zone origin

85 mm

⚠ **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.

Other

When the reflection of the detection object or the background area that cannot be detected exceeds 60°, an error will occur and [MI Error] will be displayed.
This function is to prevent the detection of people from interfering with the objects that emit very little reflection when very close to the SZ.
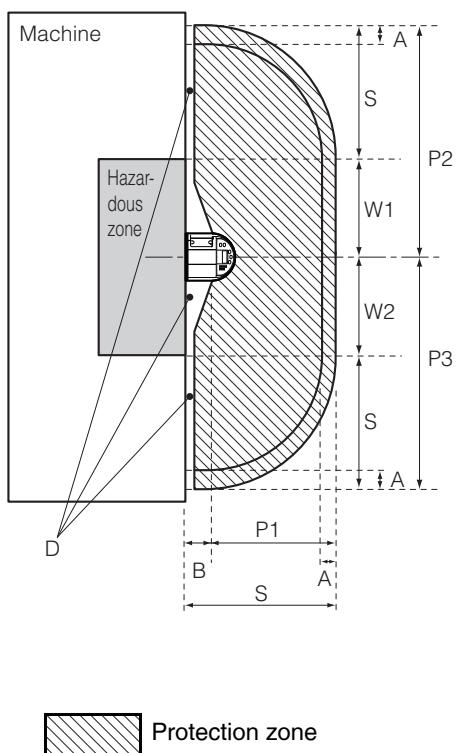
3-3 | Safety distances
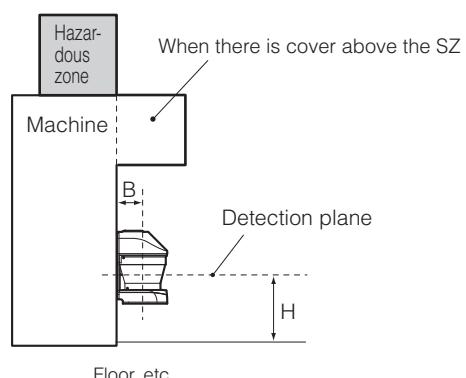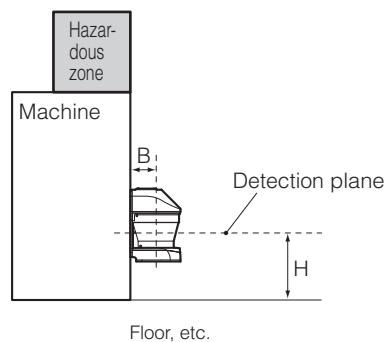
The protection zone must be configured so as to ensure the minimum safety distance, which has been calculated according to the laws, regulations, standards of the country and region in which the SZ is installed as well as the specification specified in this user's manual.

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

Top view of the machine

Side view of the machine

Protection zone

$S = K \times T + C + A$ < 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 (t1 + t2)

t1: SZ response time in second

t2: Max. time in second required to stop the machine after receiving the OSSD signal from SZ

C: 1200 - 0.4 x H (850 mm or higher)

H: Height of detection plane (protection zone) above the reference plane in millimeters, for example the floor. 1000 mm ≥ H ≥ 15 x (d-50)

d: SZ minimum detectable object size in millimeters

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

⚠ **Danger**

- 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 300 mm (200 mm 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

K = 1600 mm/s Approach speed of the body or parts of the body (Constant)

T = $t_1 + t_2$ = 0.59 s Overall response time

    t_1 = 0.09 seconds SZ response time (Changeable)

    t_2 = 0.5 seconds Max. time required to stop the machine after receiving the OSSD signal from SZ

C = 1200-0.4 x H = 1080 mm

    H = 300 mm 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 mm Minimum detectable object size (Changeable)

A = 100 mm Supplementary necessary distance for SZ

B = 59 mm Distance between the edge of the hazardous area and protection zone origin on the SZ

$W_1 = W_2$ = 1000 mm Width of the hazardous area

Safety Distances

$S = K \times T + C + A$

    = 1600 x 0.59 + 1080 + 100 = 2124 mm

Protection distances to be configured as the protection zones

$P_1 = S - B$ = 2065 mm

$P_2 = S + W_1$ = 3124 mm

$P_3 = S + W_2$ = 3124 mm

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.
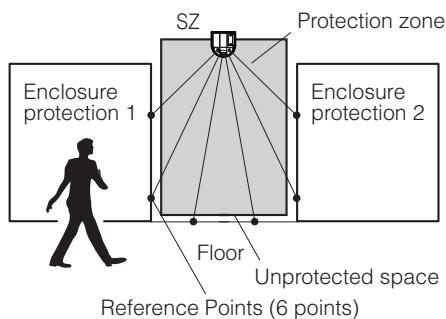
We recommend you should have a marking on the floor for indicating the specified protection zone.

3

Example of access protection 1 (Direction of approach normal to the protection zone)
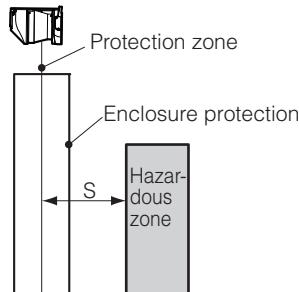
⚠ Danger

- 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 ±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.
  "2-9 Reference points monitoring function" (page 2-17)
- 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.
- According to GB 19436.3-2008, "if the maximum distance between the AOPDDR and the reference boundary is greater than 4.0 m, displacement of the detection zone greater than 100 mm shall be detected." In order to comply with this requirement for SZ, this may be achieved by limiting the width of the objects of the reference point to ≤200 mm. For the case where the maximum protection distance of the protection zone is over 4.0 m, this limitation must be followed.

Front view of the machine

SZ · Protection zone · Enclosure protection 1 · Enclosure protection 2 · Floor · Unprotected space · Reference Points (6 points)

Side view of the machine

Protection zone · Enclosure protection · S · Hazardous zone

S = (K x 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 (t1 + t2)
  t1: SZ response time in second
  t2: Max. time in second required to stop the machine after receiving the OSSD signal from SZ.
  C: Additional distance in millimeters, taking into accounts the intrusion prior to actuation of protective equipment.

■ Example of safety distance calculation

K = 1600 mm/s   Approach speed of the body or parts of the body
T = t1+t2 = 0.59 s   Overall response time
    t1 = 0.09 seconds   SZ response time (Changeable)
    t2 = 0.5 seconds   Max. time required to stop the machine after receiving the OSSD signal from SZ
C = 850 mm
    d = 70 mm   Minimum detectable object size
S = K x T + C = 1600 x 0.59 + 850 = 1794 mm
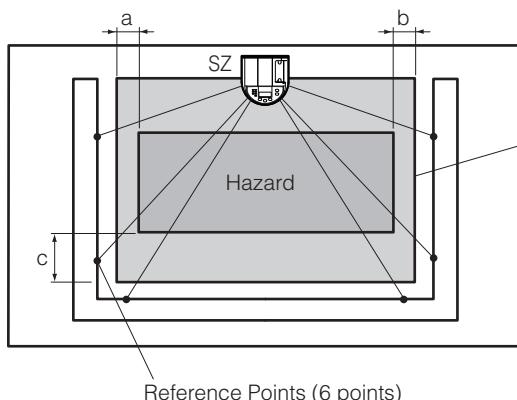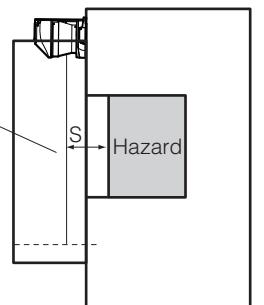
Example of access protection 2 (In case of approaching of the body or parts of the body to the hazardous area)

⚠ **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 ±30° to the detection plane). In this case, the tolerance for reference points must be ±100 mm or less and the response time muse be 90ms or less.
  📖 "2-9 Reference points monitoring function" (page 2-17)
- 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.

Front view of the machine   **Side view of the machine**

Reference Points (6 points)

S = (K x 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 (t1 + t2)
  - t1:   SZ response time in second
  - t2:   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 x (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 safety distance calculation

K = 2000 mm/sApproach speed of the parts of the body, such as hand and arm.
T = t1+t2 = 0.18sOverall response time
   t1 = 0.06 secondsSZ response time (Changeable)
   t2 = 0.12 secondsMax. time required to stop the machine after receiving the OSSD signal from SZ
C = 8 x (d-14) = 128 mm
   d = 30 mmMinimum detectable object size
S = K x T + C = 2000 x 0.18 + 128 = 488 mm
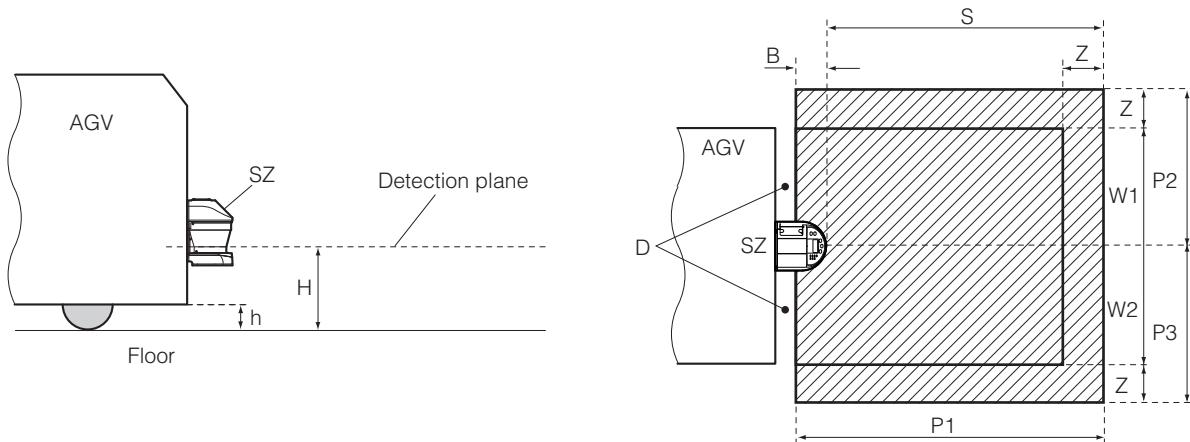
Note

If "S" is found to be greater than 500 mm using this formula, you can use "K=1,600 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 (t1 + t2)
  - t1: SZ response time in second
  - t2: 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.
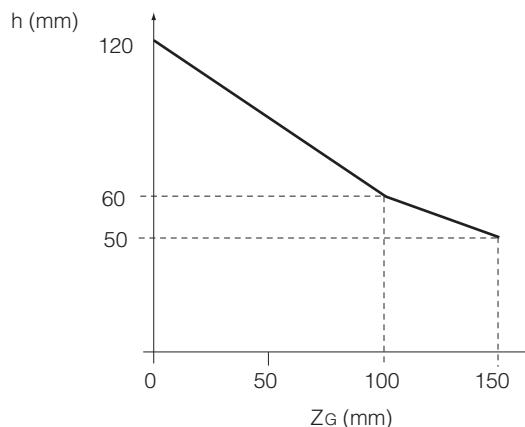
If the "h" is not enough ensured, you must take into account the risk that the toe or toe tip is caught between the ground (floor) and the AGV.
The relationship between "h" and "Z_G" is as follows.

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.

⚠ **Danger**

- 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 200 mm. 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 mm/s

T = $t1+t2$ = 0.19 s   Overall response time

　　$t1$ = 0.09 seconds   SZ response time (Changeable)

　　$t2$ = 0.1 seconds   Max. time in second that AGV responds after receiving the OSSD signal from SZ.

S_{brake} = 1,300 mm   Required distance for braking AGV in millimeters

L = 1.1　　　Safety coefficient for required distance based on the wear of braking

Z = $Z_{SZ}+Z_G$ = 100+100 = 200 mm   Additional distance in millimeters (mm),

　　Z_{SZ} = 100 mm   Supplementary necessary distance for SZ in millimeters

　　Z_G = 100 mm   Supplementary necessary distance in millimeters, if "h" is not enough.

　　h = 60 mm   Space between the reference plane (floor) and the bottom of AGV.

B = 45 mm　　Distance between the front edge of the SZ and protection zone origin on the SZ

$W1$ = $W2$ = 1,000 mm   Width of AGV

Safety Distances

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

Protection distances to be configured as the protection zones

$P1 = S + B$ = 1,960 mm $P2 = W1 + Z$ = 1,200 mm $P3 = W2 + Z$ = 1,200 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)

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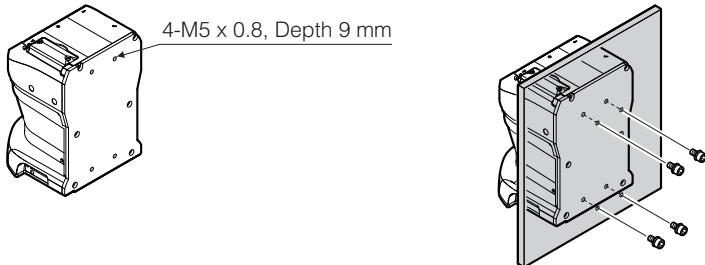
Reference   For more information about the dimensions of SZ or the mounting bracket, see . 📖 "9-3 Dimensions" (page 9-5)

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)

4-M5 x 0.8, Depth 9 mm
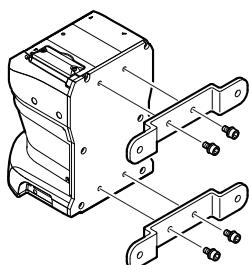
Mounting with horizontal mounting bracket (OP-86935)

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.

3

Installation to a Machine

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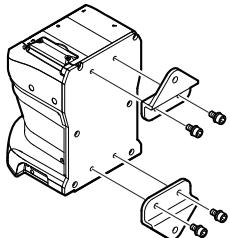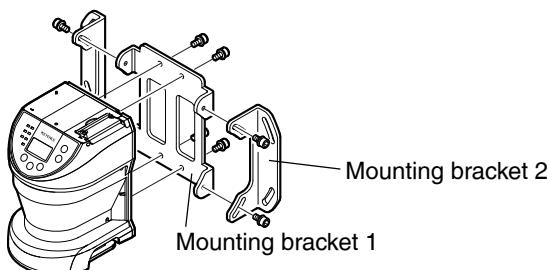
(2) You can install the SZ with vertical mounting bracket to the intended place. The M6 screws (2 screws) are necessary for installation of SZ itself, which can be prepared on your side.

Mounting with horizontal mounting bracket with angle alignment (OP-86937)
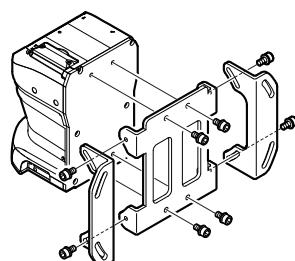
You can install the SZ with horizontal mounting bracket with angle alignment, which is suitable for the place with low height. Additionally, you can align the vertical angle of detection plane with ±7.5 degrees and the horizontal angle of detection plane with ±7.5 degrees.
(1) You can use four hexagon 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)

Front view

Rear view

Mounting bracket 2

Mounting bracket 1

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.

Front view   **Rear view**

Mounting bracket 2
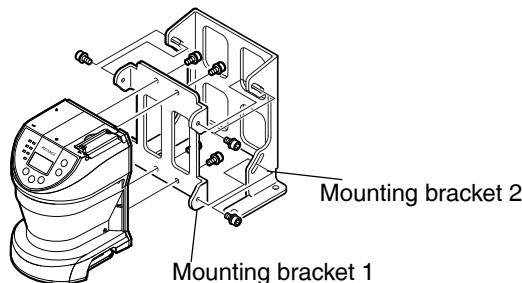
Mounting bracket 1

Mounting with L-shaped mounting bracket with angle alignment (OP-86939)
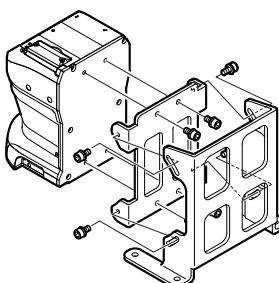
You can install the SZ with L-shaped mounting bracket with angle alignment, which is suitable for the installation on the reference plane, such as a floor. Additionally, you can align the vertical angle of detection plane with ±7.5 degrees.

(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)

Front view   **Rear view**

Mounting bracket 2

Mounting bracket 1

3

MEMO

4

Wiring

4-1 Precautions on wiring

⚠️ **Danger**

- 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 +24 V, 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.

Note

- The NPN output cable shield is connected to +24 V inside the SZ. When wiring, do not connect the shield to 0 V.
- The PNP output cable shield is connected to 0 V inside the SZ. When wiring, do not connect the shield to + 24 V.

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.

| Reference | For more information about the shape or model of the connector cable, see
📖 "Connector cable" (page 1-6). |
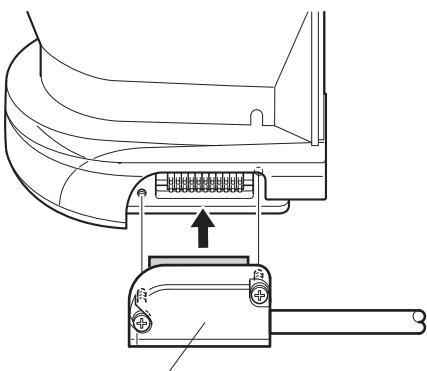
Note Do not remove the gray gasket mounted on the connector. The specification of IP65 cannot be fulfilled without this gasket.

■ **How to mount**
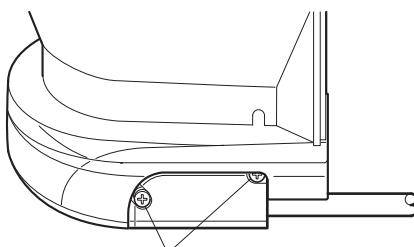
As shown in the figures below, you can use the M2.6 screws (2 screws) to mount the connector cable, and tighten the screws according to the specified tightening torque.

(Recommended tightening torque: 0.3 N·m)

1. 2.

PNP output type cable: Black
NPN output type cable: Gray

M2.6 screws
Recommended tightening torque: 0.3 N·m
Minimum cable bending radius: 5 mm

■ **Removal**

You can perform the removal of the connector cable in reverse order.

4-4 Wire color and assigned function

SZ-01S

Wire color	Function
Brown	+24 V
Blue	0 V
Black	OSSD1
White	OSSD2
Yellow	Input 1:Reset input / Check input
Red	Input 2:EDM input
Orange	AUX output 1
Orange/Black	AUX output 2

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■ Multi-OSSD function: Mode D

(1) In case of applying the bank switching function

Wire color	Function
Brown	+24 V
Blue	0 V
Black	OSSD1
White	OSSD2
Gray	OSSD3
Gray/Black	OSSD4
Yellow	Input 1:Reset input (for OSSD1/2) / Check input
Red	Input 2:EDM input (for OSSD1/2)
Light Blue	Input 3:Bank input 1
Light Blue/Black	Input 4:Bank input 2
Yellow/Black	Input 5:Reset input (for OSSD3/4)
Red/Black	Input 6:EDM input (for OSSD3/4)
Orange	AUX output 1
Orange/Black	AUX output 2
Pink	AUX output 3
Pink/Black	AUX output 4
Green	AUX output 5
Green/Black	AUX output 6

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Wiring

(2) In case of NOT applying the bank switching function

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

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

(1) In case of applying the bank switching function

Wire color	Function
Brown	+24 V
Blue	0 V
Black	OSSD1
White	OSSD2
Gray	OSSD3
Gray/Black	OSSD4
Yellow	Input 1:Reset input / Check input
Red	Input 2:EDM input (for OSSD1/2)
Light Blue	Input 3:Bank input 1
Light Blue/Black	Input 4:Bank input 2
Yellow/Black	Input 5:Bank input 3
Red/Black	Input 6:EDM input (for OSSD3/4/Bank input 4)
Orange	AUX output 1
Orange/Black	AUX output 2
Pink	AUX output 3
Pink/Black	AUX output 4
Green	AUX output 5
Green/Black	AUX output 6

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

Wire color	Function
Brown	+24 V
Blue	0 V
Black	OSSD1
White	OSSD2
Gray	OSSD3
Gray/Black	OSSD4
Yellow	Input 1:Reset input / Check input
Red	Input 2:EDM input (for OSSD1/2)
Light Blue	Input 3:Muting input 1
Light Blue/Black	Input 4:Muting input 2
Yellow/Black	Input 5:Override input
Red/Black	Input 6:EDM input (for OSSD3/4)
Orange	AUX output 1
Orange/Black	AUX output 2
Pink	AUX output 3
Pink/Black	AUX output 4
Green	AUX output 5
Green/Black	AUX output 6

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

Wire color	Function
Brown	+24 V
Blue	0 V
Black	OSSD1
White	OSSD2
Gray	OSSD3
Gray/Black	OSSD4
Yellow	Input 1:Reset input / Check input
Red	Input 2:EDM input (for OSSD1/2)
Light Blue	Input 3:Teach mode input
Light Blue/Black	Input 4:Teach ready input
Yellow/Black	Input 5:Override input
Red/Black	Input 6:EDM input (for OSSD3/4)
Orange	AUX output 1
Orange/Black	AUX output 2
Pink	AUX output 3
Pink/Black	AUX output 4
Green	AUX output 5
Green/Black	AUX output 6

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

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Wiring

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Wiring

(4) In case of NOT applying bank switching, muting function and the suspension in teaching mode

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

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/SZ-16D

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

4-5 Examples of wiring

SZ-01S

Note
- The NPN output cable <u>shield</u> is connected to +24 V inside the SZ. When wiring, do not connect the <u>shield</u> to 0 V.
- The PNP output cable <u>shield</u> is connected to 0 V inside the SZ. When wiring, do not connect the <u>shield</u> to + 24 V.

■ 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 (S1) 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 (S1) 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.

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SZ-04M

Note	• The NPN output cable <u>shield</u> is connected to +24 V inside the SZ. When wiring, do not connect the <u>shield</u> to 0 V. • The PNP output cable <u>shield</u> is connected to 0 V inside the SZ. When wiring, do not connect the <u>shield</u> to + 24 V.

■ 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.

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● **For the NPN output type cable**

K1, K2, K3, K4:   External device (Safety relay, magnet contactor, tc.)
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 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.

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Wiring

■ **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, the yellow wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
- 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.)
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, the yellow wire should be short-circuited to 0 V.
• When "Not use" is applied as the operation mode for OSSD3/4, red/black is assigned to bank input 4 in this case.
• 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.

■ **Multi-OSSD function: Mode A, B, C and Not use**
Configuration of start/restart mode: Manual/Manual
In case of applying the muting function
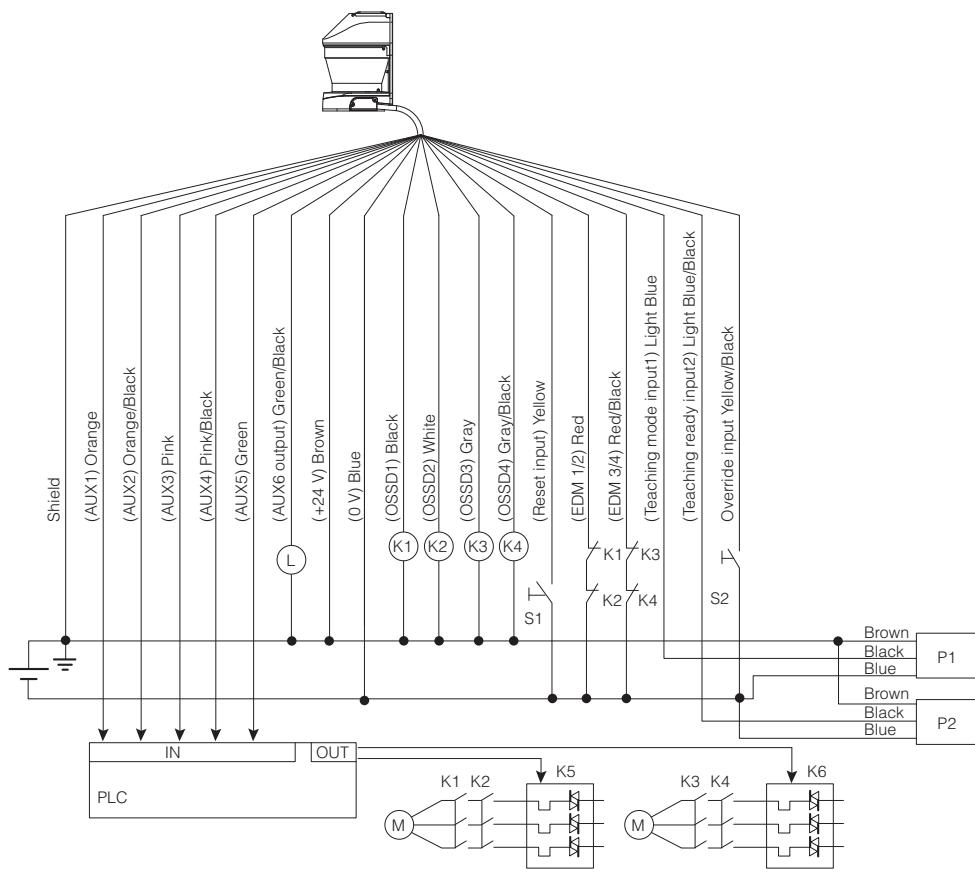
● **For the PNP output type cable**

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, the yellow 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**

Wire labels (top to bottom on the connections):
Shield, (AUX1) Orange, (AUX2) Orange/Black, (AUX3) Pink, (AUX4) Pink/Black, (AUX5) Green, (AUX6 output) Green/Black, (+24 V) Brown, (0 V) Blue, (OSSD1) Black, (OSSD2) White, (OSSD3) Gray, (OSSD4) Gray/Black, (Reset input) Yellow, (EDM 1/2) Red, (EDM 3/4) Red/Black, (Teaching mode input1) Light Blue, (Teaching ready input2) Light Blue/Black, Override input Yellow/Black

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, the yellow 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)
- 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.

4

Wiring

■ **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, the yellow 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, the yellow 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)
- 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.

4

SZ-16V/SZ-16D

> **Note**
> • The NPN output cable <u>shield</u> is connected to +24 V inside the SZ. When wiring, do not connect the <u>shield</u> to 0 V.
> • The PNP output cable <u>shield</u> is connected to 0 V inside the SZ. When wiring, do not connect the <u>shield</u> to + 24 V.

### ■ 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, 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 is NON SAFETY-RELATED system.

● **For the NPN output type cable**
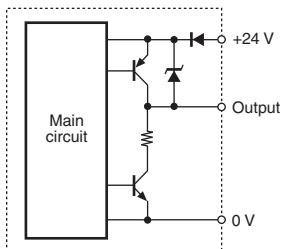
K1 K2:   External device
          (Safety relay, magnet contactor, etc.)
K3:   Solid state contactor
S1:   Switch for reset operation (N.O.)

• 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, 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 is NON SAFETY-RELATED system.
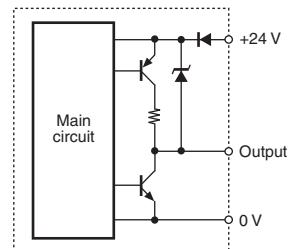
## 4-6 Input / output circuit

OSSD output circuit (Safety output)

For the PNP output type cable
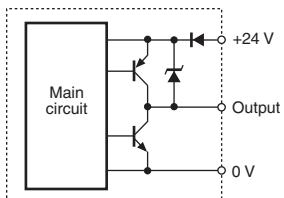
For the NPN output type cable
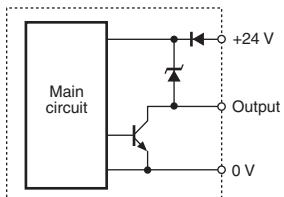
AUX output circuit (Non-safety output)

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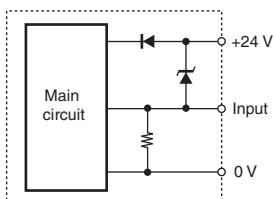
Muting lamp output

Common for the PNP output type cable /
NPN output type cable
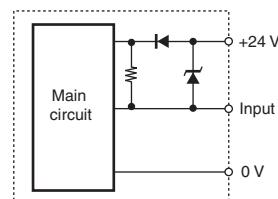
Input circuit

For the PNP output type cable

For the NPN output type cable

5

Manual Configuration on the SZ

5-1 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 and SZ-16D must be configured through SZ Configurator because the system does not provide for manual configuration on the SZ.
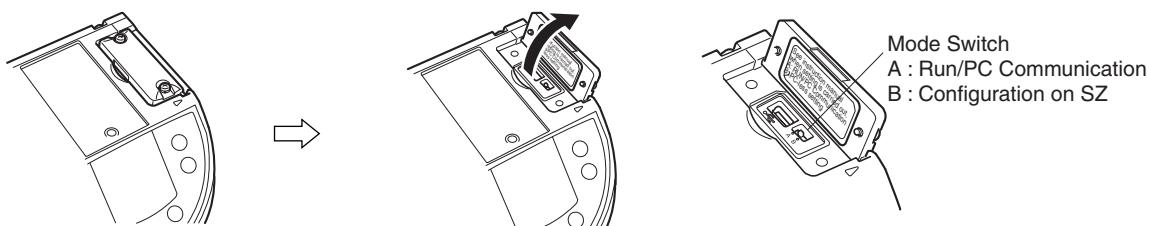
Reference See ☐ "Configuration of Others" (page 5-17) for setting password on the SZ-01S and SZ-04M, or
☐ "5-3 Manual configuration for SZ-16V" (page 5-20). Password settings and changes cannot be made from the main body of the communication type.
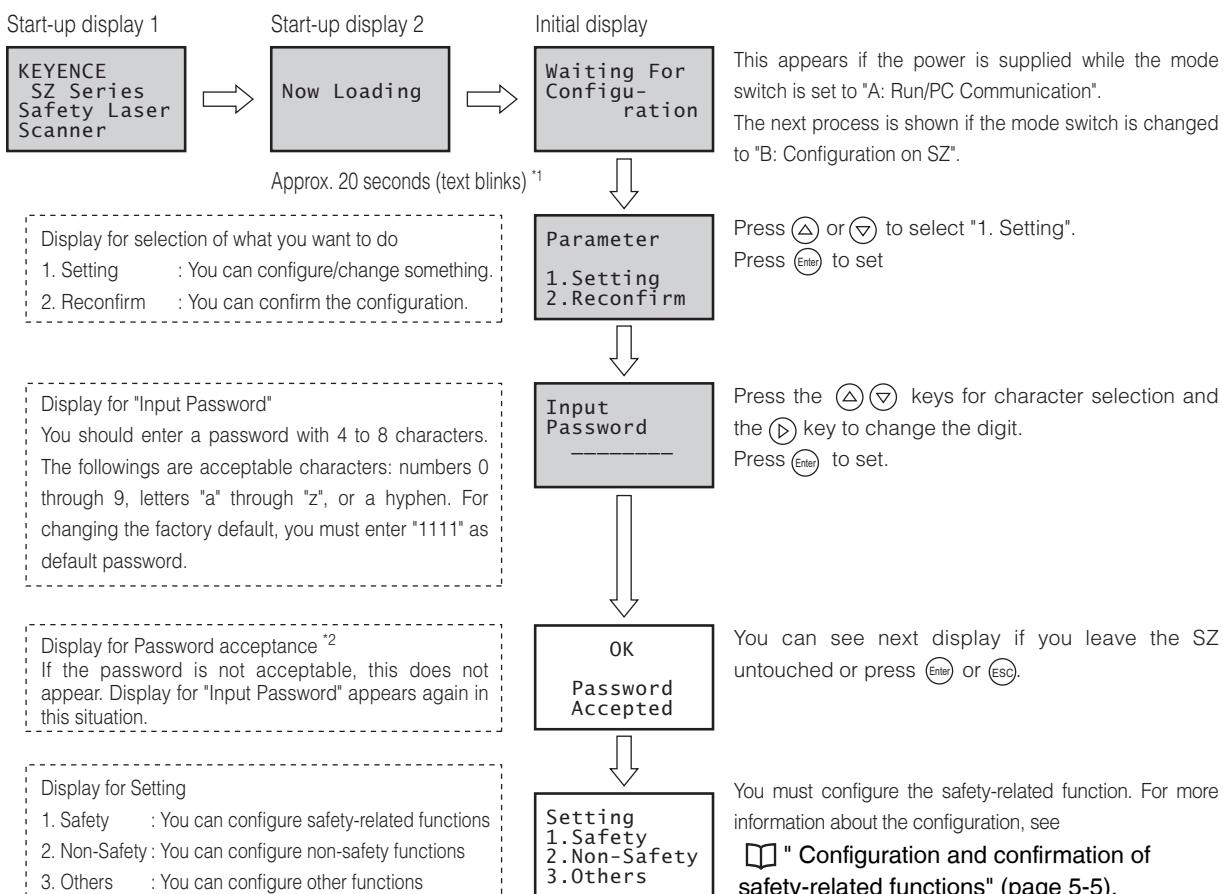
1 Two screws must be loosed to open the setting cover. (The setting cover must be closed after completing the configuration, and then two screws must be tightened. (Recommended tightening torque: 0.3 N·m))

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

```
KEYENCE
 SZ Series
Safety Laser
Scanner
```

Start-up display 2

```
Now Loading
```

Approx. 20 seconds (text blinks) *1

Initial display

```
Waiting For
Configu-
      ration
```

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".

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

```
Parameter

1.Setting
2.Reconfirm
```

Press ⊙ or ⊙ to select "1. Setting".
Press (Enter) to set

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.

```
Input
Password
   _____
```

Press the ⊙⊙ keys for character selection and the ⊙ key to change the digit.
Press (Enter) to set.

Display for Password acceptance *2
If the password is not acceptable, this does not appear. Display for "Input Password" appears again in this situation.

```
   OK

Password
Accepted
```

You can see next display if you leave the SZ untouched or press (Enter) or (ESC).

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

```
Setting
1.Safety
2.Non-Safety
3.Others
```

You must configure the safety-related function. For more information about the configuration, see
☐ " Configuration and confirmation of safety-related functions" (page 5-5).

*1 If the main body of the SZ is not Ver.2 or newer, it will take approximately 50 seconds.

*2 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.

```
        OK
 Recommend to
    Change
   Password
```

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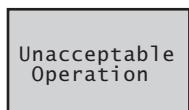
```
   Failed

    Wrong
  Password
```

Note	The configuration for safety-related functions and the others cannot be performed without the password (ex. when you forget password). Store the password carefully. 📖 "When you forget the password" (page 6-57)

5

Manual Configuration on the SZ

| 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". |

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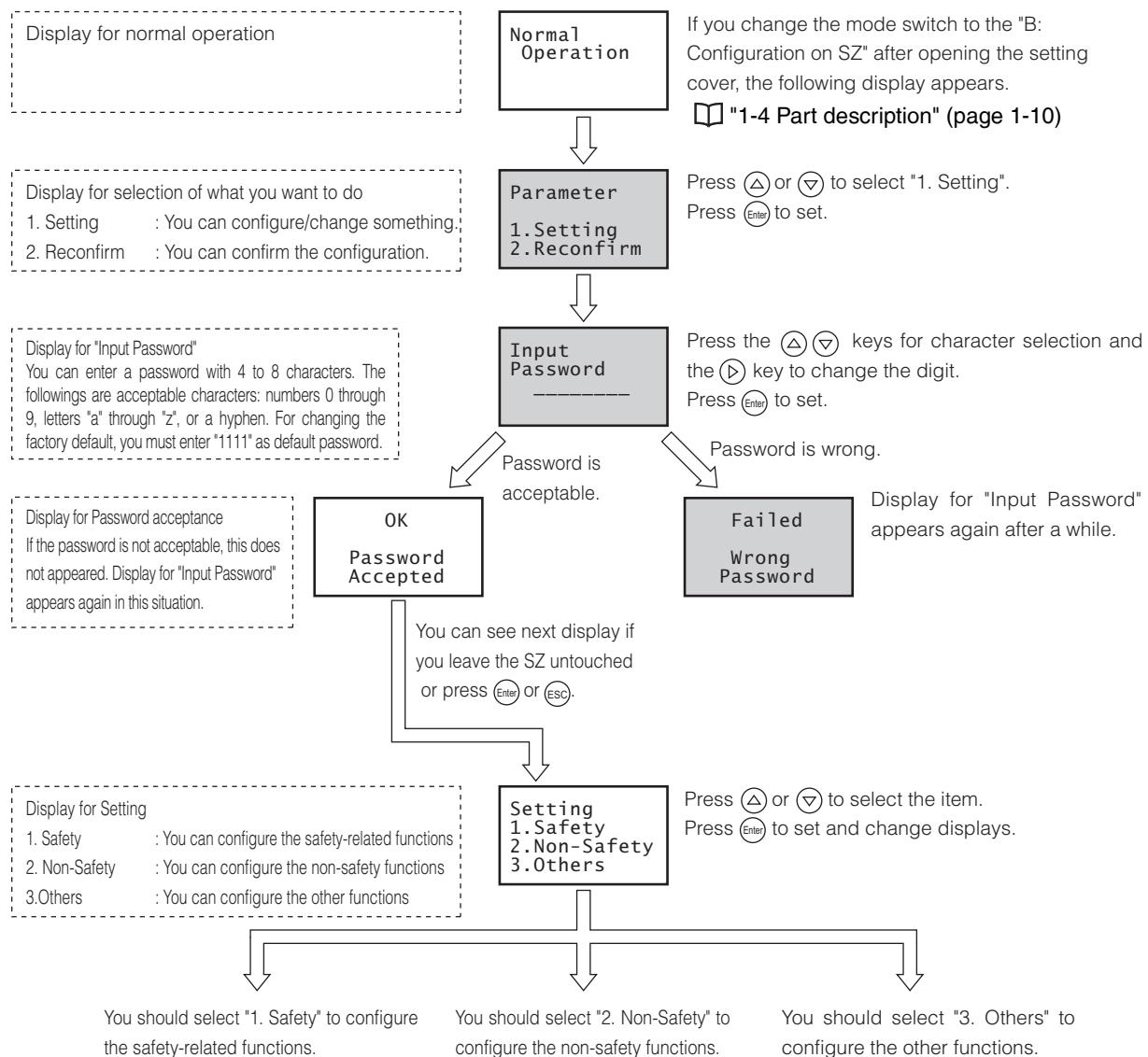
If you want to perform the manual configuration on the SZ, such as the configuration for "1. Safety" or "2. Non-Safety", you must initialize the configuration that was carried out through the SZ Configurator. For more information, see 📖 " Configuration of Others" (page 5-17).

• It is necessary for the SZ-16V and the SZ-16D 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

```
Normal
 Operation
```

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

📖 "1-4 Part description" (page 1-10)

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

```
Parameter
1.Setting
2.Reconfirm
```

Press Ⓐ or Ⓥ to select "1. Setting".
Press Ⓔⓝⓣⓔⓡ to set.

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.

```
Input
Password
_____
```

Press the Ⓐ Ⓥ keys for character selection and the Ⓓ key to change the digit.
Press Ⓔⓝⓣⓔⓡ to set.

Password is acceptable.

Password is wrong.

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

```
OK

Password
Accepted
```

```
Failed

Wrong
Password
```

Display for "Input Password" appears again after a while.

You can see next display if you leave the SZ untouched or press Ⓔⓝⓣⓔⓡ or Ⓔⓢⓒ.

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

```
Setting
1.Safety
2.Non-Safety
3.Others
```

Press Ⓐ or Ⓥ to select the item.
Press Ⓔⓝⓣⓔⓡ to set and change displays.

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.

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.

```
Unacceptable
 Operation
```

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 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.

```
Setting
1.Safety
2.Non-Safety
3.Others
```

Press ⊝ or ⊝ to select "1. Safety".
Press ⊝ to set.

Display for configuration of start/restart mode*1
Manual   : Manual start / Manual restart
Automatic : Automatic start / Automatic restart

```
11.Start/
    Restart
    Manual
```

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

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

```
12.EDM

    Enable
```

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

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

```
13.Detection
   Capability
        70mm
```

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

Display for the configuration of response time*2
60 to 480 ms are options

```
14.Response
    Time
       120ms
```

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

Display for the configuration of protection zone*3
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

```
15.Zone□□●□□
    □□↓□□
Front  □□↑□□
1400  M1350
```

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

(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 flat board.

```
16.Zone□□●→→
   □□□□□
Left  □□□□□
700  M 700
```

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

```
17.Zone←←●□□
   □□□□□
Right □□□□□
700  M 750
```

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

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

```
Save?

No      Yes
```

In case of "Yes", press ⊝ .

To 📖 "Confirmation procedure" (page 5-9)

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.
📖 "2-6 Response time and scan cycle" (page 2-11)
*3 You can only configure the quadrate and rectangular protection zone through the manual configuration on the SZ.
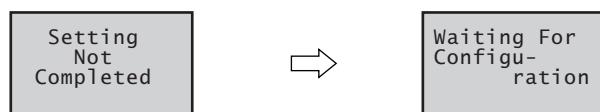
5

Manual Configuration on the SZ
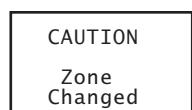
| Note |

- Press (ESC) 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.)

```
Setting
Canceled
```
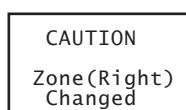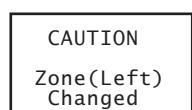
- If you change the mode switch to "A: RUN/PC Communication" without confirmation procedures, the following display appears to show that the SZ is waiting for the configuration.
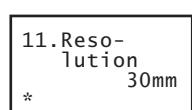
```
Setting
    Not
Completed
```
⟹
```
Waiting For
Configu-
      ration
```

- 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)

```
CAUTION

  Zone
Changed
```

- 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.

```
CAUTION

Zone(Left)
 Changed
```
```
CAUTION

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

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

```
11.Reso-
   lution
        30mm
*
```
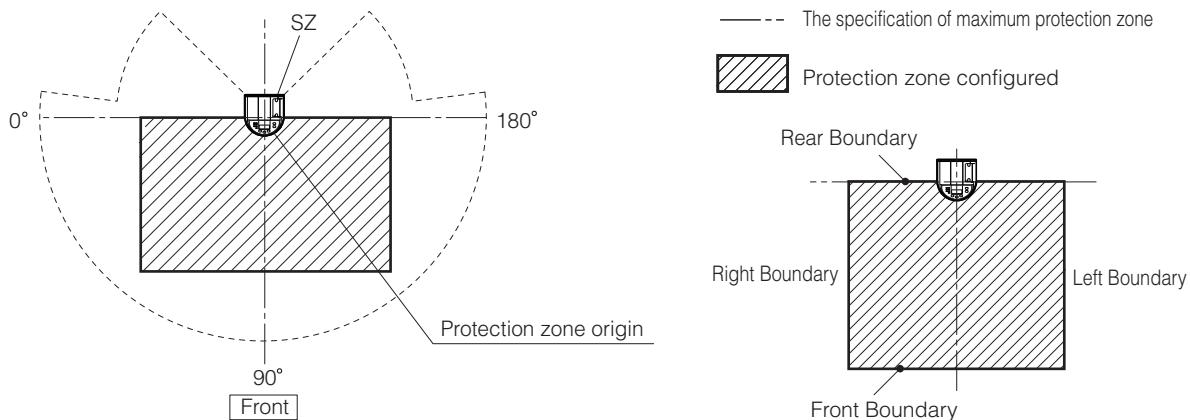
■ **Details of display for the configuration of protection zone**

📖 "2-3 Protection zone" (page 2-6)

● **Example of Protection zone**
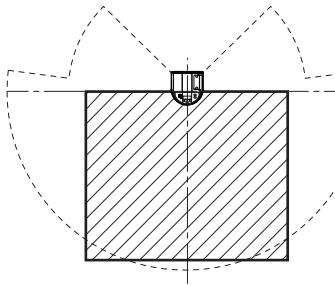
● **Condition for the configuration of protection zone**

You can configure the protection zone on the SZ under the following condition. The following conditions are always applicable.
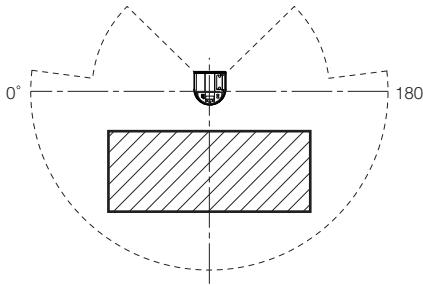
(1) The shape of the protection zone must be the quadrate or rectangular.

(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 100 mm or more. The distance from the protection zone origin to the left or right boundary must be also 100 mm or more.

<Example of unconfigurable protection zone>
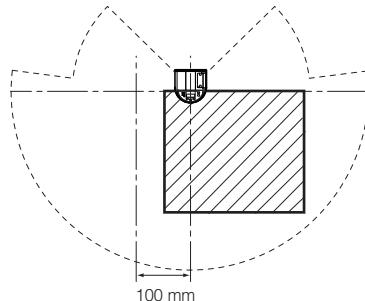
The following protection zone is beyond the specification of maximum protection zone

The rear boundary of protection zone is not on the line including the protection zone origin
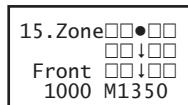
The distance from the protection zone origin to the right boundary is less than 100 mm
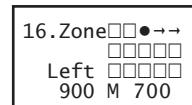
● **Detail procedure for the configuration of protection zone**

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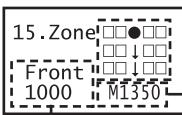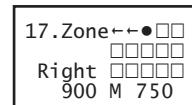
15. Display for Front boundary   16. Display for Left boundary   17. Display for Right boundary

```
15.Zone□□●□□
     □□↓□□
Front □□↓□□
  1000 M1350
```

```
16.Zone□□●→→
     □□□□□
Left □□□□□
  900 M 700
```

```
17.Zone←←●□□
     □□□□□
Right □□□□□
  900 M 750
```

```
15.Zone□□●□□
     □□↓□□
Front □□↓□□
1000 M1350
```
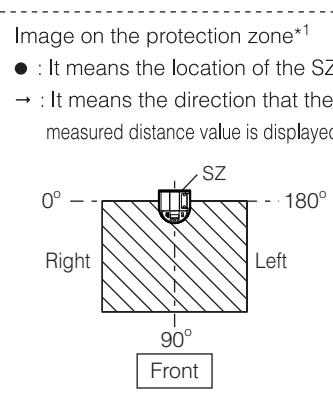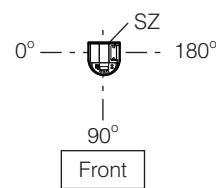
The distance of protection zone

It indicates that the distance from the protection zone origin to each boundary. (Unit: "mm" or "inch") You must determine these distances to configure the protection zone.

Front : The distance to front boundary
Left : The distance to left boundary
Right : The distance to right boundary

Measured distance value (monitoring)[2]

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).
(Unit: "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 flat board.

Image on the protection zone[1]
● : It means the location of the SZ
→ : It means the direction that the measured distance value is displayed.

*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 execeeds 9,999 mm.

Reference • You can set the actual measured distance value as the distance of protection zone if you press both △ and ▽ 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.
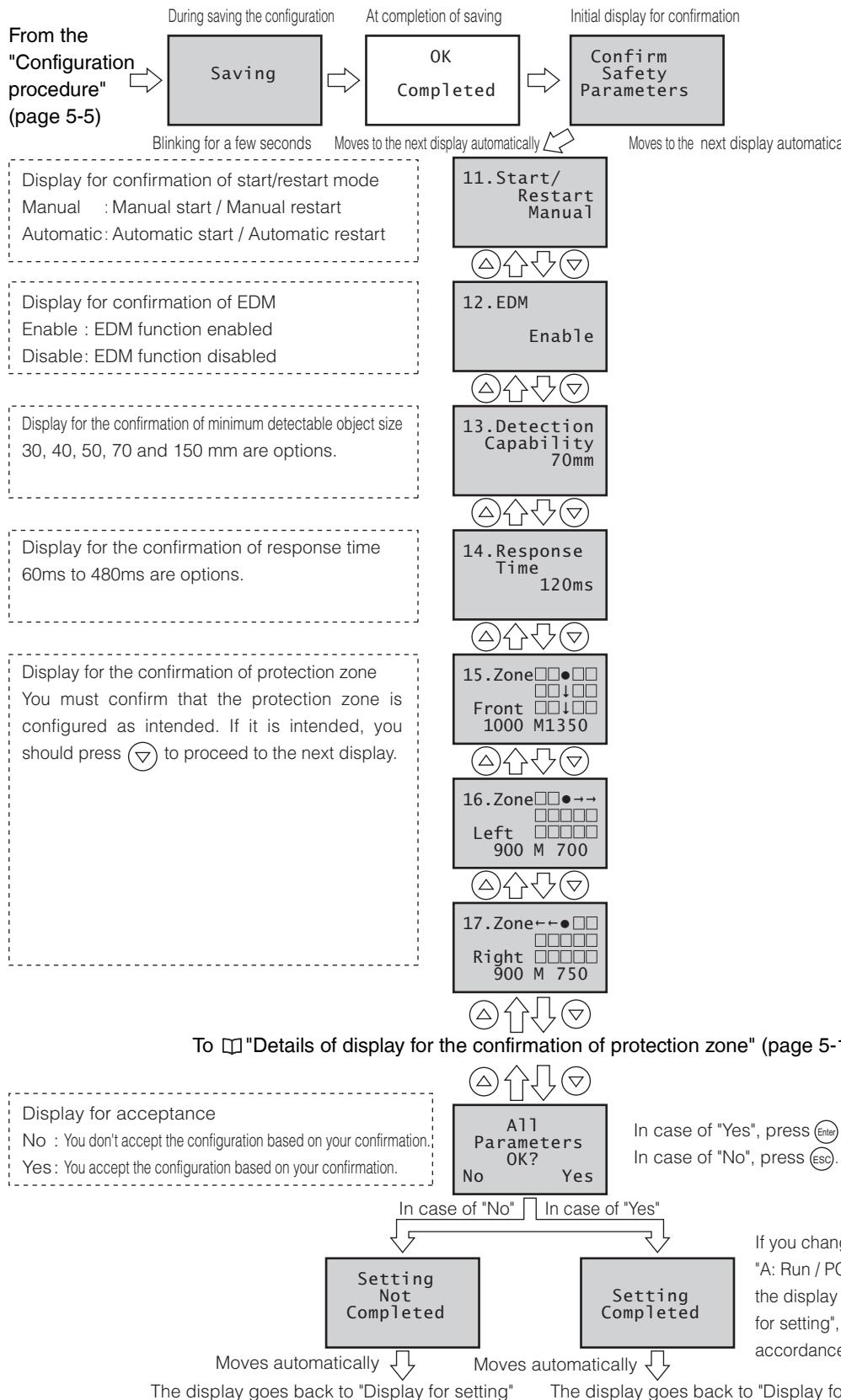
If you find the following display, you must reconfigure the protection zone according to the specification.

```
Over
Range
```

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

■ **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.

During saving the configuration   At completion of saving   Initial display for confirmation

From the "Configuration procedure" (page 5-5) ⇨

Saving

⇨

OK Completed

⇨

Confirm Safety Parameters

Blinking for a few seconds   Moves to the next display automatically   Moves to the next display automatically

Display for confirmation of start/restart mode
Manual   : Manual start / Manual restart
Automatic: Automatic start / Automatic restart

11.Start/
   Restart
      Manual

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

12.EDM   Enable

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

13.Detection
   Capability
       70mm

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

14.Response
   Time
      120ms

Display for the confirmation of protection zone
You must confirm that the protection zone is configured as intended. If it is intended, you should press ▽ to proceed to the next display.

15.Zone□□●□□   □□↓□□ Front □□↓□□ 1000 M1350

16.Zone□□●→→   □□□□□ Left   □□□□□ 900 M 700

17.Zone←←●□□   □□□□□ Right □□□□□ 900 M 750

To 📖 "Details of display for the confirmation of protection zone" (page 5-11)

Display for acceptance
No : You don't accept the configuration based on your confirmation.
Yes: You accept the configuration based on your confirmation.

All Parameters OK? No   Yes

In case of "Yes", press (Enter).
In case of "No", press (esc).

In case of "No" | In case of "Yes"

Setting Not Completed

Setting Completed

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.

Moves automatically ⬇   Moves automatically ⬇
The display goes back to "Display for setting"   The display goes back to "Display for setting"

5

Manual Configuration on the SZ

5

Note

• If you press the ⊙(Enter) at each step, the following display appears.

```
   Cancel?

No        Yes
```

If you select "No" (press (ESC)), the display goes back to the confirmation procedure.
If you select "Yes" (press (Enter)), 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.

```
   Setting
     Not
  Completed
```
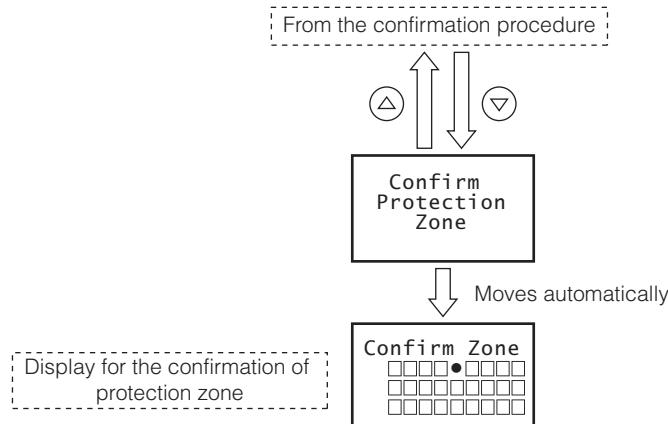
• If you change the mode switch to "A: RUN/PC Communication" without completing the confirmation procedure, the following display appears to show that the SZ is waiting for the configuration.

```
   Setting
     Not
  Completed
```
⟹
```
Waiting For
Configu-
      ration
```
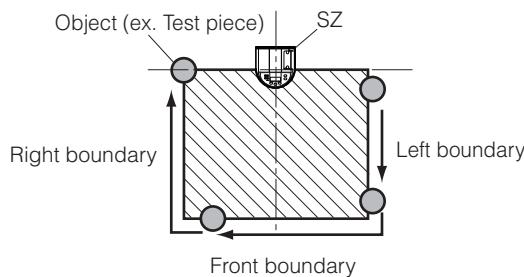
■ **Details of display for the confirmation of protection zone**

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.
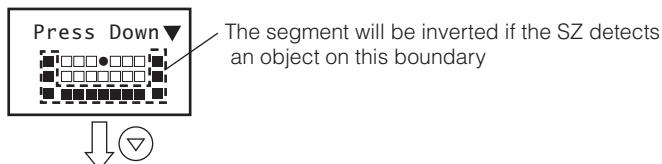
● **The sequence of confirmation**

(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 $\bigtriangledown$ at this moment.

| 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 $\bigtriangledown$ in this situation, the following display appears, and then the display goes back to the "display for the confirmation of protection zone".

```
Confirmation
    Not
 Completed
```

Reference You can perform the confirmation fro boundary in any order.

Configuration of Non-safety Function

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

```
Unacceptable
 Operation
```

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 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.
```

```
Setting
1.Safety
2.Non-Safety
3.Others
```

Press (△) or (▽) to select "2. Non-Safety".
Press (Enter) to set.

```
Display for the configuration on AUX1
OSSD State Output:"OSSD state output"
(page 2-37)
Error/Alert Output:"Error or alert output"
(page 2-37)
```

```
21.AUX1

OSSD State
 Output
```

Press (Enter) , and then the third and forth row blinks.
Press (△) or (▽) to change the AUX1 function.
Press (Enter) to set.

```
Display for the configuration on AUX2
Error/Alert Output:"Error or alert output"
(page 2-37)
Warning Zone Output:"Output for detection in
the warning zone" (page 2-38)
```

```
22.AUX2

 Error
 Output
```

Press (Enter) once, and then the third and forth row blinks.
Press (△) or (▽) to change the AUX2 function.
Press (Enter) to set.

| You go to the "A" in page 5-14 if you select "Warning Zone Output". |

```
Display for saving the configuration
Yes:You save the configuration to the SZ.
No :You don't save the configuration to the SZ.
```

```
Save?

No      Yes
```

In case of "Yes", press (Enter).
In case of "No", press (Esc).

In case of "No" → Display goes back to the "Display for the configuration on AUX1".

In case of "Yes"

```
Saving
```
Blinking in a few seconds

```
Setting
Completed
```
Moves automatically

Display goes back to the "Display for setting".

5

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.)

```
Setting
Canceled
```

- 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 2-8)

```
CAUTION

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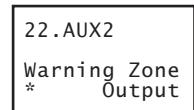
- If you change the current configuration for the distance (1) of the warning zone, the following display may appear, and then the distance (2) and (3) of the warning zone may be automatically changed accordingly in order to meet the specification of maximum warning zone according to the new warning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

```
CAUTION

Zone(Left)
Changed
```

```
CAUTION

Zone(Right)
Changed
```

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

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

<Example>

```
22.AUX2

Warning Zone
*      Output
```

5

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

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

```
23.Detection
   Capability
        70mm
 (Warning-Z)
```

Press (Enter) , and then the third row blinks.
Use the (△) (▽) keys to change the minimum detectable object size.
Press (Enter) to set.

Display for the configuration of response time*1
60ms to 480 ms are options
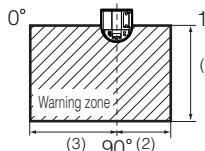
```
24.Response
     Time
        60ms
 (Warning-Z)
```

Press (Enter) , and then the third row blinks.
Use the (△) (▽) keys to change the response time.
Press (Enter) to set.

Display for the configuration of warning zone*3
Refer to 📖 "Details of display for the configuration of warning zone" (page 5-15)
(1) to (3) : The distance of warning zone

0 to maximum distance in units of 10 mm

0°   180°

(1)

Warning zone

(3)   90° (2)

(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.

```
25.Zone□□●□□
   □□↓□□
 Front □□↓□□
  1600 M1350
(1)        (4)
```

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

```
26.Zone□□●→→
   □□□□□
 Left  □□□□□
  900 M 700
(2)        (5)
```

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

```
27.Zone←←●□□
   □□□□□
 Right □□□□□
  900 M 750
(3)        (6)
```

Press (Enter), and then the item 3 blinks.
Use the (△) (▽) keys to change the distance (3) of protection zone.
Press (Enter) to set.
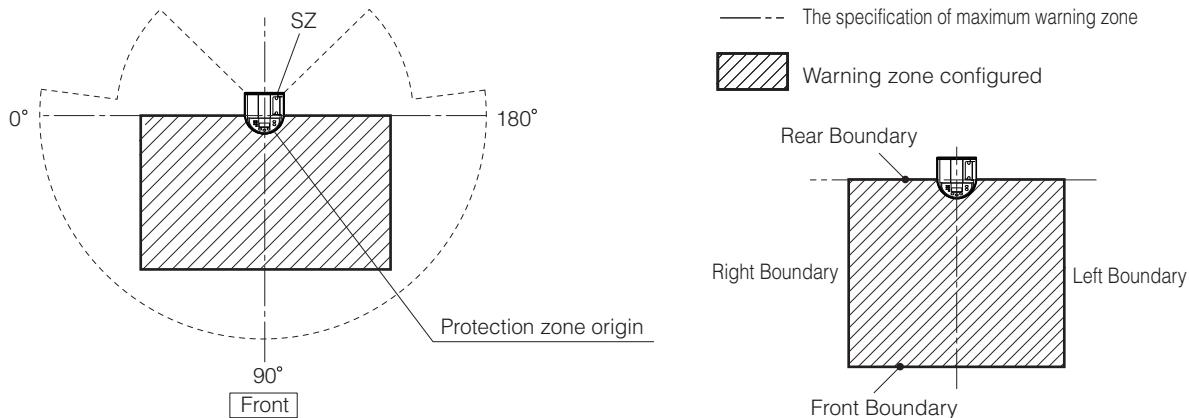
* When the configuration is made using the SZ, the shape of the protection zone is limited to a quadrate or rectangle.

■ **Details of display for the configuration of warning zone**

📖 "2-4 Warning zone" (page 2-8)

● **Example of warning zone**

──── ─ ─ ─ The specification of maximum warning zone

▨▨▨ Warning zone configured
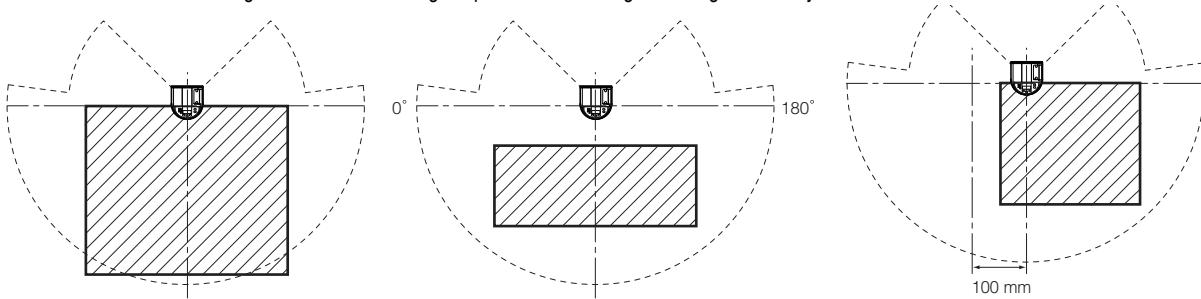
● **Condition for the configuration of warning zone**

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 100 mm or more. The distance from the protection zone origin to the left or right boundary must be also 100 mm or more.

<Example of unconfigurable warning zone>
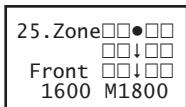
The following warning zone is beyond the specification of maximum warning zone

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 100 mm

100 mm
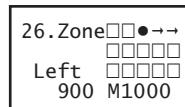
● **Detail procedure for the configuration of warning zone**

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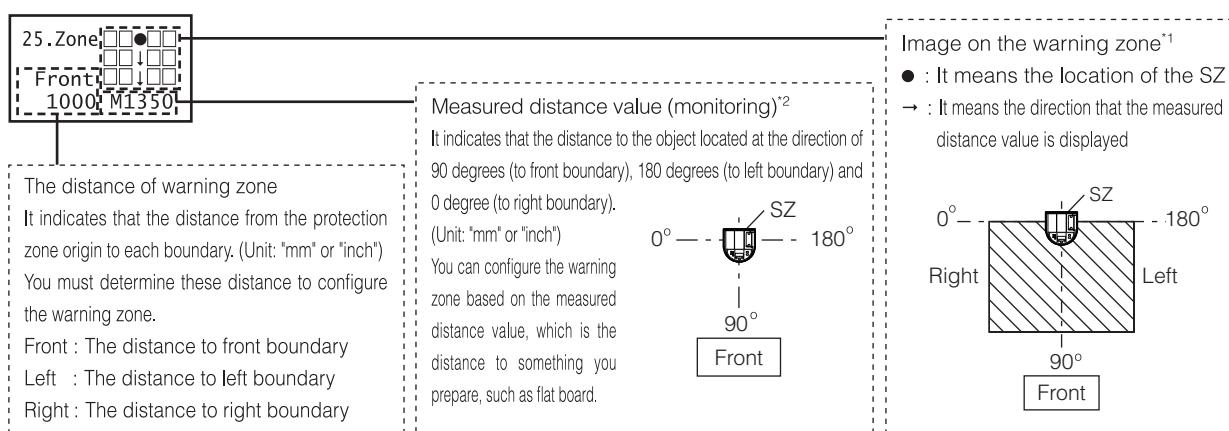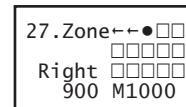
25. Display for Front boundary   26. Display for Left boundary   27. Display for Right boundary

```
25.Zone□□●□□
      □□↓□□
Front □□↓□□
   1600 M1800
```

```
26.Zone□□●→→
      □□□□□
Left  □□□□□
    900 M1000
```

```
27.Zone←←●□□
      □□□□□
Right □□□□□
    900 M1000
```

```
25.Zone□□●□□
      □□↓□□
Front □□↓□□
   1000 M1350
```

The distance of warning zone

It indicates that the distance from the protection zone origin to each boundary. (Unit: "mm" or "inch") You must determine these distance to configure the warning zone.

Front : The distance to front boundary
Left   : The distance to left boundary
Right : The distance to right boundary

Measured distance value (monitoring)[2]

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).
(Unit: "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.

Image on the warning zone[1]
● : It means the location of the SZ
→ : It means the direction that the measured distance value is displayed

[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 9,999 mm.

| Reference |

● 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.

```
Over
Range
```

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

Configuration of Others

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

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.

```
Setting
1.Safety
2.Non-Safety
3.Others
```

Press △ or ▽ to select "3. Others".
Press (Enter) to set .

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.

```
31.Change
   Password
```

(ESC)
(Enter)

```
Input
New Password
--------
```

Press the △ ▽ keys for character selection and the ▷ key to change the digit. Press (Enter) to set.

```
Confirm
New Password
********
```

Press (Enter) after confirmation of password.

Reserved for future use.

```
32.Reserved
   For Future
   Use
```

```
   OK

Completed
```

To "Display for setting".

Display for initialization

You can bring all configurations, except for password, back to the factory default.

Yes : Initialize   No : Not initialize

```
33.Initiali-
   zation
```

(ESC)
(Enter)

```
Start
Initiali-
   zation
No      Yes
```

Press (ESC) in case of "No".
Press (Enter) in case of "Yes" [2].

Display for contrast setting

You can change the contrast of the display.
You can get high brightness if you increase the number.

```
34.Contrast

        6
```

Press (Enter), and then the third row blinks
Use the △ ▽ keys to change the number
Press (Enter) to set.

Hold down ▽ for over 3 seconds.

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.

```
35.Change
   Unit

        mm
```

Press (Enter) , and then the third row blinks
Use the △ ▽ keys to change the units
Press (Enter) to set.

[Reference] When setting the contrast settings of the communication type (SZ-16D), refer to ▭ "Contrast settings (SZ-16D)" (page 5-32).

5
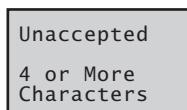
Manual Configuration on the SZ

*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.

```
  OK
Completed
```

Leave the SZ untouched or press (Enter) or (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.

```
Unaccepted

4 or More
Characters
```
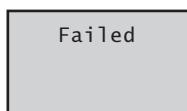
Press (Enter) or (Esc) to go back to the "Display for password change".
Enter new password with 4 characters or more.

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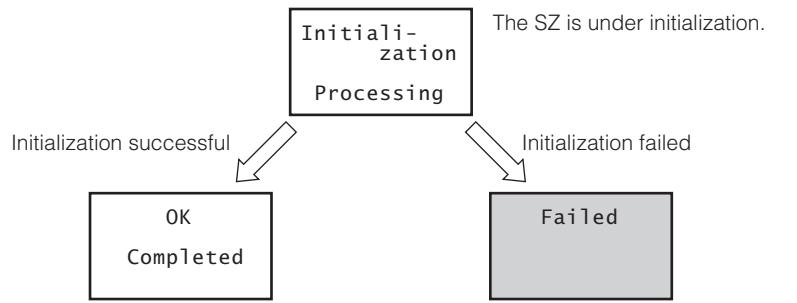
```
  Failed
```

Press (Enter) or (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 6-57)

*2 The following display appears if you perform the initialization.
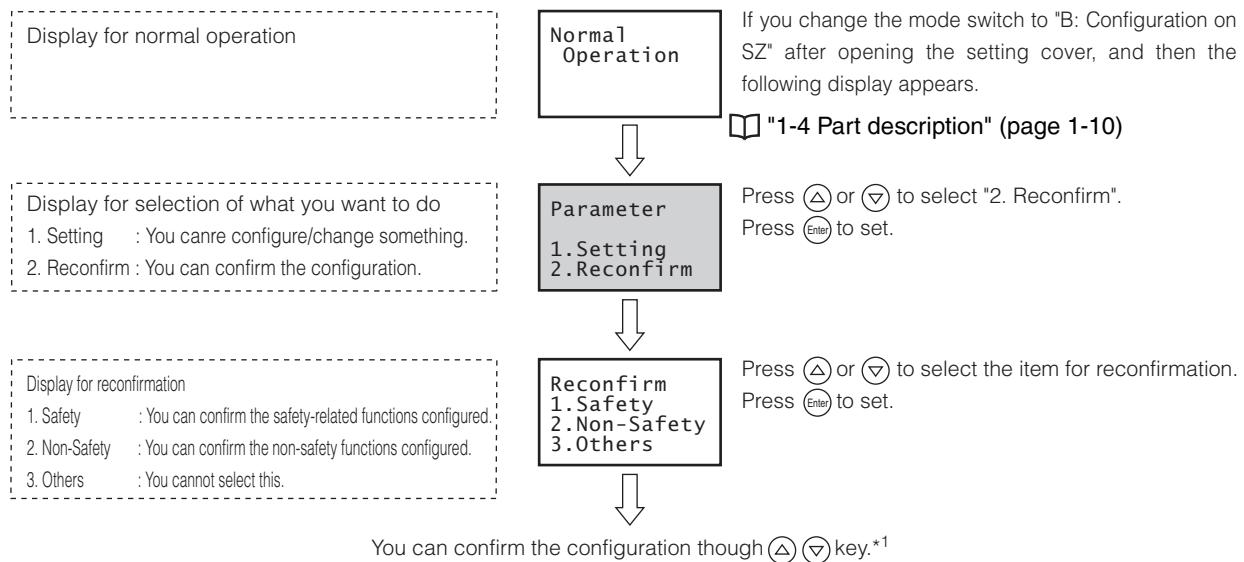
```
Initiali-
    zation

Processing
```

The SZ is under initialization.

Initialization successful

Initialization failed

```
   OK
Completed
```

```
  Failed
```

Leave the SZ untouched or press (Enter) or (Esc) to go back to the " Display for initialization"

Press (Enter) or (Esc) to go back to the "Display for initialization".
You should perform the initialization again.

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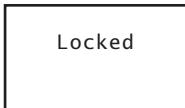
Note
- If the SZ Configurator is used to configure the SZ, you cannot reconfirm the configurations on the SZ.
- It is necessary for the SZ-16V and SZ-16D to reconfirm the configurations through the SZ Configurator, because it does not provide the system for the manual configuration on the SZ.

Display for normal operation

```
Normal
 Operation
```

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

📖 "1-4 Part description" (page 1-10)

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

```
Parameter
1.Setting
2.Reconfirm
```

Press (△) or (▽) to select "2. Reconfirm".
Press (Enter) to set.

Display for reconfirmation
1. Safety : You can confirm the safety-related functions configured.
2. Non-Safety : You can confirm the non-safety functions configured.
3. Others : You cannot select this.

```
Reconfirm
1.Safety
2.Non-Safety
3.Others
```

Press (△) or (▽) to select the item for reconfirmation.
Press (Enter) to set.

You can confirm the configuration though (△) (▽) key.*1

*1 You cannot change the configuration in reconfirmation procedure.
If you press (Enter) at each step, the following display apears.

```
Locked
```
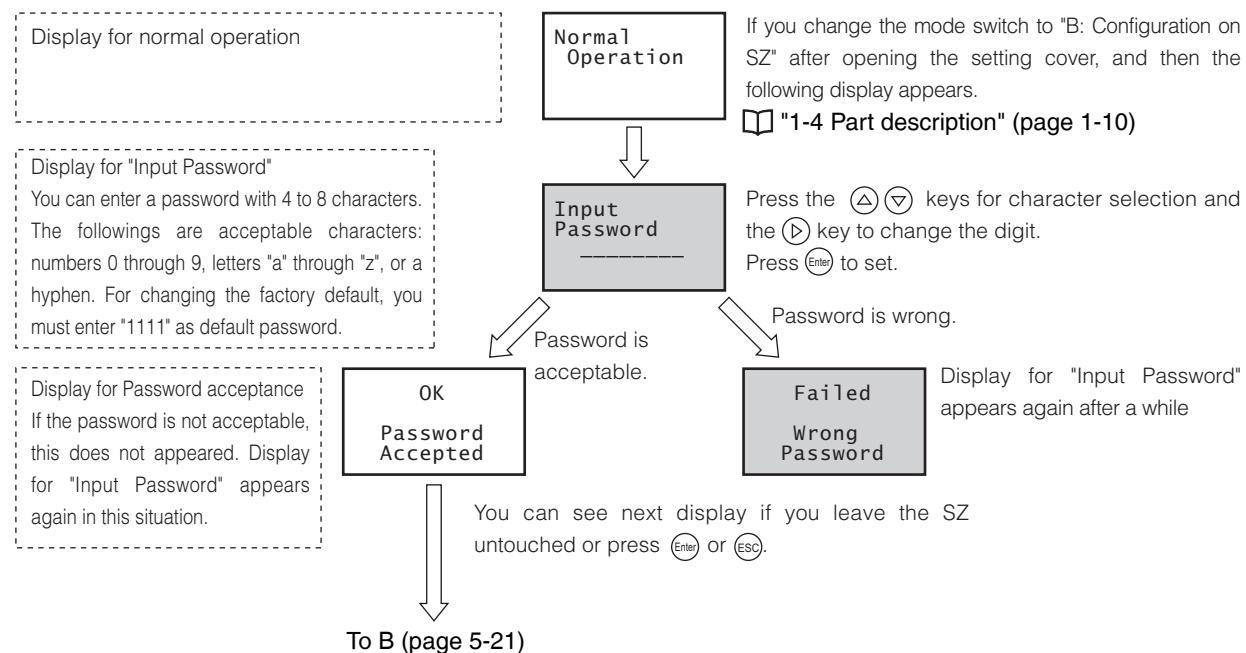
If you want to change the configuration, refer to 📖 "5-2 Manual configuration for SZ-01S and SZ-04M" (page 5-4)

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Manual Configuration on the SZ
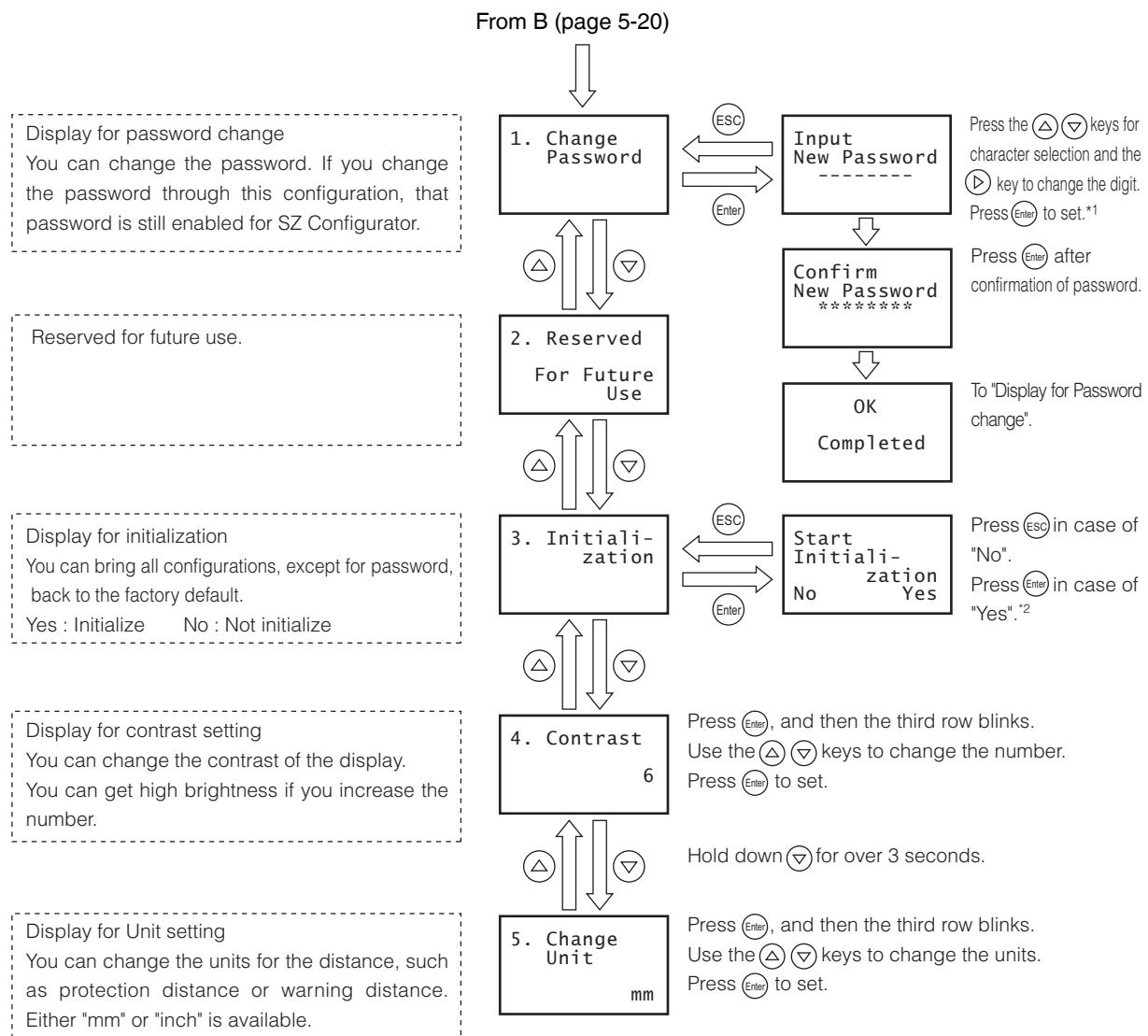
5-3 | Manual configuration for SZ-16V

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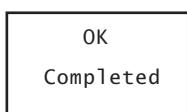
You must change the mode switch to "A: RUN/PC Communication" in order to start the normal operation.

Display for normal operation

```
Normal
 Operation
```

If you change the mode switch to "B: Configuration on SZ" after opening the setting cover, and then the following display appears.
📖 "1-4 Part description" (page 1-10)

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.

```
Input
Password
_____
```

Press the ⬆️⬇️ keys for character selection and the ▷ key to change the digit.
Press (Enter) to set.

Password is acceptable.

Password is wrong.

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

```
OK

Password
Accepted
```

```
Failed

Wrong
Password
```

Display for "Input Password" appears again after a while

You can see next display if you leave the SZ untouched or press (Enter) or (ESC).

To B (page 5-21)

Manual Configuration on the SZ

5

From B (page 5-20)

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.

1. Change Password

Input New Password --------

Press the (△)(▽) keys for character selection and the (▷) key to change the digit. Press (Enter) to set.*1

Confirm New Password ********

Press (Enter) after confirmation of password.

OK Completed

To "Display for Password change".

Reserved for future use.

2. Reserved For Future Use

3. Initialization

Start Initialization
No   Yes

Press (Esc) in case of "No".
Press (Enter) in case of "Yes".*2

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

4. Contrast
                6

Press (Enter), and then the third row blinks.
Use the (△)(▽) keys to change the number.
Press (Enter) to set.

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

Hold down (▽) for over 3 seconds.

5. Change Unit
             mm

Press (Enter), and then the third row blinks.
Use the (△)(▽) keys to change the units.
Press (Enter) to set.

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.

*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.

OK Completed

Leave the SZ untouched or press (Enter) or (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.

Unaccepted
4 or More Characters

Press (Enter) or (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.

Failed

Press (Enter) or (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 6-57)

5

Manual Configuration on the SZ

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

```
Initiali-
     zation

Processing
```

The SZ is under initialization.

Initialization successful   Initialization failed

```
     OK

Completed
```

```
    Failed

```

Leave the SZ untouched or press (Enter)
or (ESC) to go back to the " Display for
initialization"

Press (Enter) or (ESC) to go back to the
"Display for initialization".
You should perform the initialization
again.

5-4 Monitoring

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 (Enter) for over 3 seconds, and then the following display appears.

(ESC) ⬆ ⬇ Hold down (Enter) for over 3 seconds.

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

In case of SZ-16D,
1. I/O
2. History
3. Contrast
will be displayed. When selecting Contrast, refer to 📖 " Contrast settings (SZ-16D)" (page 5-32)

```
Information
1.I/O
2.Zone
3.History
```

Use the (△) (▽) keys to select.
Press (Enter) to set.

In case of I/O selected | In case of zone selected | In case of history selected

```
11.I/O
12.Wiring
```

```
21.Protect
22.Warning
```

```
31.OSSD OFF
```

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.

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 (Esc) to go back to the "Display for monitoring".
Use the (△) (▽) keys to select.
Press (Enter) to set.

Press (Esc) to go back to the "Display for monitoring".
Use the (△) (▽) keys to select.
Press (Enter) to set.

Press (Esc) to go back to the "Display for monitoring".
Press (Enter) to set.

In case of selecting "I/O"
📖 " I/O monitoring" (page 5-24)

In case of selecting "Wiring"
📖 " Wiring confirmation" (page 5-25)

In case of selecting "Protect"
📖 " Protection zone monitoring" (page 5-29)

In case of selecting "Warning"
📖 " Warning zone monitoring" (page 5-30)

In case of selecting OSSD OFF
📖 " OSSD OFF History" (page 5-31)

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>

```
11.I/O
12.Wiring
```

Select I/O →
← (ESC)

Press (ESC) to go back to the previous display.

```
I/O Monitor1
Input 12
     ON ■■
    OFF --
```

△ ▽

```
I/O Monitor2
AUX   12
     ON ■■
    OFF --
```

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.
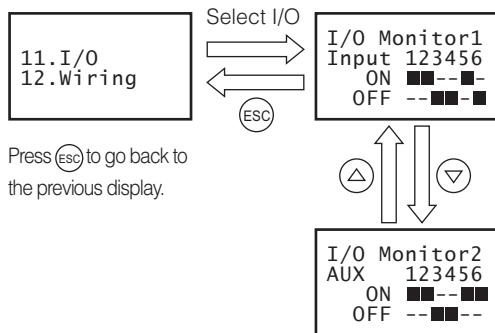
The item in question is ON when there is a square " ■" for ON and a dash "-" for OFF.

The item in question is OFF when there is a square " ■" for OFF and a dash "-" 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>

```
11.I/O
12.Wiring
```

Select I/O →
← (ESC)

Press (ESC) to go back to the previous display.

```
I/O Monitor1
Input 123456
     ON ■■--■-
    OFF --■■-■
```

△ ▽

```
I/O Monitor2
AUX   123456
     ON ■■--■■
    OFF --■■--
```

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 " ■" for ON and a dash "-" for OFF.
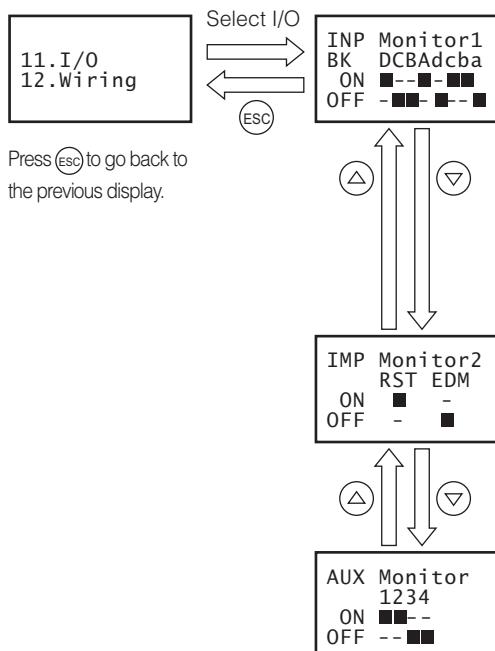
The item in question is OFF when there is a square " ■" for OFF and a dash "-" for ON.

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/SZ-16D>

```
11.I/O
12.Wiring
```

Select I/O →
← (ESC)

Press (ESC) to go back to the previous display.

```
INP Monitor1
BK   DCBAdcba
 ON  ■--■-■■
OFF  -■■-■--■
```

△ ▽

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 " ■" for ON and a dash "-" for OFF.

The item in question is OFF when there is a square " ■" for OFF and a dash "-" 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.

```
IMP Monitor2
   RST EDM
 ON  ■   -
OFF  -   ■
```

△ ▽

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.

```
AUX Monitor
    1234
 ON ■■--
OFF --■■
```
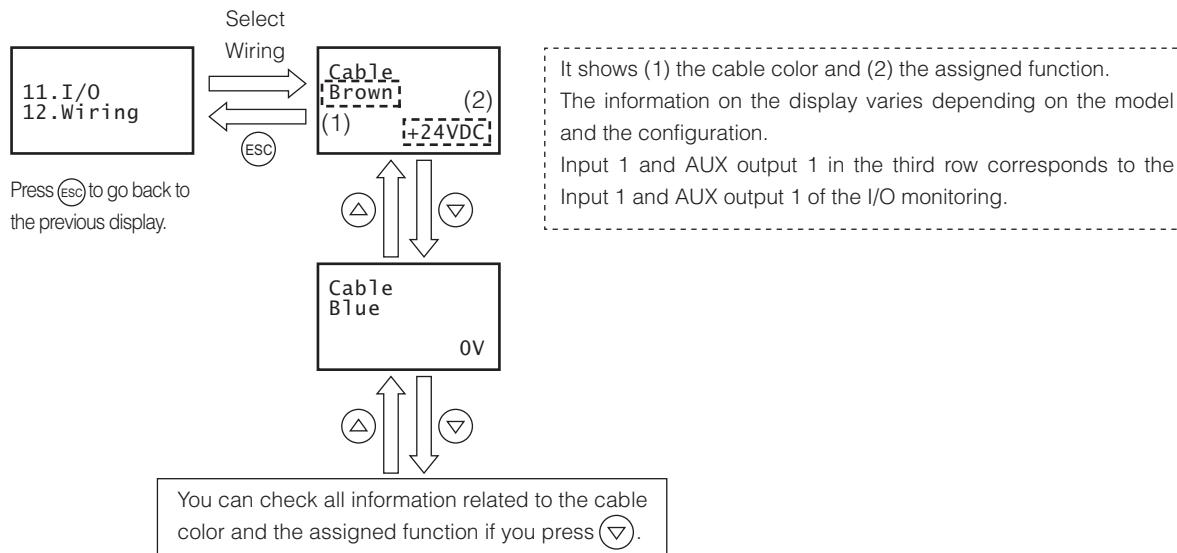
It shows the ON/OFF state for AUX output 1, 2, 3, and 4.

In the example to the left:

AUX output 1 and 2 are ON state, while AUX output 3 and 4 are OFF state.
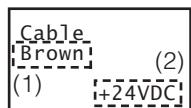
Wiring confirmation

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

```
            Select
            Wiring
┌───────────┐         ┌───────────┐
│11.I/O     │  ═════▶ │Cable      │
│12.Wiring  │  ◀═════ │Brown   (2)│
└───────────┘  (ESC)  │(1)  +24VDC │
                      └───────────┘
```

Press (ESC) to go back to the previous display.

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.

```
┌───────────┐
│Cable      │
│Blue       │
│        0V │
└───────────┘
```

You can check all information related to the cable color and the assigned function if you press (▽).

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Manual Configuration on the SZ

The following table shows the cable color and assigned function that you can see on the information display
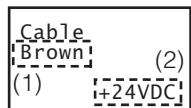
SZ-01S

```
Cable
Brown          (2)
(1)
      +24VDC
```

| (1)	Cable color	(2)	Assigned function
Brown	Brown	+24 V DC	+24 V DC
Blue	Blue	0 V	0 V
Black	Black	OSSD 1	OSSD 1
White	White	OSSD 2	OSSD 2
Yellow Input 1	Yellow	Reset Check Input	Reset input Check input
Red Input 2	Red	Not Used EDM	Not used EDM input
Orange AUX 1	Orange	Not Used Error Alert Error/Alert	Not used Error output Alert output Error or alert output
Orange/Black AUX 2	Orange/Black	OSSD State Protection-Z Warning-Z Interlock	OSSD state output Output for detection in protection zone Output for detection in warning zone Interlock-reset-ready output

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Manual Configuration on the SZ

SZ-04M

| (1)	Cable color	(2)	Assigned function
Brown	Brown	+24 V DC	+24 V DC
Blue	Blue	0 V	0 V
Black	Black	OSSD 1	OSSD 1
White	White	OSSD 2	OSSD 2
Gray	Gray	Not Used OSSD 3	Not used OSSD 3
Gray/Black	Gray/Black	Not used OSSD 4	Not used OSSD 4
Yellow Input 1	Yellow	Reset Check Input RST (OSSD 1/2)	Reset input Check input Reset input for OSSD 1/2
Red Input 2	Red	Not Used EDM (OSSD 1/2)	Not used EDM input for OSSD 1/2
Light Blue Input 3	Light Blue	Not Used Bank 1 Muting 1 Teach Mode	Not used Bank input 1 Muting input 1 Teach mode input
L-Blue/Black Input 4	Light Blue/Black	Not Used Bank 2 Muting 2 Teach Ready	Not used Bank input 2 Muting input 2 Teach ready input
Yellow/Black Input 5	Yellow/Black	Not Used Bank 3 Override RST (OSSD 3/4)	Not used Bank input 3 Override input Reset input for OSSD 3/4
Red/Black Input 6	Red/Black	Not Used Bank 4 EDM (OSSD 3/4)	Not used Bank input 4 EDM input for OSSD 3/4
Orange AUX 1	Orange	Not Used State Info.1 State Info.2	Not used State information output 1 State information output 2
Orange/Black AUX 2	Orange/Black	Error Alert Error/Alert Mute/O-ride	Error output Alert output Error or alert output Muting or Override output
Pink AUX 3	Pink	Muting Lamp OSSD State OSSD 1/2 State OSSD 3/4 State	Muting lamp output OSSD state output OSSD1/2 state output OSSD3/4 state output
Pink/Black AUX 4	Pink/Black	Protection-Z Protection 12 Protection 34	Output for detection in protection zone Output for detection in protection zone for OSSD1/2 Output for detection in protection zone for OSSD3/4
Green AUX 5	Green	Protection-A Protection-B Warning-Z Warning-A Warning-B	Output for detection in protection zone (A) Output for detection in protection zone (B) Output for detection in warning zone Output for detection in warning zone (A) Output for detection in warning zone (B)
Green/Black AUX 6	Green/Black	Interlock Interlock 1/2 Interlock 3/4	Interlock-reset-ready output Interlock-reset-ready output for OSSD 1/2 Interlock-reset-ready output for OSSD 3/4

SZ-16V/SZ-16D
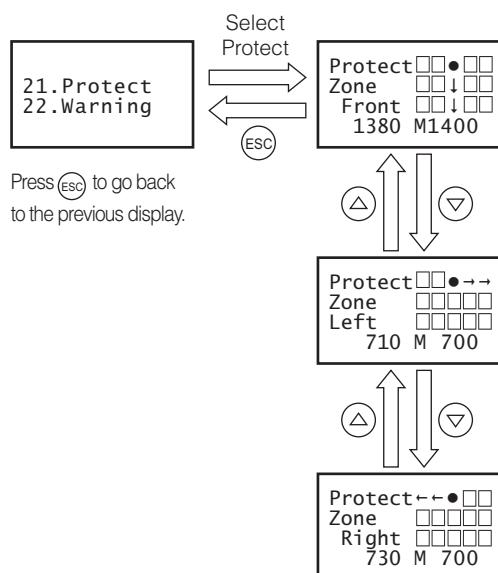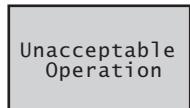
```
Cable
Brown         (2)
(1)
     +24VDC
```

(1)	Cable color	(2)	Assigned function
Brown	Brown	+24 V DC	+24 V DC
Blue	Blue	0 V	0 V
Black	Black	OSSD 1	OSSD 1
White	White	OSSD 2	OSSD 2
Yellow Input 1	Yellow	Reset	Reset input
Red Input 2	Red	EDM	EDM input
Light Blue Input 3	Light blue	Bank A	Bank input A
Gray Input 4	Gray	Not Used Bank B	Not used Bank input B
Pink Input 5	Pink	Not Used Bank C	Not used Bank input C
Green Input 6	Green	Not Used Bank D	Not used Bank input D
L-Blue/Black Input 7	Light Blue/Black	Bank a	Bank input a
Gray/Black Input 8	Gray/Black	Not Used Bank b	Not used Bank input b
Pink/Black Input 9	Pink/Black	Not Used Bank c	Not used Bank input c
Green/Black Input 10	Green/Black	Not Used Bank d	Not used Bank input d
Orange AUX 1	Orange	Not Used State Info.1 State Info.2	Not used State information output 1 State information output 2
Orange/Black AUX 2	Orange/Black	Error Alert	Error output Alert output
Yellow/Black AUX 3	Yellow/Black	Error/Alert OSSD State Protection-Z	Error or alert output OSSD state output Output for detection in protection zone
Red/Black AUX 4	Red/Black	Warning-1 Warning-2 Interlock	Output for detection in warning zone 1 Output for detection in warning zone 2 Interlock-reset-ready output

Protection zone monitoring

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

| Note	
	• The SZ-16V or the SZ-16D 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
```

Select
Protect

```
21.Protect
22.Warning
```

Press (esc) to go back
to the previous display.

```
Protect□□●□□
Zone   □□↓□□
Front  □□↓□□
    1380 M1400
```

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

(△) (▽)

```
Protect□□●→→
Zone   □□□□□
Left   □□□□□
     710 M 700
```

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

(△) (▽)

```
Protect←←●□□
Zone   □□□□□
Right  □□□□□
     730 M 700
```
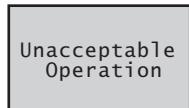
Display for the monitoring on right boundary
You should refer to 📖 "Details of display for the configuration of protection zone" (page 5-7)

5

Manual Configuration on the SZ

Warning zone monitoring

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

Note	

- The SZ-16V or the SZ-16D 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
```
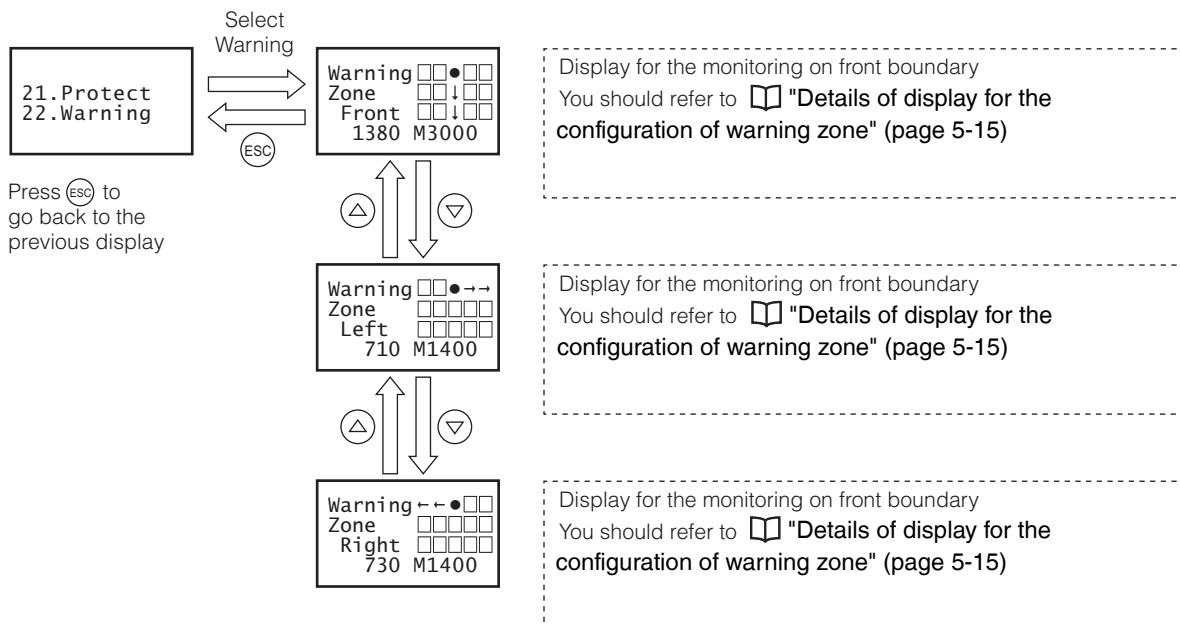
- The following display appears if you don't configure the warning zone.

```
No Setting
```

Select
Warning

```
21.Protect
22.Warning
```

Press (ESC) to
go back to the
previous display

```
Warning □□●□□
Zone    □□↓□□
Front   □□↓□□
   1380 M3000
```

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

```
Warning □□●→→
Zone    □□□□□
 Left   □□□□□
    710 M1400
```

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

```
Warning ←←●□□
Zone    □□□□□
 Right  □□□□□
    730 M1400
```

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

OSSD OFF History

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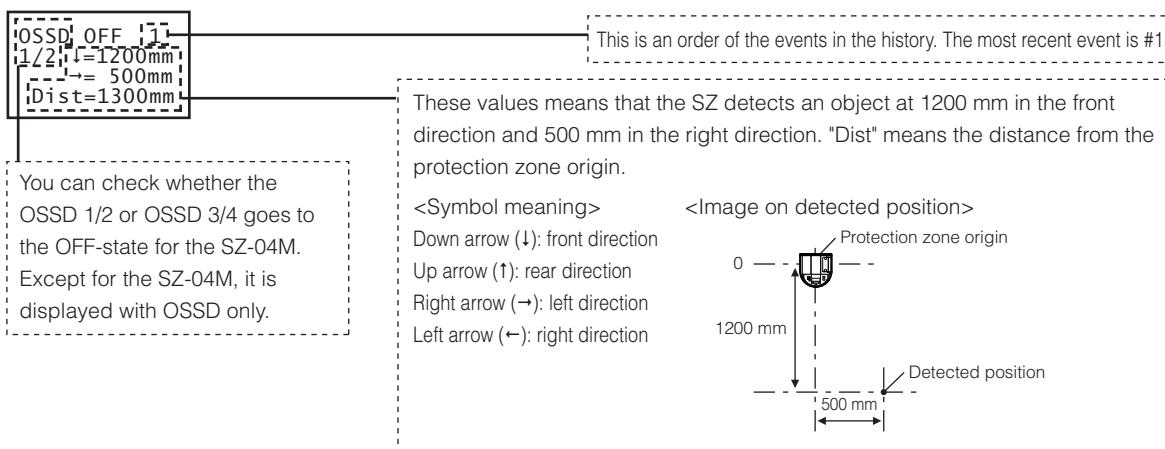
Note	
	The history is retained as long as the power is supplied to the SZ. The history is cleared when the power is turned off.

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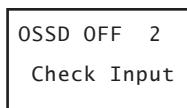
Information on "Display 1" varies depending on the reason why the OSSD went to the OFF-state.

● In case of detection in the protection zone

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

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.

<Symbol meaning>
Down arrow (↓): front direction
Up arrow (↑): rear direction
Right arrow (→): left direction
Left arrow (←): right direction

<Image on detected position>

You can check whether the OSSD 1/2 or OSSD 3/4 goes to the OFF-state for the SZ-04M. Except for the SZ-04M, it is displayed with OSSD only.

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

📖 "2-14 Check input function" (page 2-43)

```
OSSD OFF  2

 Check Input
```

● In case where the laser shutdown was activated (Only for SZ-16V and SZ-16D)
📖 "Laser Shutdown" (page 2-26)

```
OSSD OFF  2
   Laser OFF
```

● In case of error state
📖 "Error state" (page 8-2)

```
OSSD OFF 20
  Error
```
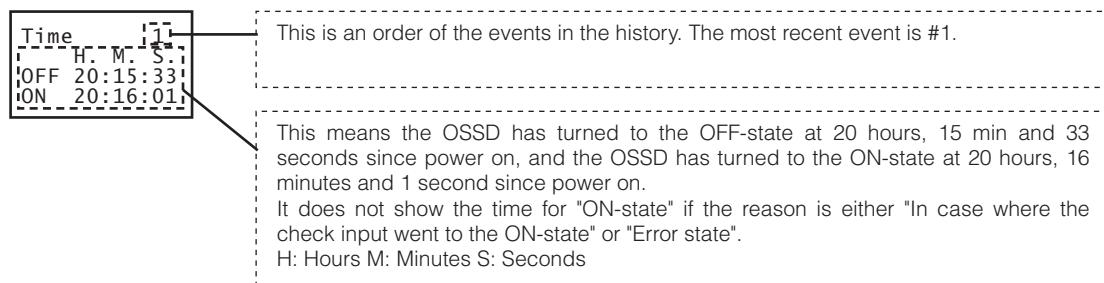
● In case of no OSSD OFF history
In this case, "Display 2" does not appear.

```
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
     H. M. S.
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

Contrast settings (SZ-16D)

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

Reference When setting the contrast settings for models other than the communication type (SZ-16D), refer to 📖 "Configuration of Others" (page 5-17).

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

```
3.Contrast

        6
```

Press (Enter) once, and then the third row blinks.
Use the (△) (▽) keys to change the number
Press (Enter) once more to set.

6

# Configuration through the configuration software
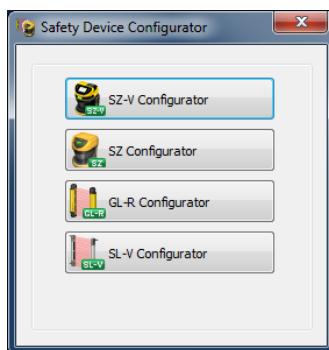
6-1　Before using SZ configuration

About the configuration software

The configuration software <Safety Device Configurator> integrates the safety device configuration software made by KEYENCE. The <Safety Device Configurator> consists of the following four software applications.
• Safety light curtain GL-R Series configuration software <GL-R Configurator>.
• Safety light curtain SL-V configuration software <SL-V Configurator>.
• Safety laser scanner SZ-V configuration software <SZ-V Configurator>.
• Safety laser scanner SZ configuration software <SZ Configurator>.

• Configuration data can be made on PC even if the SZ main unit is not connected.

System Environment

The following system requirements are necessary to use SZ Configurator.

CPU	Pentium 4, 1.5 GHz or higher
Compatible OS*1	Windows 10 Windows 8.1 Windows 8 Windows 7 Windows XP (SP3 or later)
Required memory size	512 MB or more
Display	XGA (1024 x 768 pixels) or greater, High Color (16 bit) or greater
Free space on hard disk	500 MB or more*2
Communication interface	USB 1.1 or more
Operation condition	.NET Framework 4.0 or 4.5 must be installed*2

* 1   Windows XP support only the 32 bit type.
       For Windows 7, only Configurator Ver. 2.0 or newer can be used.
       For Windows 8, only Configurator Ver. 2.6 or newer can be used.
       For Windows 10, only Configurator Ver. 2.8 or newer can be used.
       Only supports Japanese, English, German, French, Italian, Spanish or Chinese OS.
* 2   If .NET Framework 4.0 is not installed on the computer, .NET Framework 4.0 is installed automatically when installing SZ Configurator.
       The following conditions must be met in order to install .NET Framework 4.0.
       • 1.2 GB or more additional free space is available on the hard disk.
       • Windows Installer 3.0 or greater is installed.
       • Internet Explorer 5.01 or greater is installed.
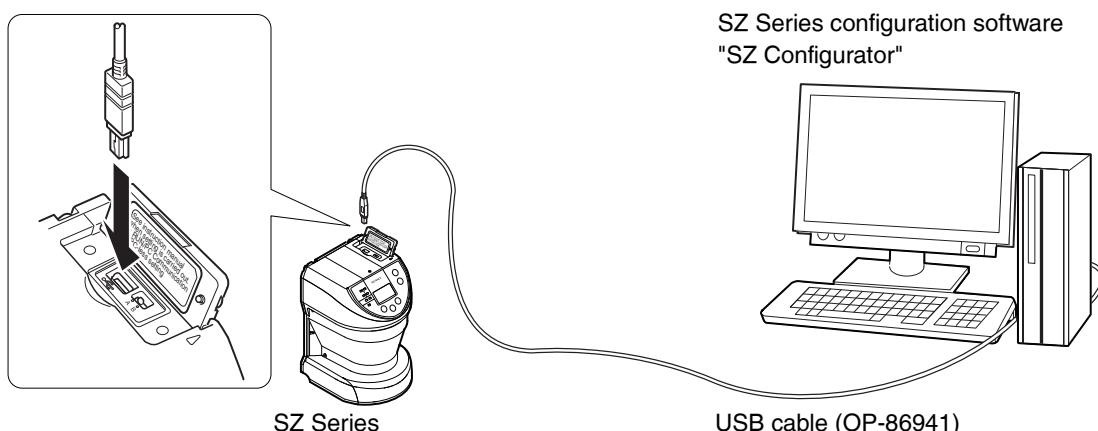
SZ Series configuration software
"SZ Configurator"

SZ Series   USB cable (OP-86941)

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| 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: 0.3 N·m) |

SZ-16D Settings

When setting the settings of the SZ-16D, it is necessary to use the SZ Configurator Ver.2.0 or newer. Ensure you have the correct version of the SZ Configurator before setting the SZ-16D.

Installing the configuration software

This section describes how to install the configuration software to a computer.

Before installation

Check the following items before installing.

■ **Free space on hard disk**
The configuration software can only be installed on the hard disk. The hard disk where the software will be installed must have at least 300 MB free space (1.2 GB (2.1 GB in case of 64 bit type) additional free space on the computer where .NET Framework 4.0 is not installed). If there is insufficient free space, delete unnecessary items to free the space.

■ **Pre-installation Windows environment**
The configuration software is a Windows application and the software is installed in Windows. Check that Windows 10/8.1/8/7/XP 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

■ **User privileges**
When the configuration software is installed into the default folder (C:\Program Files\KEYENCE\Safety Device Configurator\), set the following access privileges.

• Users must be given rights for "Administrator" or greater in order to use the configuration software.

Precautions for Windows 7/8/8.1/10

■ User privileges

When the configuration software is installed into the default folder (C:\Program Files\Keyence\Safety Device Configurator\), set the following access privileges.

• Users must be given rights for "Administrator" or greater in order to use the configuration software.

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

Downloading the configuration Software

The configuration software can be downloaded from KEYENCE homepage.
http://www.keyence.com
If using in the environment where downloading software is not possible via the internet, contact your nearest KEYENCE office or distributor.

Installation Procedure

Execute "setup.exe" stored in the downloaded file.
After that, start installation according to the instruction of the installation program.
When installation ends successfully, the following five software applications are installed.
• Integrated software <Safety Device Configurator>.
• GL-R configuration software <GL-R Configurator>.
• SL-V configuration software <SL-V Configurator>.
• SZ-V configuration software <SZ-V Configurator>.
• SZ configuration software <SZ Configurator>.

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
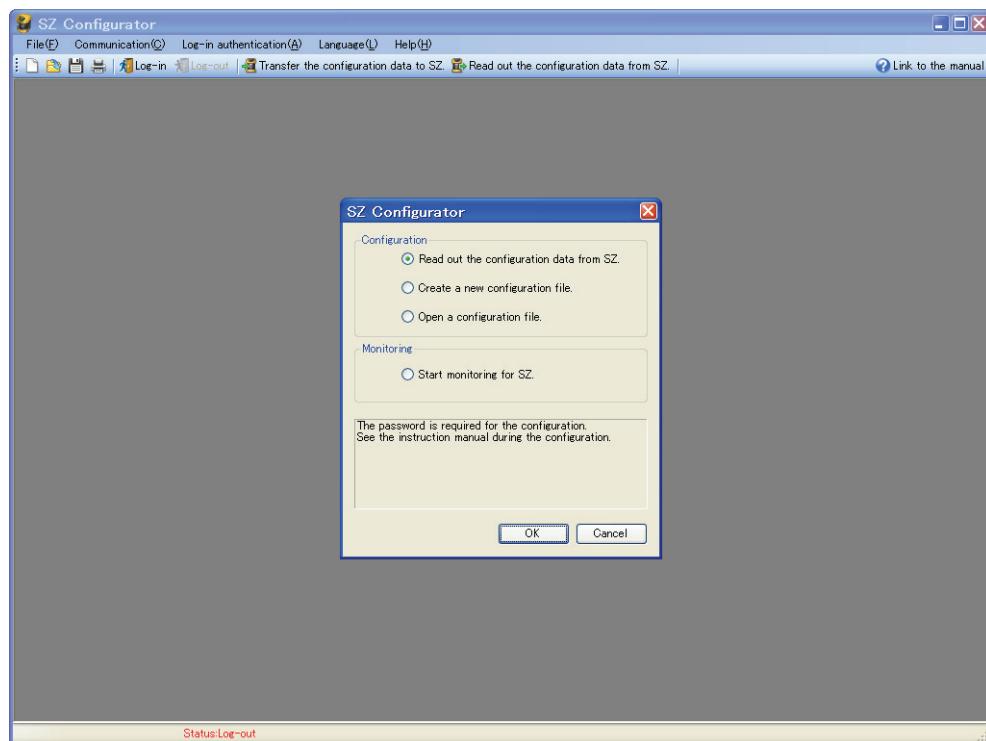
SZ Configurator starts up with the following methods.

1 **Click the Windows [Start] button and select [All Programs] - [KEYENCE Applications] - [Safety Device Configurator] or [SZ Configurator], or double-click the KEYENCE Safety Device Configurator icon on the desktop.**
Double-clicking the shortcut icon will display the Configurator selection screen.
Select [SZ Configurator]. If the powered-on SZ is connected via USB, this item is skipped.

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

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

Item		Description
Setting	Read out the configuration data from SZ.	Before start-up, reading the configuration data saved to the SZ Series itself.
	Create a new configuration file	Creates a new configuration file.
	Open a configuration file	Opens a configuration file currently saved to the personal computer.
Monitoring	Start monitoring for SZ	Communicates with the SZ Series and starts up in the monitoring mode.

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

■ **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.
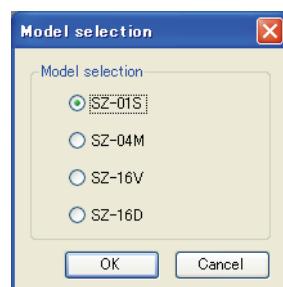
| **Note** | • Before selecting [Read out the configuration data from SZ.],you should check that the USB cable is properly connected between the personal computer and SZ Series.
• You should check that the power is supplied to the SZ.
• Other than for the SZ-16D, you should check that the mode switch 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.
"SZ-16D" will only appear in the Configurator Ver.2.0 or newer.
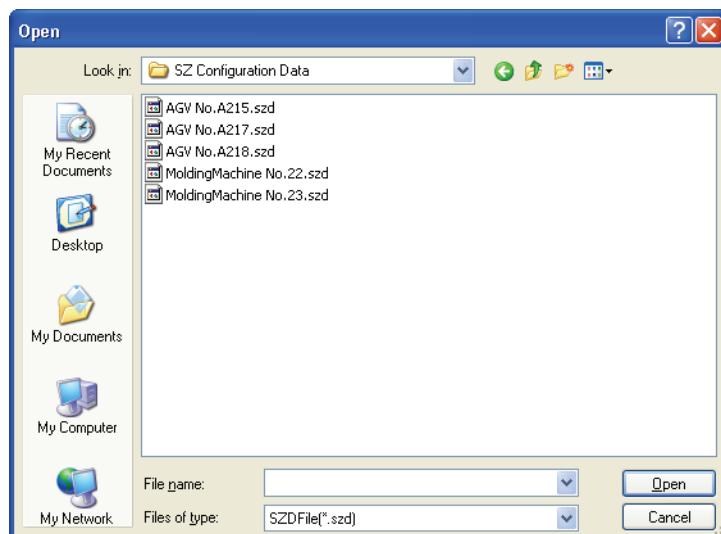
■ **When [Open a configuration file.] is selected**

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.
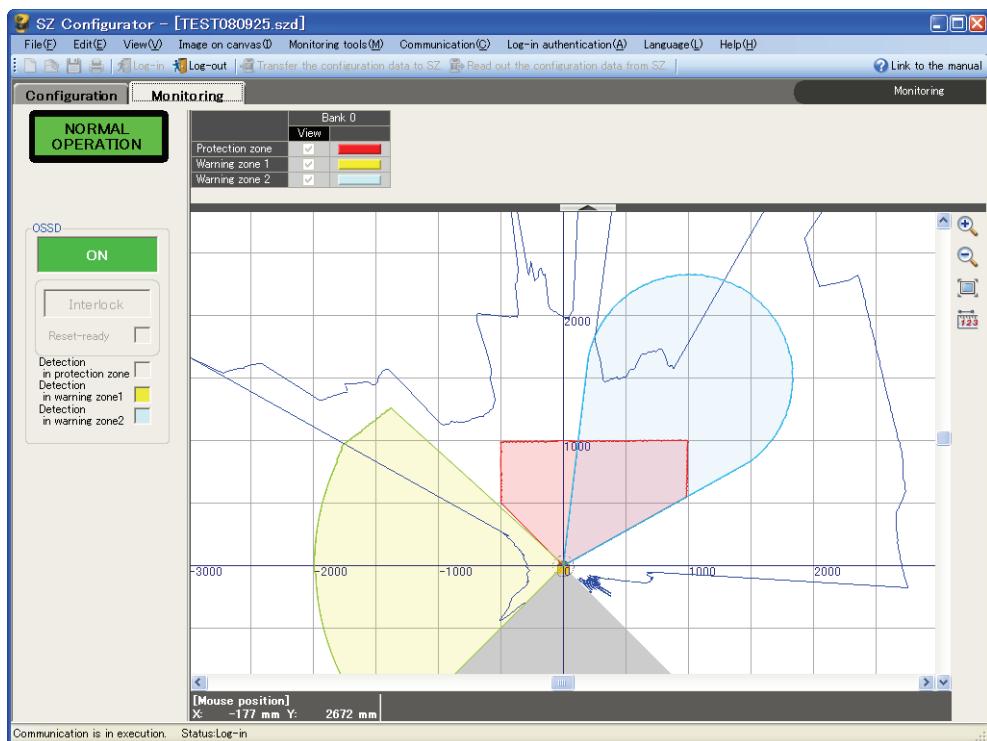
■ **When [Start monitoring for SZ.] is selected**

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.
- Other than for the SZ-16D, 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.

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Configuration through the configuration software

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
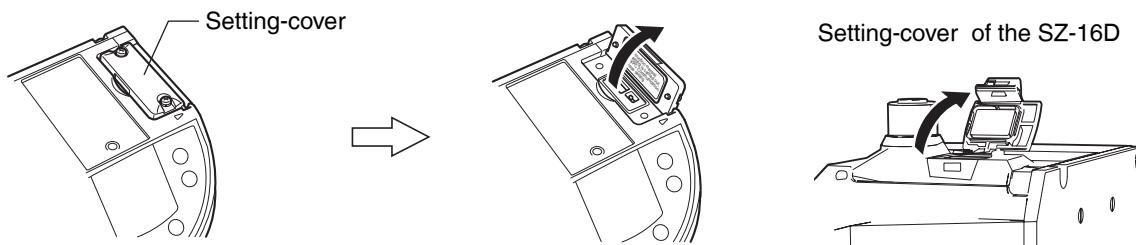
**1** **Open the setting-cover on the SZ Series.**
Loosen the two screws on the setting-cover and open the cover.
There is no screw on the setting-cover of the SZ-16D.
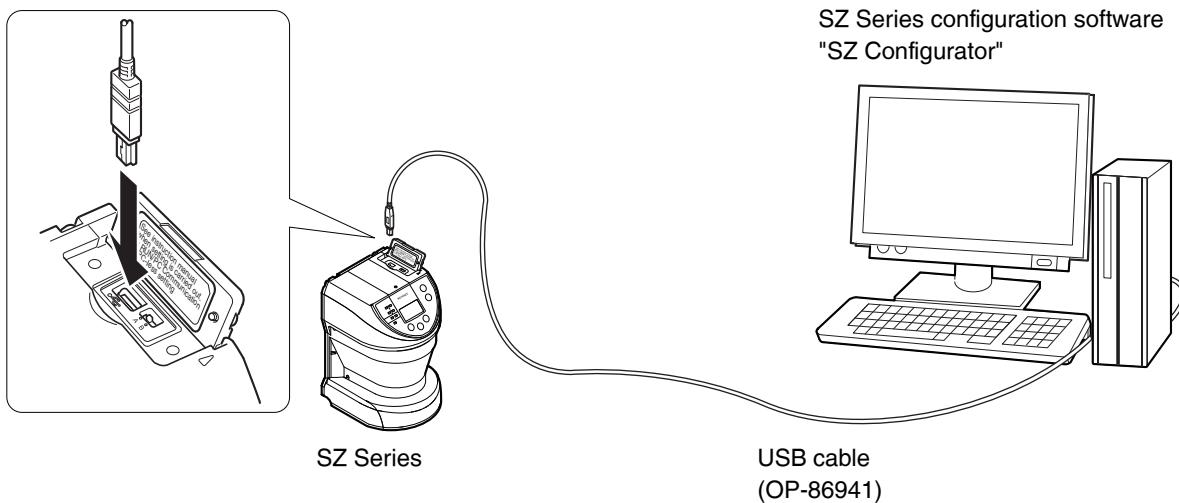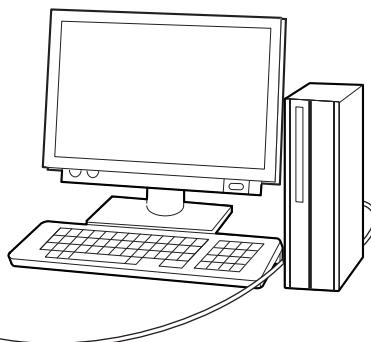
Setting-cover

Setting-cover of the SZ-16D

2 **Use the USB cable (OP-86941) to connect the SZ Series to the personal computer.**
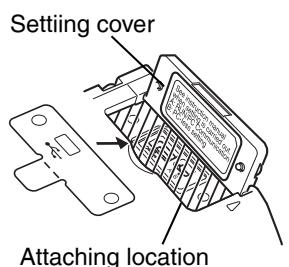
SZ Series configuration software
"SZ Configurator"

SZ Series

USB cable
(OP-86941)

Note

Settiing cover

Attaching location
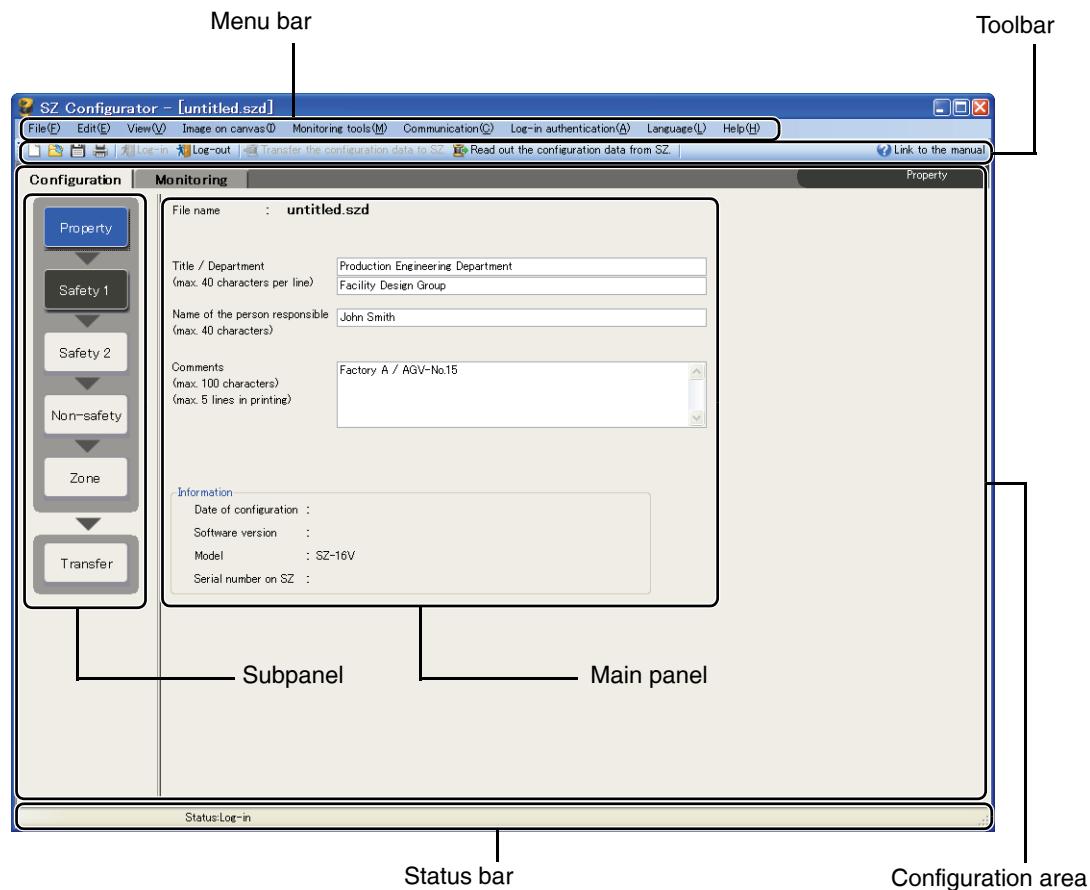
If the setting cover is open, the enclosure rating IP65 cannot be satisfied.
Make sure that dust does not enter the inside.
If it is possible that impurities such as dust may enter the inside of the sensor at the time of USB cable connection, attach a seal as depicted in the diagram to models other than the SZ-16D.

* With the supplied seal, the enclosure rating IP65 cannot be satisfied.
After setting and monitoring are complete, remove the seal and close the setting cover for use. (Recommended tightening torque: 0.3 N·m)
There is no screw on the setting cover of the SZ-16D. After setting and monitoring are completed, make sure to close the cover until you hear the click.

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Configuration through the configuration software

6-2 Part names and functions

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

Menu bar

Toolbar

Subpanel

Main panel

Status bar

Configuration area

■ **Menu bar**

Displays the menus for each function.

For more information about the menus, see 📖"6-5 Operation menu" (page 6-35).

■ **Toolbar**

Display a row of buttons for frequently used functions.

Icon	Function
(New)	Creates a new configuration file.
(Open)	Opens a saved configuration file (*.szd).
(Save)	Saves the configuration file being edited over the old file.
(Print)	Prints the information in the configuration file being edited.
Log-in	Enter a password to login to the SZ Series.
Log-out	Logs out.
Read out the configuration data from SZ.	Transfers a configuration file to the SZ Series.
Transfer the configuration data to SZ.	Reads configuration data from the SZ Series.
Link to the manual	Displays the PDF file of the SZ Series User's Manual.

■ **Configuration area**

The tabs can be used to switch between configuration and monitoring.
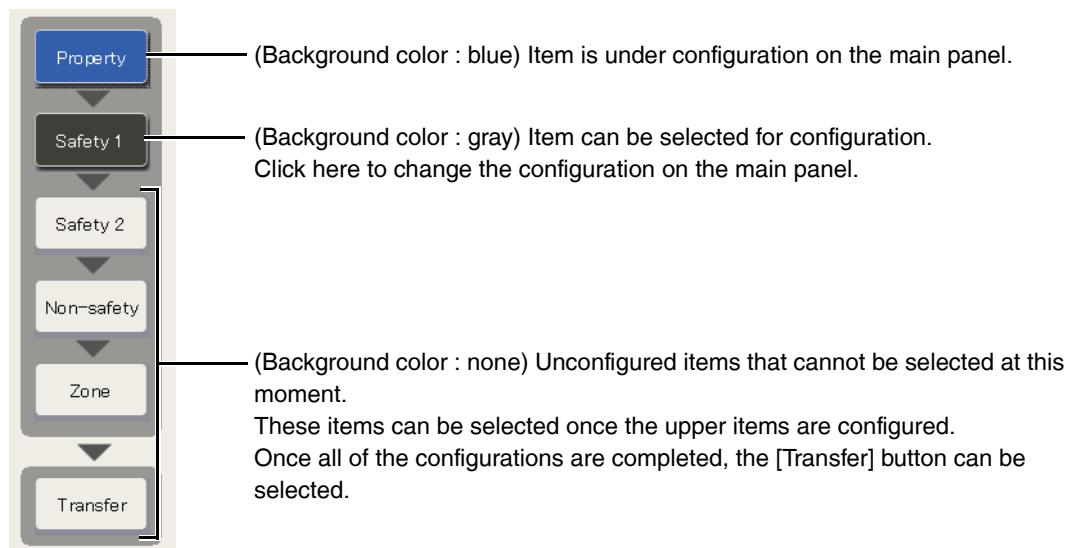
Tab	Function
Configuration	Sets each of the functions. 📖 "6-3 Configuration tab" (page 6-11) You can select the configuration item in the subpanel and set the item in the main panel. 　Property:　　You can configure the information for the configuration file. 　Safety 1:　　You can configure OSSD1/2. 　Safety 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.

Status	Description
Under communication...	SZ Configurator (computer) and the SZ Series are online (communicating).
Status:Log-in	Logged in. The configuration can be changed.
Status:Log-out	Logged out. Configuration cannot be changed.

6-3 Configuration tab

Property

Item	Description
File name	This shows the name of the configuration file. "untitled.szd" is displayed as the name for new, unsaved files.
Title / Department	You can enter the title or department information. Up to 80 characters can be entered (two lines of 40 characters).
Name of the person responsible	You can enter the name of the person in charge of configuration. Up to 40 characters can be entered.
Comments	You can enter a comment. Up to 100[*1] characters can be entered.
Information	This shows information about the configuration.
Date of configuration[*3]	This shows the date and time that the configuration was transferred from SZ Configurator to the SZ Series.[*2]
Software version[*3]	This shows the version information for the SZ Configurator software , which was used to create the configuration data transferred to the SZ Series.[*2]
Model	This shows the model of the SZ Series.
Serial number on SZ	This shows the serial number of the SZ Series.[*2]

*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.
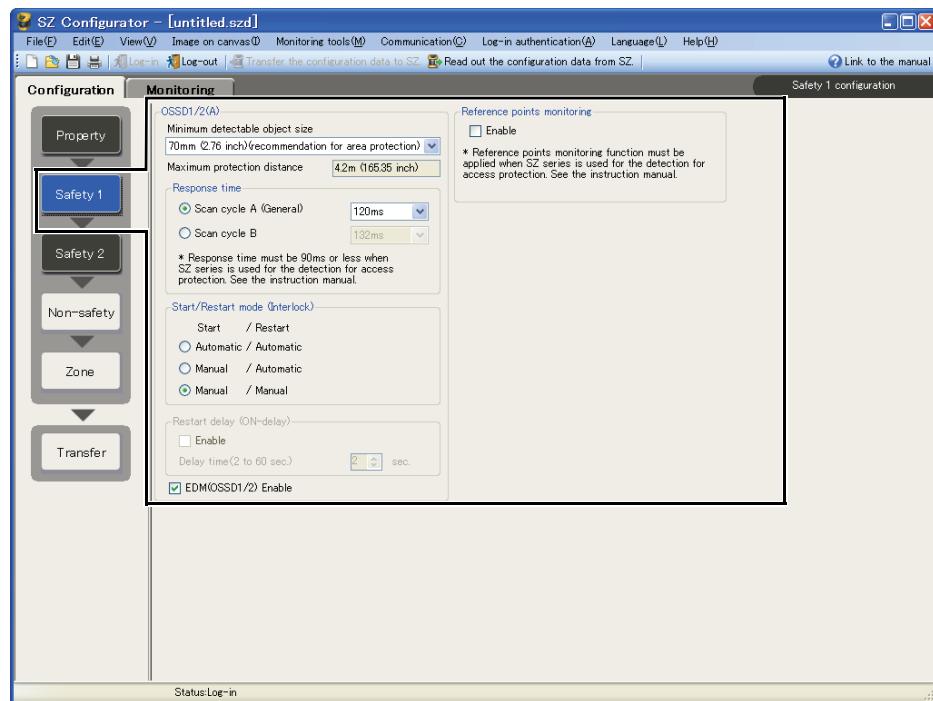
Safety 1

📖 Reference | 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)

Item		Description
OSSD1/2(A)*1		Configuration for the OSSD1/2 function.
	Minimum detectable object size	Setting for the minimum detectable object size. 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) Default : 70 mm (2.76 inch)
	Maximum protection distance	This shows the maximum protection distance. This cannot be set. The distance varies depending on the minimum detectable object size setting.<table><tr><td>Minimum detectable object size</td><td>30 mm (1.19in.)</td><td>40 mm (1.58 in.)</td><td>50 mm (1.97 in.)</td><td>70 mm (2.76 in.)</td><td>150 mm (5.91 in.)</td></tr><tr><td>Max distance</td><td>1.8 m (70.87in.)</td><td>2.4 m (94.49in.)</td><td>3.0 m (118.11in.)</td><td colspan="2">4.2 m (165.35in.)</td></tr></table>
Response time*2	Scan cycle A (General)	You can select the following time when using scan cycle A. The response time can be selected in 30 ms increments. 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 Default : 120 ms
	Scan cycle B	You can select the following time when using scan cycle B. The scan cycle can be selected in 33 ms increments. 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 Default : 132 ms

Item	Description
Start/Restart mode (Interlock)	Setting for start/restart mode (interlock). Possible setting: Automatic/Automatic, Manual/Automatic, Manual/Manual*4 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*3	Setting for the reference points monitoring function. Place a check mark ☑ in the checkbox to enable the reference points monitoring function. Default : ☐ (Unchecked)

*1   This item is displayed as [OSSD] for "SZ-01S", "SZ-16V" and "SZ-16D".

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

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

*4   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] check box ☐ in order to change. Start/Restart mode to "Manual/Manual".

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Configuration through the configuration software

Safety 2

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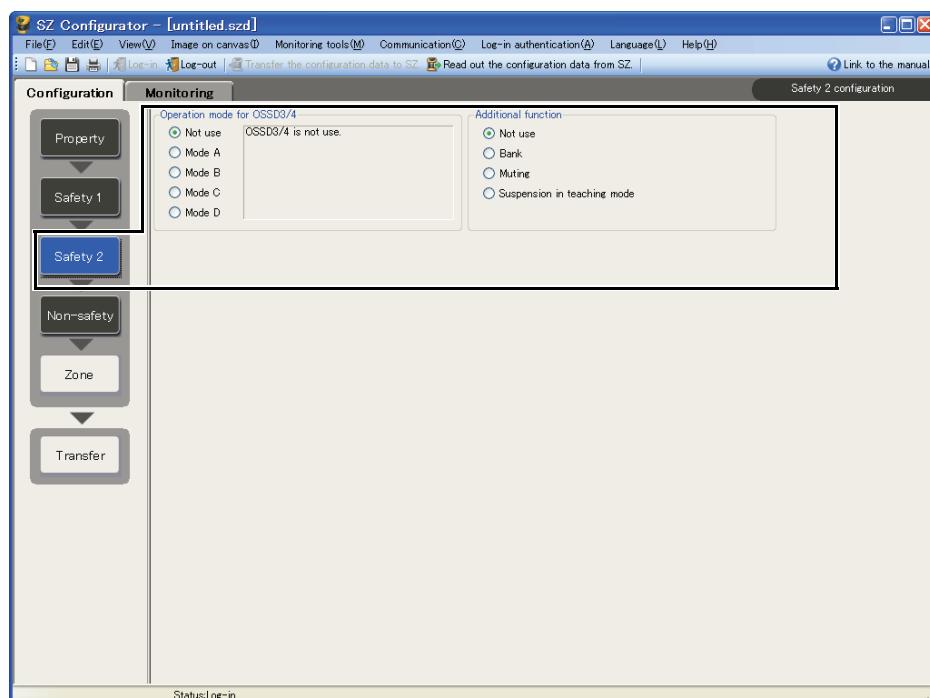
| Note |
|------|

- 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" and "SZ-16D".
- Only the bank function can be set for the [Additional function] item when the model is "SZ-16V" and "SZ-16D".

Reference

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)

Item	Description
Operation mode for OSSD3/4	Setting for the operation mode for OSSD3/4. A description of the operations for each mode appears in the box next to the selections. 📖 "Operation mode for OSSD3/4" (page 6-15) Possible setting: Not used, Mode A, Mode B, Mode C, Mode D Default : Not used
Additional function	Setting for the additional function. 📖 "Additional functions" (page 6-18) Possible setting: Not used, Bank, Muting, Suspension in teaching mode Default : Not used

■ **Operation mode for OSSD3/4**

| Note | This can only be configured when the model is "SZ-04M". |
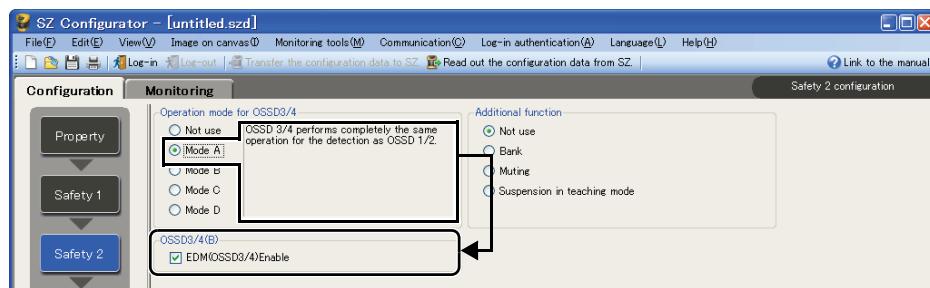
● **When "Not used" is selected**
OSSD3/4 is not used.(OSSD3/4 is always turned OFF.)

● **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.
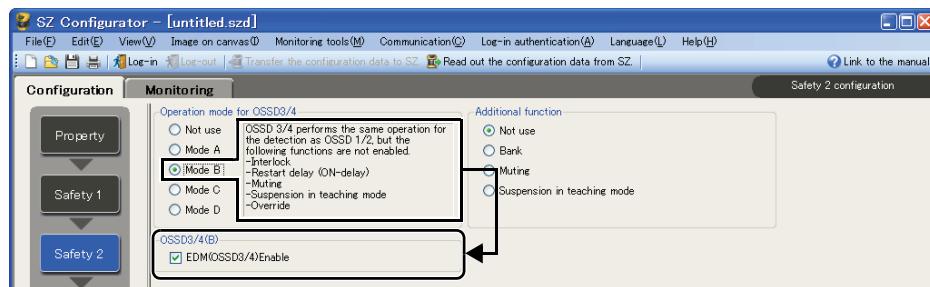
Item	Description
OSSD3/4 (B)	Setting for the EDM function. Place a check mark ☑ in the checkbox to enable the EDM function for OSSD3/4. Default : ☑ (Checked)

● **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.

Item	Description
OSSD3/4 (B)	Setting for the EDM function. Place a check mark ☑ in the checkbox to enable the EDM function for OSSD3/4. Default : ☑ (Checked)

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Configuration through the configuration software

● **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).

Item		Description
OSSD3/4 (B)		Configuration for the OSSD3/4 function.
	Minimum detectable object size	Setting for the minimum detectable object size. You can set the minimum detectable object size different from OSSD 1/2.
	Maximum protection distance	This shows the maximum protection distance. This cannot be set.
Response time	Scan cycle A (General)	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.
	Scan cycle B	
	EDM (OSSD3/4) Enable	Setting for the EDM function for OSSD3/4 Place a check mark ☑ in the checkbox to enable the EDM function. Default : ☑ (Checked)

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Configuration through the configuration software
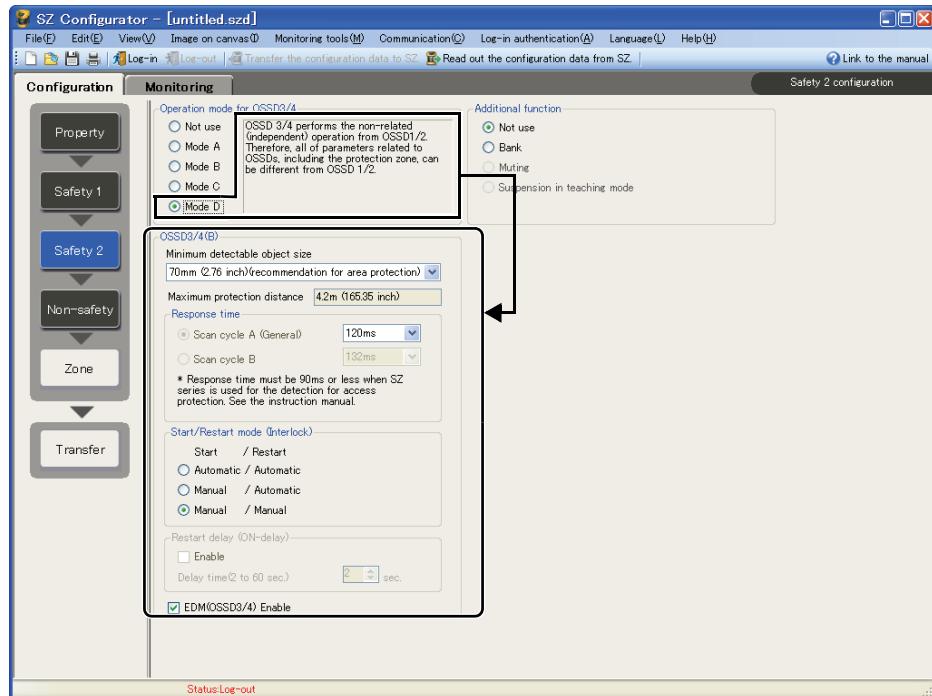
● **When "Mode D" is selected**

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).

Item	Description
OSSD3/4 (B)	Configuration for the OSSD 3/4 function.
Minimum detectable object size	Setting for the minimum detectable object size. You can set the minimum detectable object size different from OSSD 1/2.
Maximum protection distance	This shows the maximum protection distance. This cannot be set.
Response time — Scan cycle A (General)	Setting for the response time.
Response time — Scan cycle B	The scan cycle for OSSD3/4 is consequently the same as the cycle for OSSD 1/2, so it cannot be set here.
Start/Restart mode (Interlock)	Setting for start/restart mode (interlock).
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] box to set the delay time.
EDM (OSSD3/4) Enable	Setting for the EDM function for OSSD 3/4. Place a check mark ☑ in the [Enable] box to enable the EDM function. Default : ☑ (Checked)

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Configuration through the configuration software

■ Additional functions
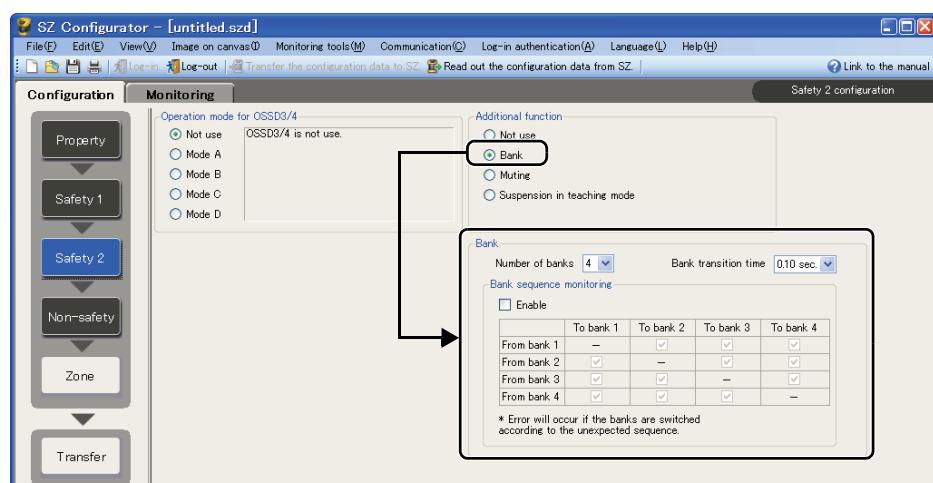
Note	• This can only be configured when the model is "SZ-04M", "SZ-16V" and "SZ-16D".
	• Only the bank function can be set when the model is "SZ-16V" and "SZ-16D".

● When "Not used" is selected

Additional function is not used.

### ● When the bank function is selected − in case of "SZ-04M" −
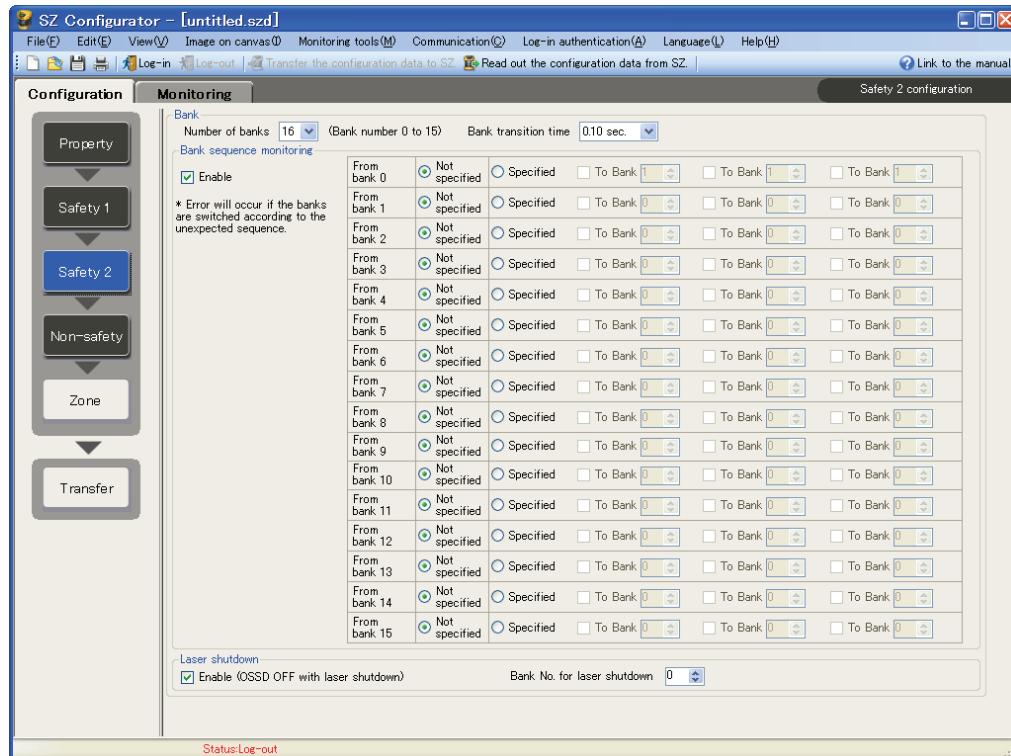
Item	Description
Bank	Setting for the number of banks for use. Setting range : 2 to 4 *1 Default : 2
Bank transition time *2	If bank switching is not completed within the specified transition time, "Error10 Bank Error" will be generated. Selectable time : 0.02 seconds, 0.05 seconds, 0.10 seconds, 0.25 seconds, 1.00 seconds, 2.50 seconds, 5.00 seconds Default : 0.10 seconds
Bank sequence monitoring	This can be set when 3 or more banks are set for "Bank". Place a check mark ☑ in the [Enable] box to monitor the bank switching sequence. The bank sequence is set by the presence of a check in the checkboxes. Checked ☑ : 　This permits bank switching in the specified sequence. Unchecked ☐ : 　Bank switching in the specified sequence will generate "Error10 Bank Error".

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

Operation mode	Setting range
Not use	2 to 4
Mode A	2 to 3
Mode B	2 to 3
Mode C	2 to 3
Mode D	2

*2 0.02 seconds and 0.05 seconds can only be chosen with a SZ Configurator Ver.2.0 or newer.

● **When the bank function is selected** – **in case of "SZ-16V" and "SZ-16D"** –

Item	Description
Warning bank switching via communication *1	If the "Valid" check box ☑ is checked, the warning area can be changed by the RS-422A communication function. However, the number of protection area banks has a maximum of 2. The number of alarm area banks has a maximum of 16. Concerning the RS-422A communication function, refer to 📖 "SZ-16D communication manual". Default : ☐ (Unchecked)
Number of banks	Setting for the number of banks for use. Setting range : 1 to 16 Default:1
Bank transition time *2	If bank switching is not completed within the specified transition time, "Error10 Bank Error" will be generated. Selectable time : 0.20 seconds, 0.05 seconds, 0.10 seconds, 0.25 seconds, 1.00 seconds, 2.50 seconds, 5.00 seconds Default : 0.10 seconds
Bank sequence monitoring *3	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)
[Not specified] radio button	ON ⦿ : This permits switching to any bank.
[Specified] radio button	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 "Error10 Bank Error". Setting Range : 0 to 15 *4 *5 Default : 0 (or "1" if "From Bank 0" is set)

Item	Description
Laser shutdown function*6	Checking ☑ [Enable] causes the laser to be shut down when the bank specified in "Bank No. for laser shutdown" is activated. The laser shutdown function stops the laser radiation and the OSSD forcibly goes to the OFF-state. Default : ☐ (Unchecked)
Bank No. for laser shutdown	Switching to the specified bank will cause the laser to be shut down. Setting range : 0 to 15 *4 *5 Default : 0

*1 This can only be set when the model is "SZ-16D". If this function is enabled, the bank sequence monitor cannot be used.
*2 This cannot be set when "Number of Banks" is set to "1". (The option will be grayed out.) 0.02 seconds and 0.05 seconds can only be chosen with a SZ Configurator Ver.2.0 or newer.
*3 This is not displayed when "Number of Banks" is set to "1" or "2".
     Additionally, the bank information for setting, which is higher than the setting value in "Number of banks", is not displayed.
*4 You cannot specify the same Bank number to the bank to be switched in the next place.
     Example: "3" cannot be set when you specify the "To bank" for "From bank3".
*5 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."
*6 This will not be displayed when "Number of Banks" is set to "1".
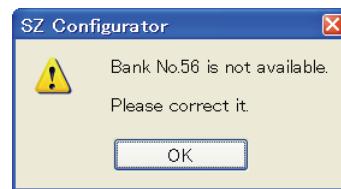
[Input error dialog box]

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)
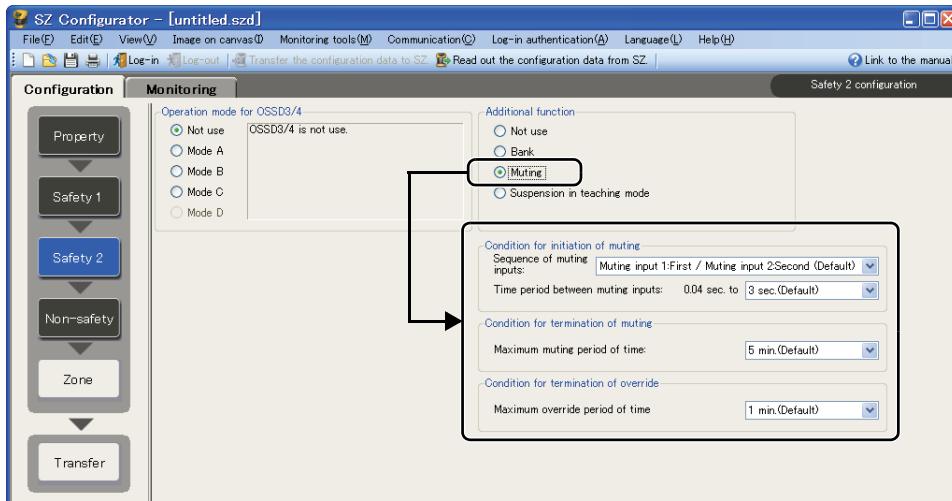
● When "Muting" is selected

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)

| Item	Description
Condition for initiation of muting	Configuration for the condition for initiation of muting.
Sequence of muting inputs	Setting for the sequence of muting input. Possible setting: Muting input 1: First / Muting input 2: Second : Muting input 2: First / Muting input 1: Second : Not specified Default : Muting input 1: First / Muting input 2: Second
Time period between muting inputs	Setting for the time period between muting inputs Muting is initiated if the SZ Series detects the muting inputs (muting input 1 and 2) within the specified time period according to the "Sequence of muting inputs" above. Selectable time : 3 seconds, 5 seconds, 10 seconds, not specified [*1] Default : 3 seconds
Condition for termination of muting	Configuration for the condition for termination of muting.
Maximum muting period of time	This specifies how long the muting will continue. Selectable time : 1 minute, 5 minutes, 10 minutes, not specified [*1] Default : 5 minutes
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
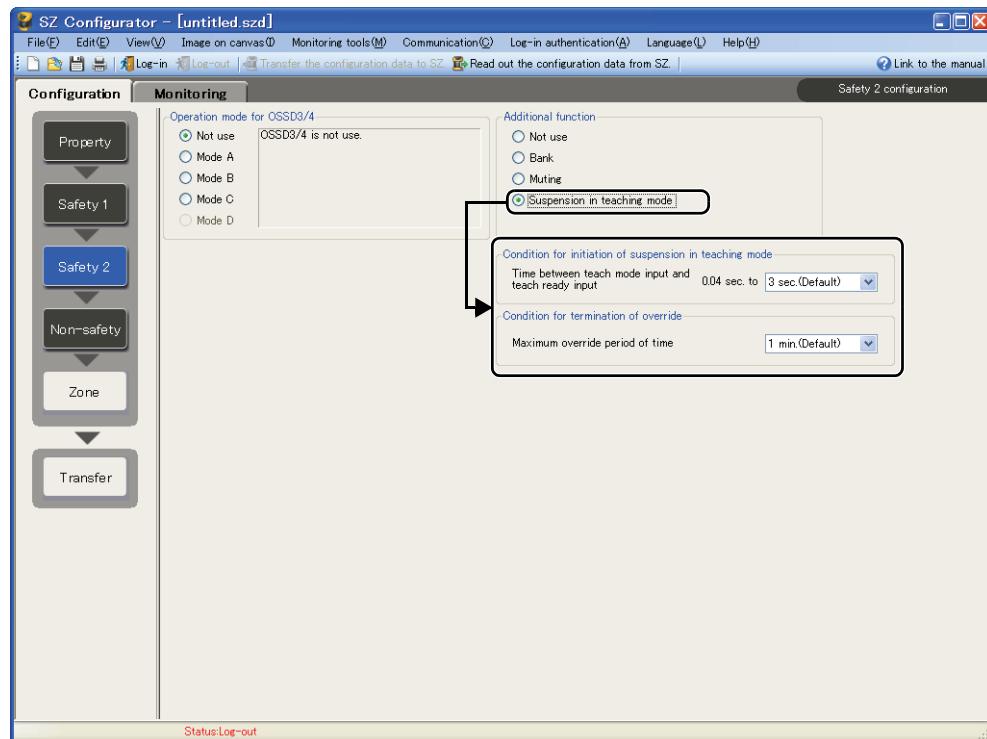
*1 Muted condition will be terminated approx. 5 minutes later when the time between muting inputs exceeds 3 seconds, even if "Not specified" is selected for maximum muting period and time between muting inputs.

● **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)
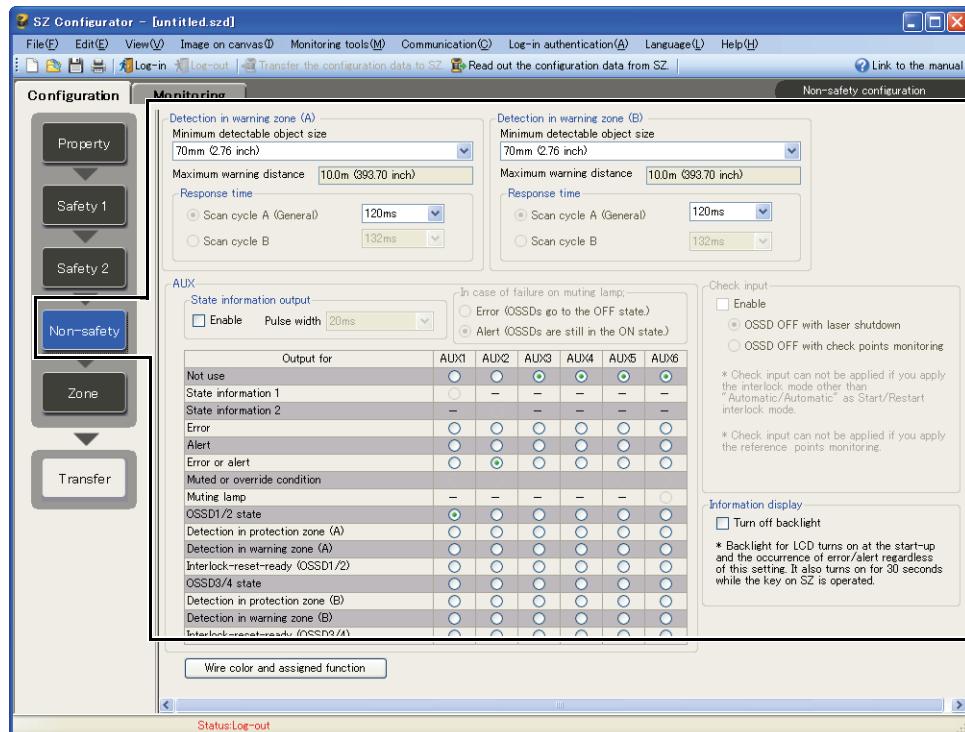
| Item	Description
Condition for initiation of suspension in teaching mode	Configuration for the condition for initiation of suspension in teaching mode.
Time between teach mode input and teach ready input	Setting for the time between teach mode input and teach ready input, which are external inputs 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

Non Safety-related Functions

This section describes how to configure non safety-related functions, such as warning zone and AUX.

Reference Refer to the following section for detail information of each function.
 "2-4 Warning zone" (page 2-8)
 "2-13 AUX (auxiliary) output" (page 2-35)
 "2-14 Check input function" (page 2-43)

Item			Description				
Detection in warning zone (A)/(B)			Configuration for the detection in the warning zone (A)/(B)*.				
	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	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.)
			Max distance	4.5 m (177.17 in.)	6.0 m (236.22 in.)	7.5 m (295.28 in.)	10.0 m (393.70 in.)
	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. Refer to "Safety 1" (page 6-12) for the selectable time and default related to response time.				
		Scan cycle B					

* 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] .

Item			Description
AUX			Configuration for auxiliary (AUX) output.
	State information output *1		Place a check mark ☑ in the [Enable] box to output state information. Default : ☐ (Unchecked)
		Pulse width	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
	In case of muting lamp failure*2		Setting for how the OSSDs perform in case of muting lamp failure.
		Error (OSSDs go to the OFF state)	Muting lamp failure generates an error and turns OSSD1/2/3/4 to the OFF-state.
		Alert (OSSDs are still in the ON state)	Muting lamp failure generates an alert, but does not turn OSSD1/2/3/4 to the OFF-state.
	(AUX output setting display)		Assignment of a function to the AUX output. • The number of AUX outputs varies depending on the model. • The assigned output function varies depending on the model. • Items marked with "-" cannot be assigned. • Items with grayed out radio buttons can become available depending on the combination of settings.
Check input *3			Place a check mark ☑ in the [Enable] box to configure check input. Default : ☐ (Unchecked)
	OSSD OFF with laser shutdown		Check input turns OSSD1/2/3/4 to the OFF-state. The SZ Series stop the laser radiation.
	OSSD OFF with check points monitoring*4		Check input turns OSSD1/2/3/4 to the OFF-state. Check point monitoring operates at the same time.
Information display*5			You can check the "Turn off backlight" check box ☑ to turn off the backlight on the information display on SZ series. Default : ☐ (Unchecked)
[Wire color and assigned function] button			You can click the [Wire color and assigned function] button to show the [Wire color and assigned function] dialog.
Communication settings*6			When using the RS-422A communication function via the SZ-16D, these settings are necessary. For details, refer to 📖 "SZ-16D Communication manual".
Measured value stabilization filter*6			
Communication monitoring*6			

*1 This can only be set when the model is "SZ-04M", "SZ-16V" and "SZ-16D".
*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.
*6 This can only be set when the model is "SZ-16D".
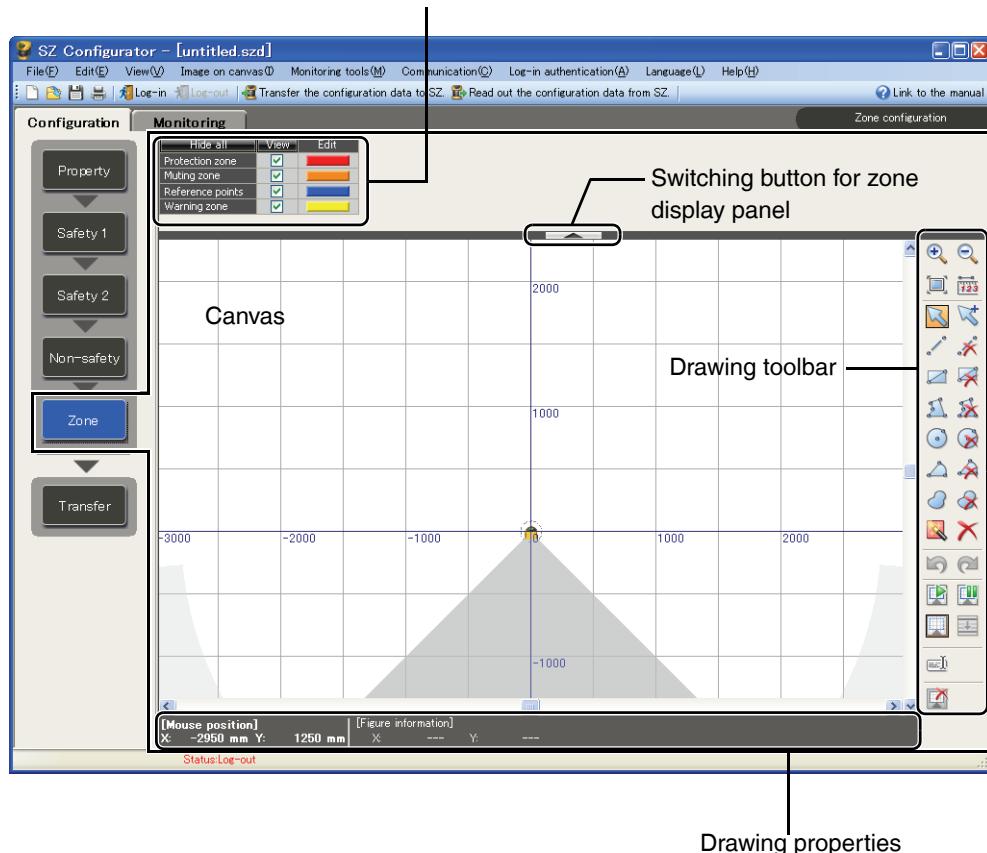
Zone

> **Reference** 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)

Zone display panel

Switching button for zone display panel

Canvas

Drawing toolbar

Drawing properties
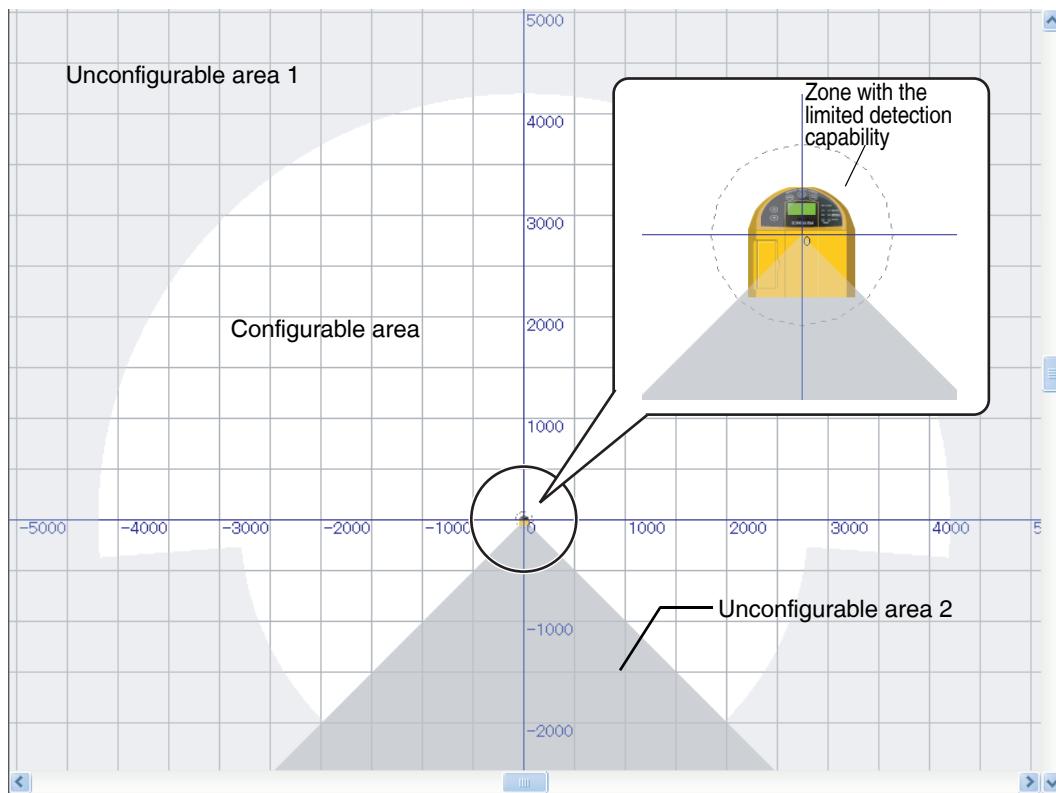
Item		Description
Canvas		You can draw the zone (protection zone, warning zone) on this canvas. You can use the "Drawing Tool bar" for zone configuration. 📖 "Canvas" (page 6-26)
Zone display panel		You can select the zone to be configured with this panel and can also switch whether the zone in question is displayed or not. 📖 "Zone display panel" (page 6-27)
	Switching button for zone display panel	For switching whether the "Zone display panel" is display or not. Click this to hide the "Zone display panel". Click this to display the "Zone display panel".
Drawing toolbar		You can draw the zone (protection zone, warning zone) on this canvas with this drawing tools. 📖 "Drawing toolbar" (page 6-28)
Drawing properties		This shows information related to the drawing.
	[Mouse position]	This shows the current coordinates for the mouse pointer.
	[Figure information]	This shows information such as the size and angles of figures on the canvas.

■ **Canvas**
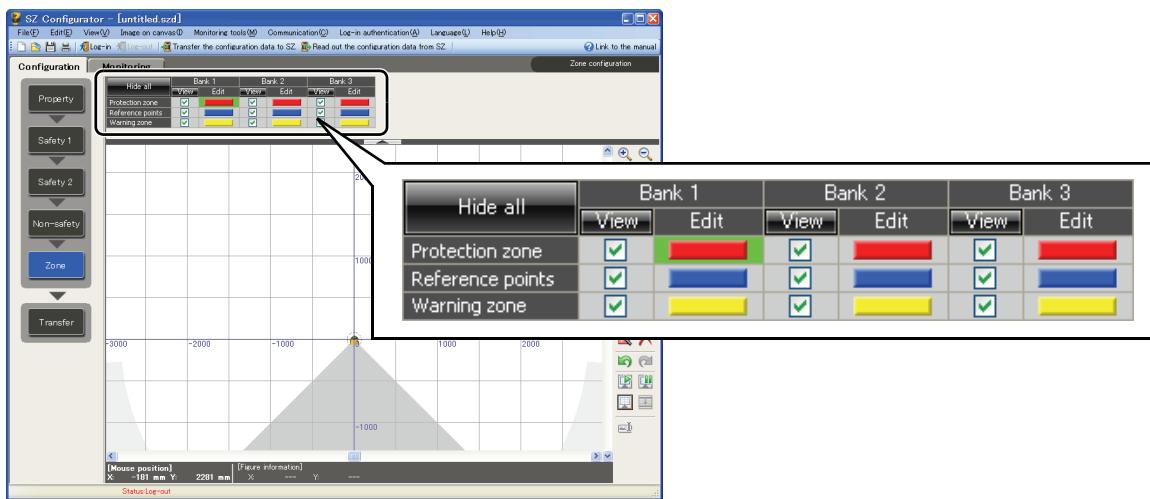
The SZ Series is represented in the center of the canvas. The grid is also shown on canvas.

Item	Description
Configurable area	The color of image on canvas is white for the configurable area. The configurable area varies depending on the configuration for safety functions.
Unconfigurable area 1	The color of image on canvas is light-Gray for unconfigurable area.
Unconfigurable area 2	The color of image on canvas is dark-Gray for unconfigurable area with no laser radiation from SZ. (Blind area)
Zone with the limited detection capability	The zone within the circle with the radius of 85 mm from the center of the SZ (protection zone origin) is the zone with the limited detection capability. □ "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.
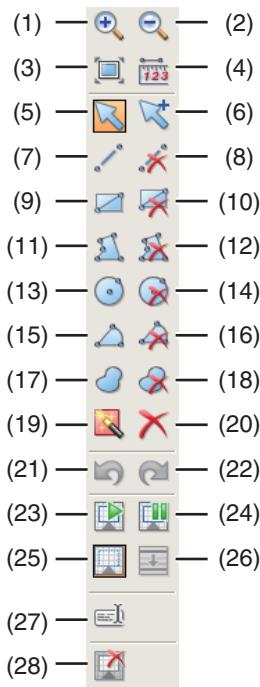
Item	Description
(Zone name)	The zone shown varies depending on the model and the configuration.
Bank 1 to	This is shown if banks have been set. This is not shown when the model is "SZ-01S".
View	• You can check this box ☑ to show the drawn protection zone. • You can uncheck this box ☐ to hide the drawn protection zone. • You can click [View] to change all of the checkboxes at once.
Display all/Hide all*1	If clicked while the [Display all] is displayed, all of the areas of all of the banks will be displayed. If clicked when the [Hide all] is displayed, all of the areas of all of the banks will be hidden (mask).
Edit	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.

*1 This item will only be displayed for the SZ Configurator Ver.2.0 or newer.

6

Configuration through the configuration software

■ **Drawing toolbar**

The following tools can be used when drawing on the canvas.

	Function	Description
(1)	Zoom in*1	Zooms in the canvas.
(2)	Zoom out*1	Zooms out the canvas.
(3)	Full display	Adjusts the screen scale in order to show the zone that is drawn on the canvas.
(4)	[Ruler] tool	This shows the distance between the specified two points.
(5)	[Specify the point*2] tool	Selects the user point, reference point or check point for the zone currently being edited. Drag to select multiple points.
(6)	[Set the point*2] tool	Adds user point, reference point or check point to the border of the zone currently being edited.
(7)	[Set the line segment] tool	Adds a line connecting two points, as well as the triangular area defined by the points on that line and the origin.
(8)	[Delete the line segment] tool	Deletes from the area currently being edited an area defined by the two points on the selected line and the origin.
(9)	[Set the rectangle] tool	Adds a rectangle with the two specified points at opposite vertices, as well as the area defined by these points and the origin.
(10)	[Delete the rectangle] tool	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.
(11)	[Add polygon] tool	Adds a polygon defined by multiple user points, as well as the area defined by these points and the origin.
(12)	[delete polygon] tool	Deletes from the area currently being edited a polygon defined by multiple user points and the area created by these points and the origin.
(13)	[Set the circle] tool	Adds a circle with a radius defined by specified points, as well as the area defined by these points and the origin.
(14)	[Delete the circle] tool	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.
(15)	[Set the sector] tool	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.
(16)	[Delete the sector] tool	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.
(17)	[Freehand*3 drawing] tool	Adds a freehand shape, as well as the area defined by this shape and the origin.
(18)	[Freehand*3 deletion] tool	Deletes a freehand shape, as well as the area defined by this shape and the origin.
(19)	Automatic drawing	Automatically draws a zone based on the detection state of the SZ Series. "Automatic drawing" (page 6-39)
(20)	[Delete all] tool	Clears everything in the zone.

	Icon name	Function
(21)	Undo	Undoes the previous operation.
(22)	Redo	Redoes the last operation that was undone.
(23)	Start real-time ranging	Displays the ranging state of the SZ Series in real time.
(24)	Pause real-time ranging	Temporarily stops the real time ranging display.
(25)	Finish real-time ranging	Clear the real time ranging display in the drawing panel.
(26)	Bottom-hold real-time ranging	Holds real time ranging display at bottom. • The bottom hold is updated by the green line in real time. • This is only available when "Real time ranging display -Start-" is ON.
(27)	Comments on the zone	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.
(28)	Clear background hold	Clear the background hold data.

*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 "n" that appear at each corner of the shape drawn.
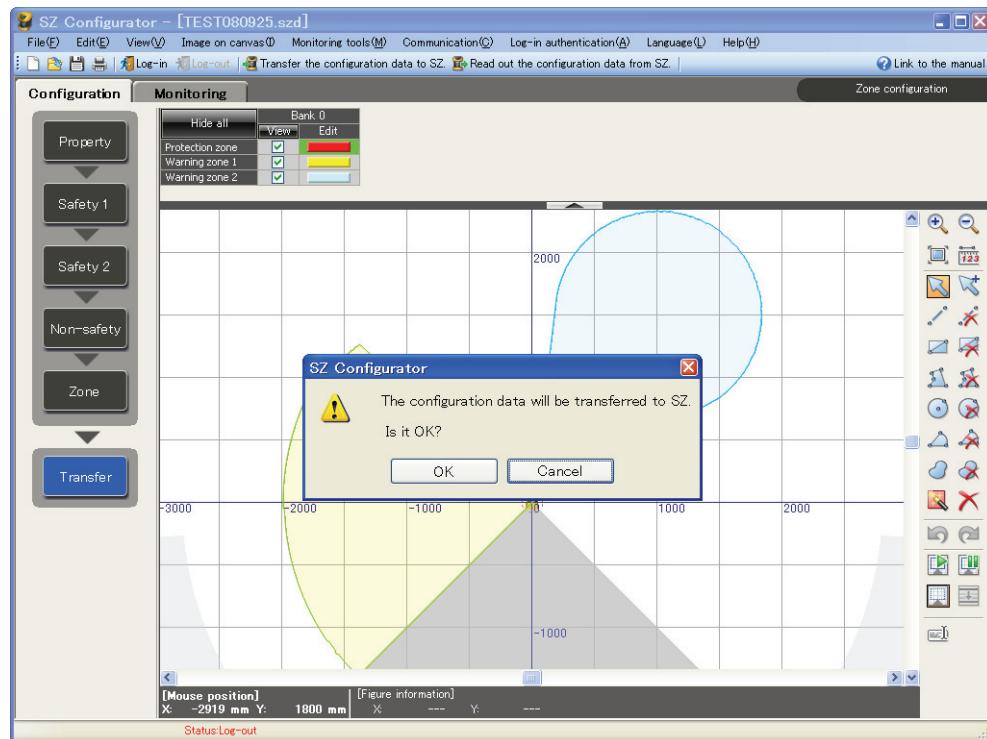
*3 Freehand shapes follow the movement of the mouse from the start of the left-dragging of the mouse to the end of it.

Reference
- Drag the mouse wheel to change the display position of the XY orientation. The mouse icon become ✛ 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.
- When setting a zone using tools (7) through (18), right-click the mouse on the drawing panel and select "Numeric entry", and you can set a zone by entering coordinates.

6

Configuration through the configuration software

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.
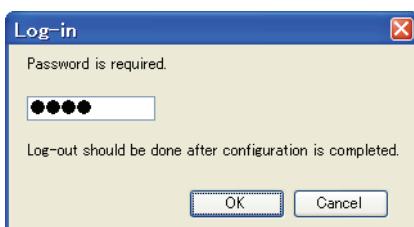
The [Transfer] button cannot be clicked if configuration is not completed.

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.

Reference The default password is "1111". Change the default password.
📖 "Password change" (page 6-56)

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 6-57)

The configuration data will be transferred after a successful login.

Note Do not disconnect the USB cable while transferring the configuration data.

After the configuration data is transferred, configuration data is read out from the SZ Series.

Note Do not disconnect the USB cable while transferring the configuration data.
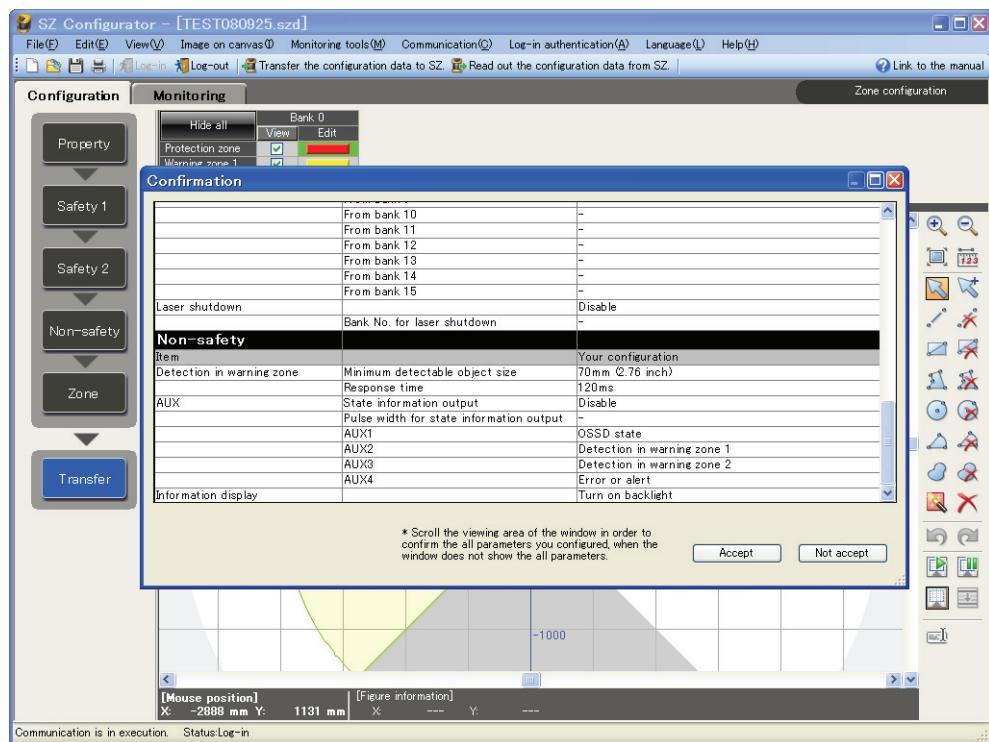
4 **Click [OK] in the confirmation dialog to show the [Confirmation] dialog for the configuration data. Confirm the configuration and then click [Accept] if you find nothing different from your intention.**

If the [Accept] button is grayed out and cannot be clicked, use the scroll bar to display all of the settings.

Note Clicking the [Not accept] button will cancel the transfer.
If this happens, all configuration data on the SZ Series will be erased.

6
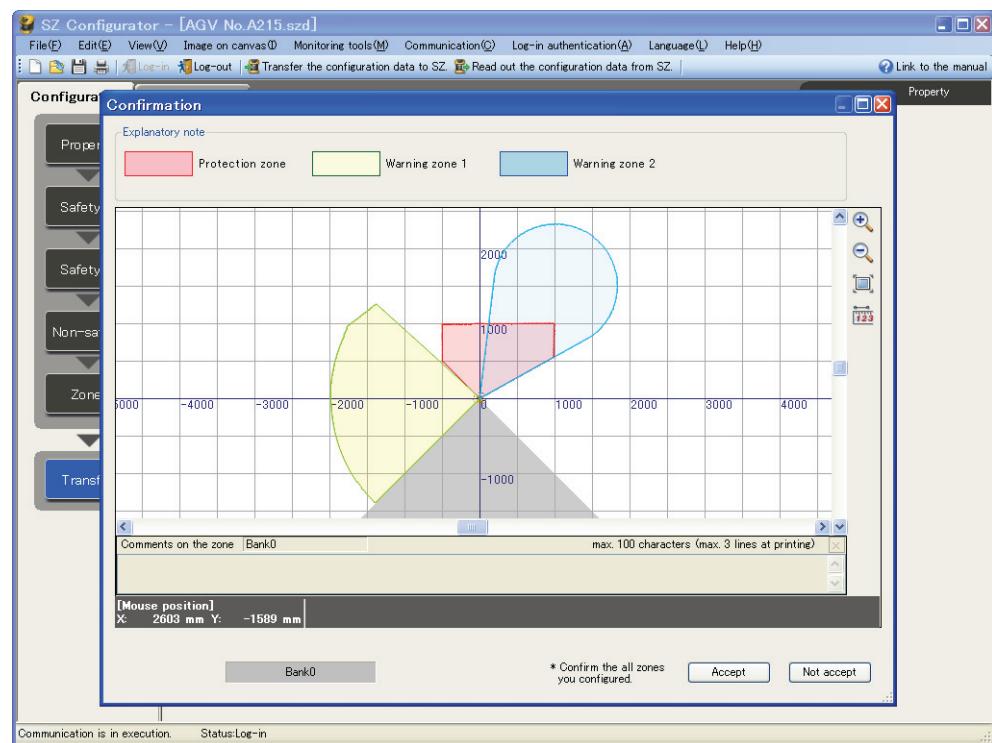
Configuration through the configuration software

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.
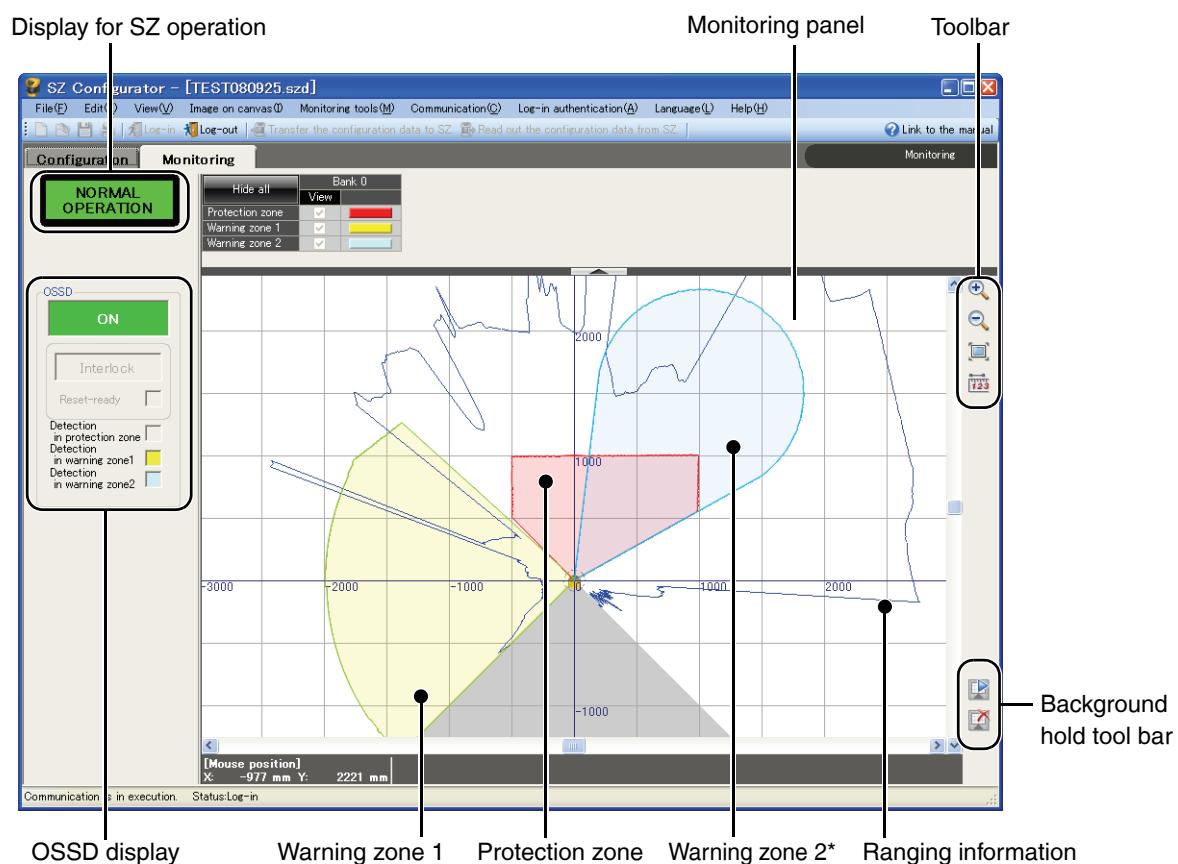
6-4 Monitoring tab

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 the configuration data on the SZ Configurator is different from the configuration data on the SZ series. Read the the configuration data from the SZ Series or transfer the the configuration data from the SZ Configurator.

Display for SZ operation   Monitoring panel   Toolbar

Background hold tool bar

OSSD display   Warning zone 1   Protection zone   Warning zone 2*   Ranging information

* Warning range 2 can be set only when the SZ Series model is "SZ-16V" and "SZ-16D".

Item	Description
Display for SZ operation	This shows the operating state of the SZ.
Monitoring panel	This shows the ranging information of the SZ in real time.
Toolbar	Zooms in and out on the Monitoring panel, and measures distance. 📖 "Drawing toolbar" (page 6-28)
OSSD display	This shows the state of OSSD.
Protection zone	The protection zone set in the SZ Configurator is shown.
Warning zone 1/2	This is shown if a warning zone 1/2 set in the SZ Configurator.
Ranging information	This shows the ranging result of the SZ Series in real time (Blue line).

Background Hold

This function can only be used for the SZ Configurator Ver.2.0 or newer.
This function is primarily for use with AGV's and can be monitored through the SZ Configurator. The minimum measured distance value is continuously updated and held for each individual bank. By using this function, the minimum distance between the AGV and objects within its travel path can be verified in order to determine whether the programmed zone interferences with these objects. Because the AGV surroundings change throughout its path, this function will assist in zone setting.
The minimum measured distance (background) is displayed on the monitoring panel and the canvas.

Note	• When using the communication bank change function, the background hold function cannot be used from the protection bank. Concerning the changing of the communication, refer to 📖 "SZ-16D communication manual"

■ Background hold tool bar

 — (1)

 — (2)

	Icon name	Function
(1)	Start background hold/ Stop background hold	If the icon is clicked, the minimum distance detected by the SZ will be displayed on the gray line. With this gray line as a border, the hold will be displayed with the far distance side as light purple, and the close distance side as white. If changing the bank, the hold display will be reset, and the shortest distance hold will display. Each hold display screen can be stored in each bank. If the icon is clicked once again, the hold display will no longer be renewed. The held area will be displayed as is.
(2)	Clear background hold	Reset the hold display conditions. The area set as purple will return to white.

■ Delay the start of the background hold function/ restart will be stopped automatically.

From the menu select [Monitor tool(M)] then [background hold timer(S)].
The [Monitor start timer] dialogue box will appear and the start time and hold time can be set.

Name	Function
Start up delay time	When the Background hold start icon is clicked, and the setting time is passed the hold display starts. By delaying the start, the background hold function can be started after leaving the protection and warning areas of the SZ. Setting range : 0 to 59 minutes and 59 seconds Initial value : 0
Hold time	After starting the background hold, and when the setting time has passed, the hold display will automatically display and stop. Setting range : 0 to 59 minutes and 59 seconds Initial value : 0

6-5 Operation menu

File(F)
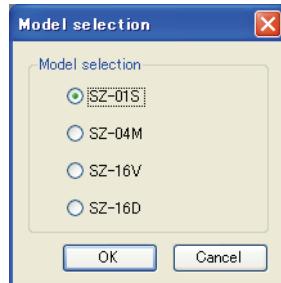
This section explains how to save the setting file used by the SZ Configurator to the computer and load it from the computer.

■ 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.
"SZ-16D" will only appear in the Configurator Ver.2.0 or newer.

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

> Reference 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.

You can change the model from SZ-16V to SZ-16D or from SZ-16D to SZ-16V.

■ **Print**

You can select [Print(P)] under the [File(F)] menu.

The [Print] dialog appears so as to pefrom the setting on print condltion.

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.

Edit(E)

This shows a menu for zone configuration.

| Note | The [Edit(E)] menu is only available when the [Configuration] sub panel of the [Zone] tab is selected. |

■ 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

■ Paste zone in reverse

You can select [Paste zone in reverse(Y)] under the [Edit(E)] menu.
This pastes a zone copied with [Copy zone] to the selected location. The pasted zone is reversed.
This menu is displayed only on the SZ Configurator Ver.2.0 or newer.
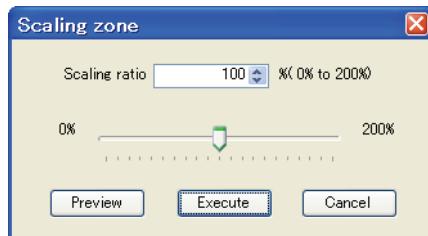
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Configuration through the configuration software

■ Scaling zone

You can select [Scaling zone(S)] under the [Edit(S)] menu.
The [Scaling zone] dialog appears.

Item	Description
Scaling ratio	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
(Slide bar)	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.
[Preview] button	You can input the scaling ratio directly into the input box. Draws the zone according to the specified scaling ratio.
[Execute] button	You can reflect the specified scaling ratio to the zone size.
[Cancel] button	This cancels the change in scaling ratio and returns to the previous size.

■ Bank copy

Select [Edit(E)] then [Bank copy(B)] from the menu.
The [Bank copy] dialogue box will display. Then by specifying the copy origin bank and the copy destination bank, except for the reference points and the muting zone, all of the zones set to the bank can be copied.
This menu is displayed only on the SZ Configurator Ver2.0 or newer.
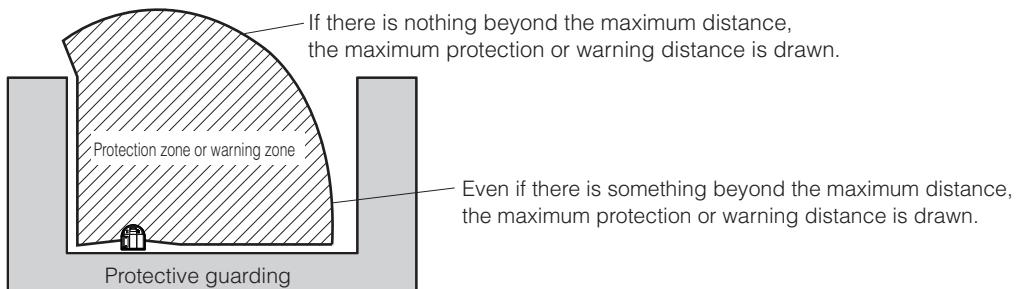
■ **Automatic drawing**

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

If there is nothing beyond the maximum distance, the maximum protection or warning distance is drawn.

Protection zone or warning zone

Even if there is something beyond the maximum distance, the maximum protection or warning distance is drawn.

Protective guarding

⚠ **Danger**
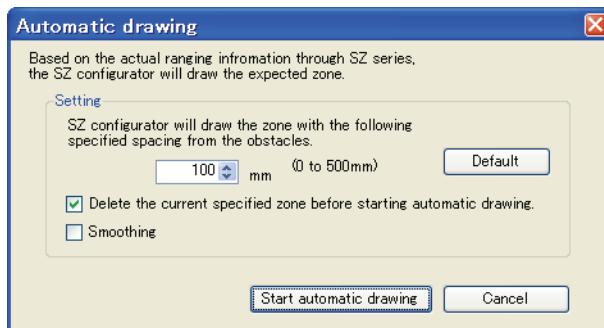
The zone drawn with the automatic drawing function is just an informative zone, which is automatically drawn by the SZ Configurator based on the surrounding situation of the SZ, such as a protective guarding.
Therefore, you must confirm whether the zone drawn with the automatic drawing is just as you 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.

Configuration through the configuration software **6**

Item	Description
space	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
[Default] button	You can reset the value in the input box to its default (100).
Delete the current specified zone before starting automatic drawing.	You can check this box ☑ to activate auto drawing after deleting a current zone. Default : ON☑
Smoothing	You can check this box ☑ to reduce the number of user points so as to make the drawing easy to see (adjust). Default : OFF☐
[Start automatic drawing] button	Start automatic drawing.
[Cancel] button	Cancels automatic drawing and closes the [Automatic drawing] dialog.

● **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.

4 **Click the [OK] button to complete the automatic drawing.**
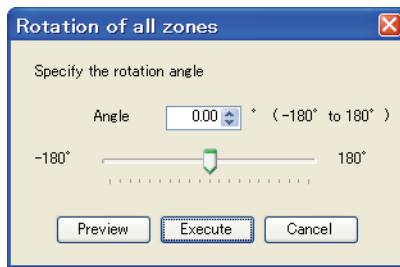
The zone generated by the automatic drawing will be reflected in the configuration data.

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.
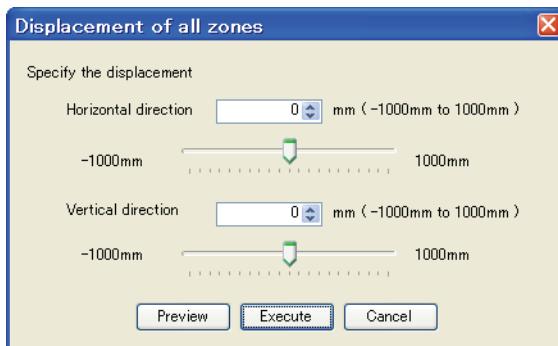
Item	Description
Angle	You can specify the angle to rotate all zones on the canvas. Press the up and down buttons in the input box to change the angle of rotation. If the angle is entered manually, click the [Preview] button to rotate the zones. Setting Range : -180 to 180 (Degree) Default : 0.00
(Slide bar)	You can change the angle of rotation via the slide bar. The all zones are rotated corresponding to the movement of slide bar.
[Preview] button	You can input the value of angle directly into the input box. All zones are rotated with the specified angle.
[Execute] button	You can change the setting data to reflect the specified angle of rotation.
[Cancel] button	This cancels the change in the angle of rotation and returns to the previous state.

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Configuration through the configuration software

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■ Displacement of all zones

Select [Displacement of all zones(M)...] under the [Edit(E)] menu.
The [Displacement of all zones] dialog appears.

Item	Description
Horizontal direction	You can specify a distance to displace all zones on the canvas horizontally. Press the up and down buttons in the input box to change the distance displaced. If the distance is entered manually, click the [Preview] button to displace the zones. Setting Range : -1000 to 1000 (mm) Default : 0
(Slide bar)	You can displace the distance horizontally via the slide bar. The all zones are displaced corresponding to the movement of slide bar.
Vertical direction	You can specify a distance to displace all zones on the canvas vertically. Press the up and down buttons in the input box to change the distance displaced. If the distance is entered manually, press the [Execute] button to displace the zones. Setting Range : -1000 to 1000 (mm) Default : 0
(Slide bar)	You can displace the distance vertically via the slide bar. The all zones are displaced corresponding to the movement of slide bar.
[Preview] button	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.
[Execute] button	You can change the setting data to reflect the specified distance(displacement).
[Cancel] button	This cancels the change in the distance(displacement) and returns to the previous state.

⚠ **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.

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.

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Configuration through the configuration software
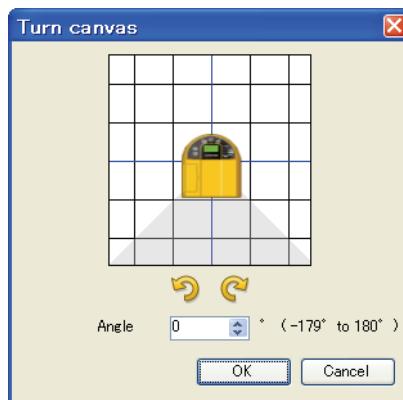
■ **Turn canvas**

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. |

Item	Description
Angle	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
(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.
[OK] button	You can reflect the specified angle to the display of the canvas or monitoring panel.
[Cancel] button	This cancels "Turn canvas".

■ **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.

● **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.
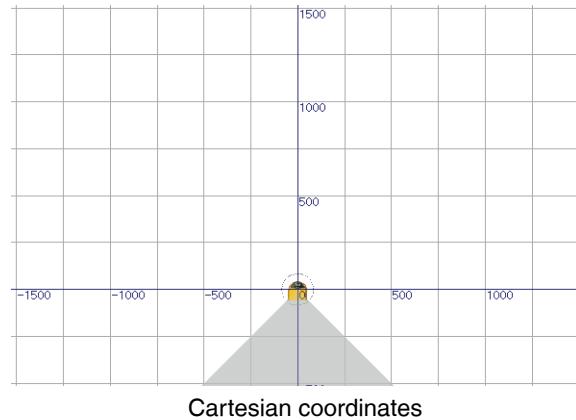
| Note | The "Undo" function cannot be used to restore to the grid interval. |

Setting Range : 100 to 2000 (mm)
Default   : 500
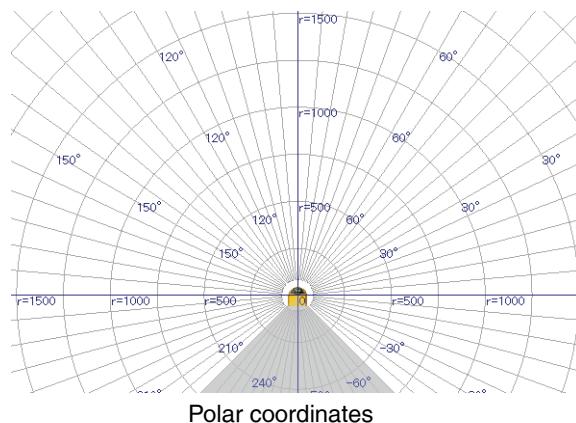
● **Cartesian coordinates**

You can select [Cartesian coordinates(C)] under [Grid(G)] on the [View(V)] menu.
The canvas and monitoring panel are displayed as Cartesian coordinates.

Cartesian coordinates

● **Polar coordinates**

You can select [Polar coordinates(P)] under [Grid(G)] on the [View(V)] menu.
The canvas and monitoring panels are displayed as polar coordinates.

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 panels are displayed in units of "inches".

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Configuration through the configuration software

■ **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. |

■ **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.
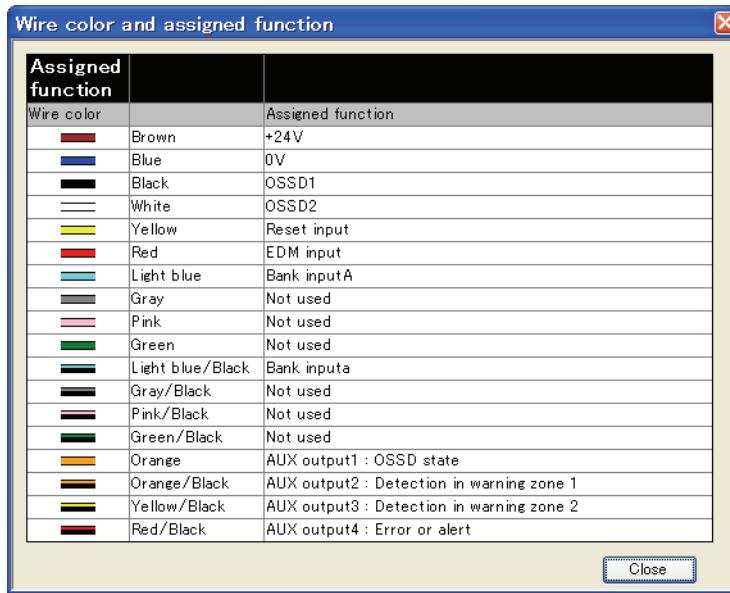
You can switch whether the zone memo is displayed or not.

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	Assigned function
Brown	+24V
Blue	0V
Black	OSSD1
White	OSSD2
Yellow	Reset input
Red	EDM input
Light blue	Bank input A
Gray	Not used
Pink	Not used
Green	Not used
Light blue/Black	Bank input a
Gray/Black	Not used
Pink/Black	Not used
Green/Black	Not used
Orange	AUX output1 : OSSD state
Orange/Black	AUX output2 : Detection in warning zone 1
Yellow/Black	AUX output3 : Detection in warning zone 2
Red/Black	AUX output4 : Error or alert

Reference　The contents on this dialog box varies depending on the model and the configuration.

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Configuration through the configuration software

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.
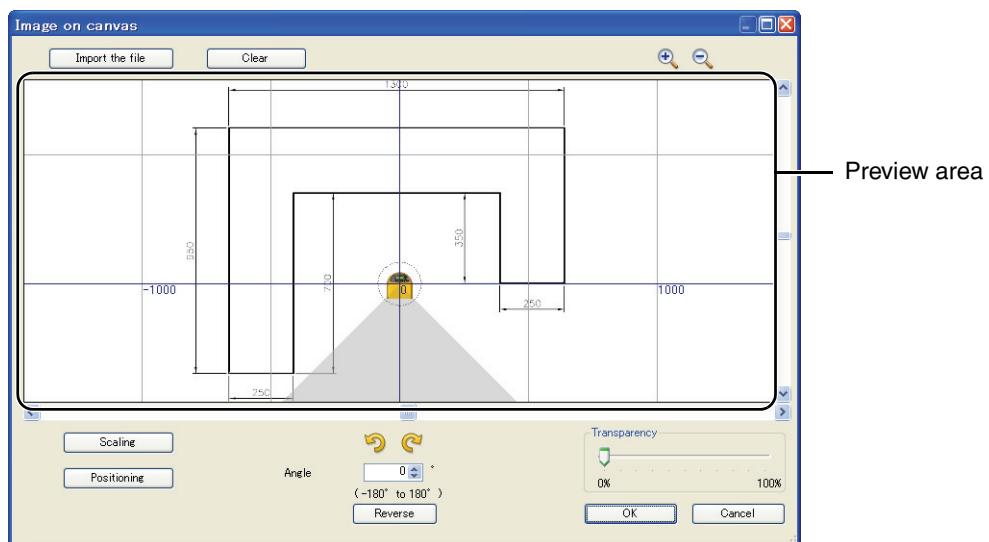
Note	This is only available when an image has been set on the canvas and monitoring panel.

■ **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.

Preview area

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.

Item	Description
Angle	You can specify the angle to rotate the image in the preview area. Setting Range : -180 to 180 (Degree) Default : 0
[Reverse] button	You can invert the image used as the background in the preview area about horizontal axis.
Transparency	The transparency of the image can be changed with the slide bar. The setting of 100% makes the image fully transparent , and then it becomes invisible. You can horizontally reverse the image in the preview area.
[OK] button	You can reflect the specified image to the canvas and monitoring panel.
[Cancel] button	This cancels the image setting.

*1   Images greater than 4000 pixels x 4000 pixels cannot be imported.

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Configuration through the configuration software
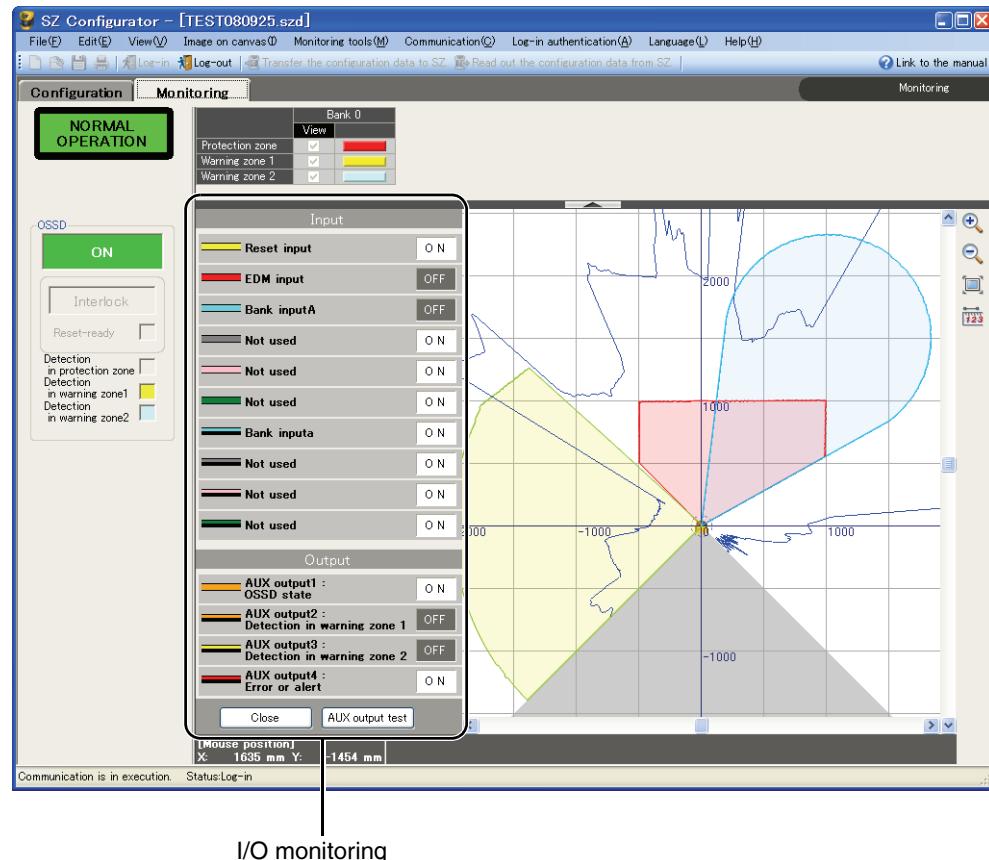
Monitoring tools(M)

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.

I/O monitoring
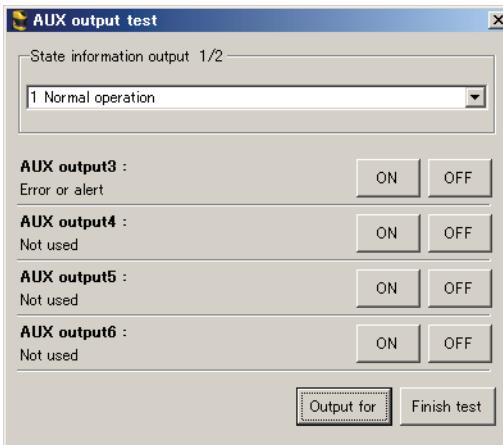
Item	Description
Input	This shows the wire color, function and ON/OFF state of the input. The contents on this varies depending on the model, configuration and input state.
Output	This shows the wire color, function and ON/OFF state of the output. The contents on this varies depending on the model, configuration and output state.
[Close] button	Closes the I/O monitoring.
[AUX output test] button	Turns OSSD OFF and tests AUX output. OSSD goes to the OFF-state in order to execute the AUX output test.

● **AUX output test**
You can click the [AUX output test] button to display the [AUX output test] dialog.
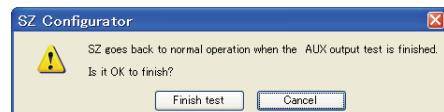
Note	OSSD goes to and keeps the OFF-state during the AUX output test.

| Item	Description
State information output 1/2[*1]	SZ series output the pulsed signal according to the specified state. 📖 "State Information Output" (page 2-41) 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 / 24 Communication monitoring error
[ON] / [OFF] button [*2]	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.
[Output for] button	Output is generated for each AUX according to the setting.
[Finish test] button	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.

*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.
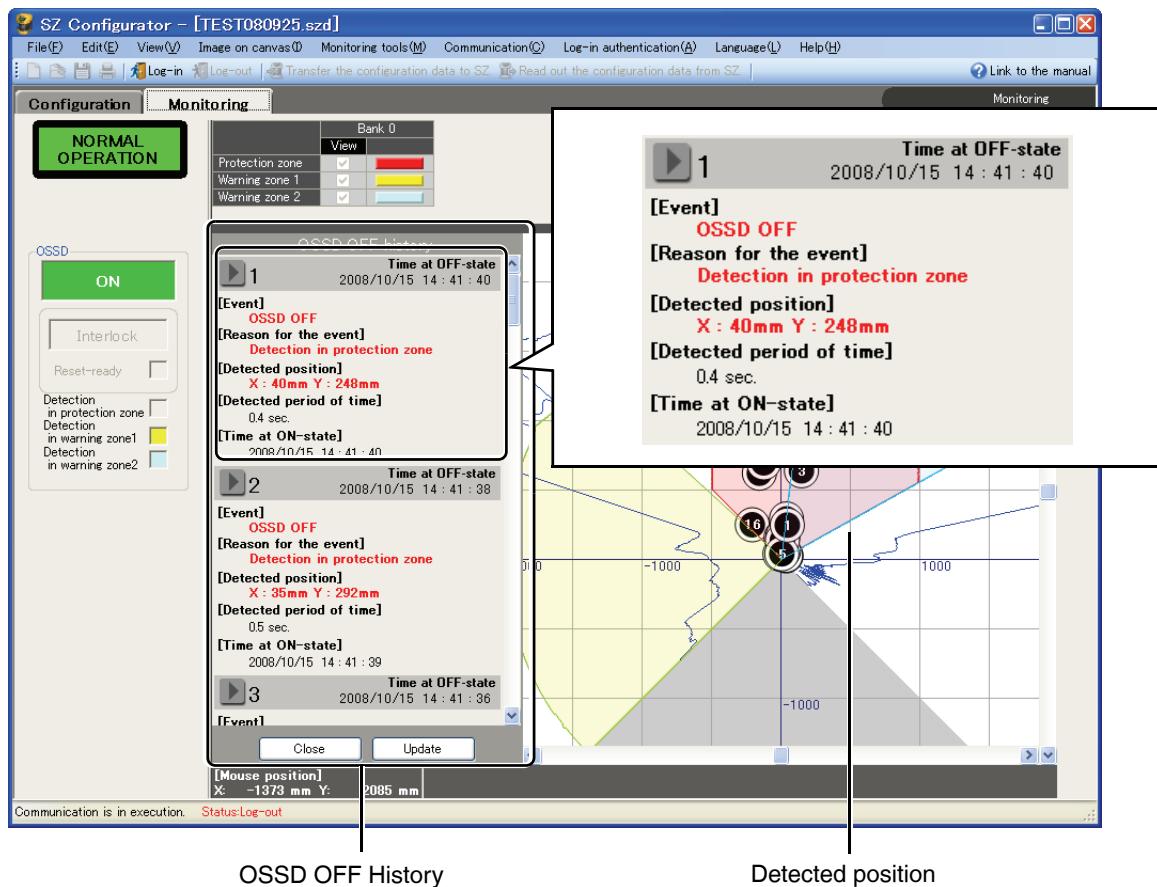
■ OSSD OFF history

You can select [OSSD OFF history(O)] under the [Monitoring tools(M)] menu.
This shows an OSSD OFF history on the monitoring panel.

OSSD OFF History   Detected position

Item	Description
▶ Selection button for detected position	Monitoring panel highlights the detected position for the specified event in the OSSD OFF history.
(Number)	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.
Time at OFF-state	The time that OSSD goes to the OFF-state is displayed. (Time of occurrence)
[Event]	The following is the relationship between the event displayed and models. OSSD OFF : OSSD 1/2 goes to the OFF-state in case of SZ-01S, SZ-16V and SZ-16D. 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.
[Reason for the event]	The reason for the event (OSSD OFF) is displayed.
[Detected position]	The coordinates of position that the event (OSSD OFF) occurred are displayed.
[Detected period of time]	The period of time that the event (OSSD OFF) continued are displayed.
[Time at ON-state]	The time that OSSD goes back to the ON-state is displayed. (Time of occurrence) "OSSDs are still in the OFF-state" is displayed if the OSSD still keeps the OFF-state.
[Close] button	Closes the OSSD OFF history display.
[Update] button	Updates the OSSD OFF history.
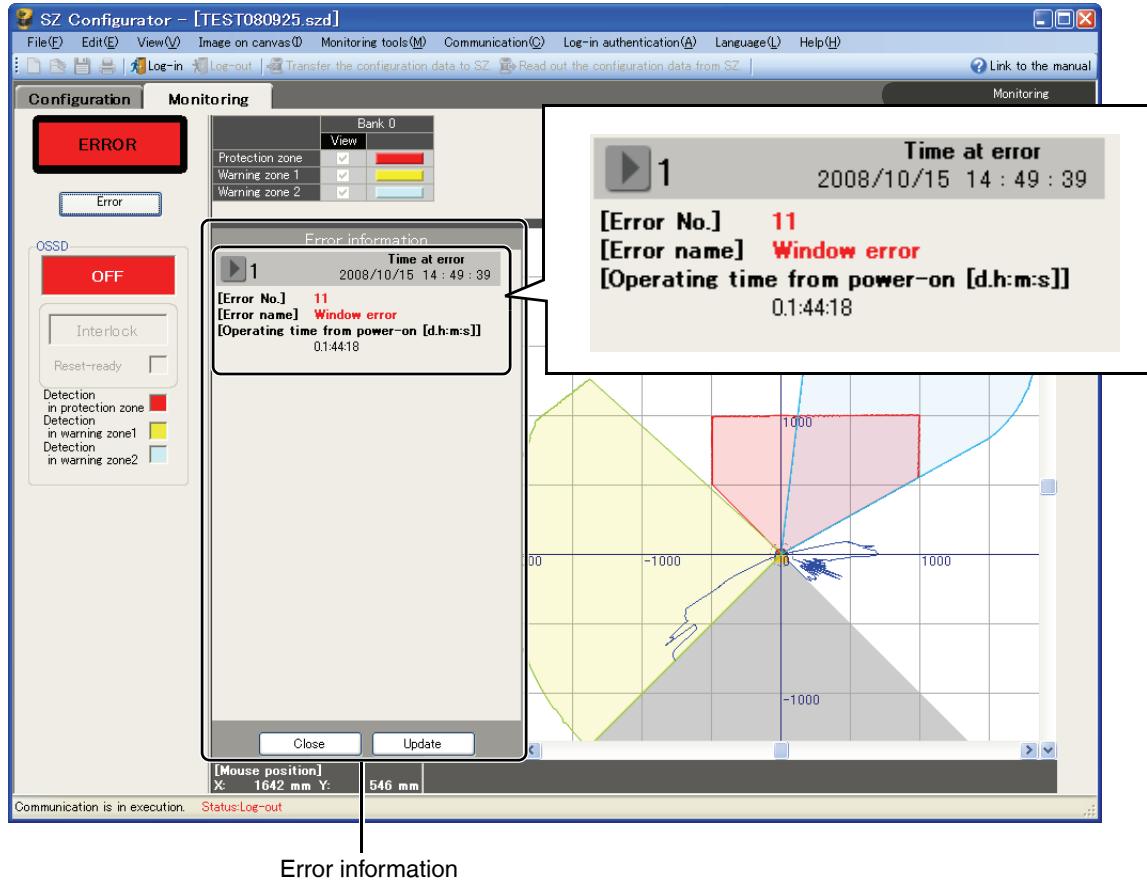
Note   OSSD OFF history is cleared if the power turns OFF.

■ 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	Description
(Number)	This is the history No. of the error in the error information. "1" is assigned to the most recent error in the error information. On the other hand, "20" is assigned to the oldest error. Error information has maximum 20 events in their history. (The 21st and later events are not displayed.)
Time at error	The time that error occurred is displayed. (Time of occurrence)
[Error No.]	The number of the error is displayed.
[Error name]	The name of the error is displayed.
Occurred at [d.h.m.s] from power-on	The period of time from the power-on to the occurrence of the error is displayed.
[Close] button	Closes the error information display.
[Update] button	Updates the error information.

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.

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Configuration through the configuration software

Communication(C)

| Note | 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 [Read out the configuration data from SZ.] 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.
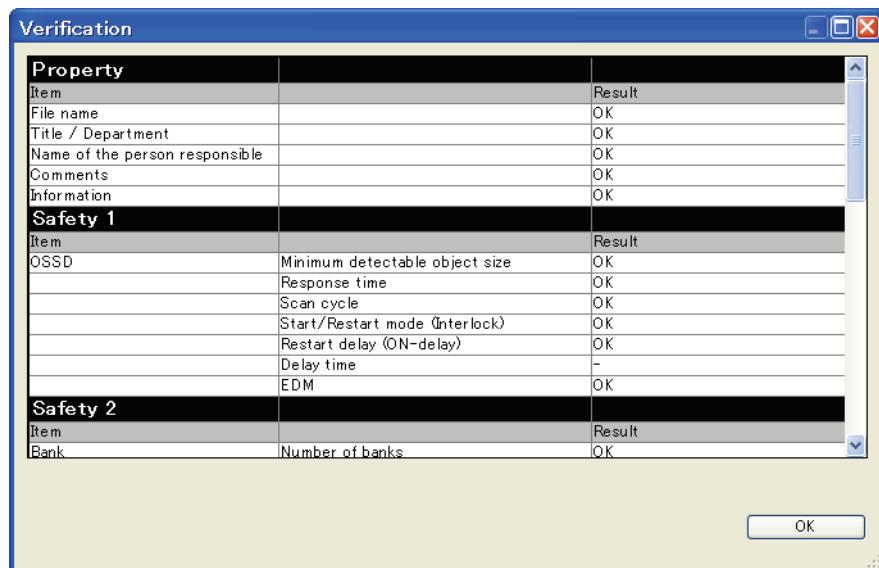
Alternate procedure　　: · Click the [Transfer the configuration data to SZ] button on the drawing toolbar.
　　　　　　　　　　　　　· Click the [Transfer] button on the sub panel belonging to the [Configuration] tab.

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.

■ **Initialization**

You can select [Initialization(I)] under the [Communication(C)] menu.
This initializes the SZ Series.
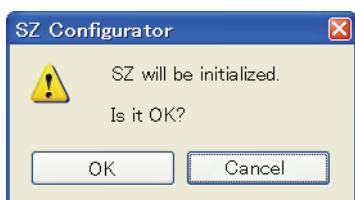
| Note | Initialization causes return to factory defaults of all configurations and deletion of the OSSD OFF history and the error information. |

● **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].

■ **RS-422A Communication Test**

You can select [RS-422A Communication test(T)] under the [Communication(C)] menu.
This can be selected when the model is "SZ-16D".
For details of the Communication Test, refer to 📖 "SZ-16D Communication Manual".

Log-in authentication(A)

> **Note**
> 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.

> **Reference**
> The default password is "1111". Change the default password.
> 📖 "Password change" (page 6-56)

Alternate procedure : Click the 🚪Log-in button on the drawing toolbar.

■ Log-out

You can select [Log-out(O)] under the [Log-in authentication (A)] menu.
This will log you out of the SZ Series.
This cannot be selected if you are already logged out.

Alternate procedure : Click the 🚪Log-out button on the drawing toolbar.

> **Note**
> You will be logged out automatically if 30 minutes has been passed with no operations.

■ Password change
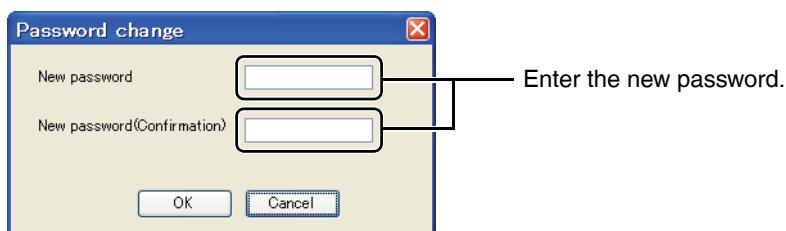
You can select [Password change(C)] under the [Log-in authentication(A)] menu.
This is only available when logged in to the SZ Series.
The [Password change] dialog appears. You can change the password.

> **Reference**
> The default password is "1111".

Enter the new password.

The password must meet the following characteristics.

Length	4 to 8
Usable characters	Alphabet and hyphen (-)

■ **When you forget the password**

You can select [When you forget the password(F)...] from the [Log-in authentication (A)] 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.

■ **Chinese**

You can select [Chinese] under the [Language(L)] menu.
You can change the language of the SZ Configurator to Chinese.

■ **German**

You can select [German] under the [Language(L)] menu.
You can change the language of the SZ Configurator to German.

■ **French**

You can select [French] under the [Language(L)] menu.
You can change the language of the SZ Configurator to French.

■ **Spanish**

You can select [Spanish] under the [Language(L)] menu.
You can change the language of the SZ Configurator to Spanish.

■ **Italian**

You can select [Italian] under the [Language(L)] menu.
You can change the language of the SZ Configurator to Italian.

■ **Portuguese**
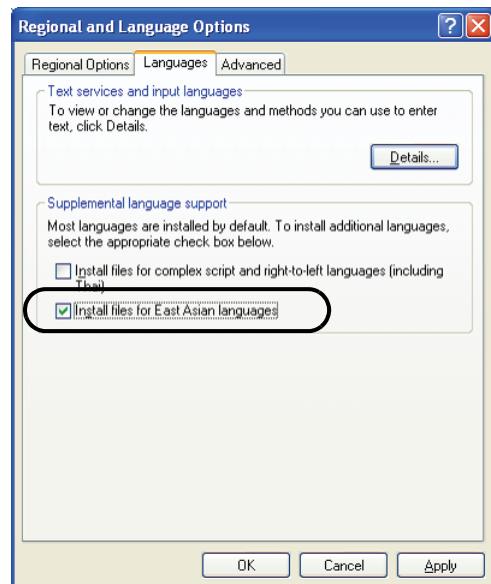
You can select [Portuguese] under the [Language(L)] menu.
You can change the language of the SZ Configurator to Portuguese.

> **Reference** Windows XP requires that fonts are installed to display Japanese and Chinese. Click the Windows [Start] button and select [Control Panel] - [Regional Options]. When a dialog box like the one below appears, select the [Languages] tab and under [Supplemental language support], select the [Install files for East Asian languages] check box and then click [OK].
> A Windows XP CD-ROM is required to install the files.

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.

7

Inspection and Maintenance

You are fully responsible for performing the risk assessment on your machine application, taking into account performing maintenance and inspections, which are critical factor 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.

7-2 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. ▱ "3-3 Safety distances" (page 3-7).

❏ 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. ▱ "2-9 Reference points monitoring function" (page 2-17).

(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.

❑ 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 starts normal operation after power on (when "Now Loading" is changed to "Normal Operation" on the information display) with either "Manual/Manual" or "Manual/Automatic" 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.

7

Inspection and Maintenance

7-3 Daily inspection

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 continues to light in red and the interlock indicator lights in yellow, when the SZ starts normal operation after power on (when "Now Loading" is changed to "Normal Operation" on the information display) with either "Manual/Manual" or "Manual/Automatic" 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 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.

❑ 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.

7

Inspection and Maintenance

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).
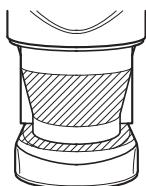
(1) Additional inspection items
❑ The SZ is installed without loosing the screws for fixture, in accordance with the specification of
tightening torque in this manual.
❑ The screw on the connector cable is fastened tightly to the SZ.
❑ The SZ does not have any change on its position. (Safety distance 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.

MEMO

7

Inspection and Maintenance

8

Troubleshooting

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 6-53)

■ 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.
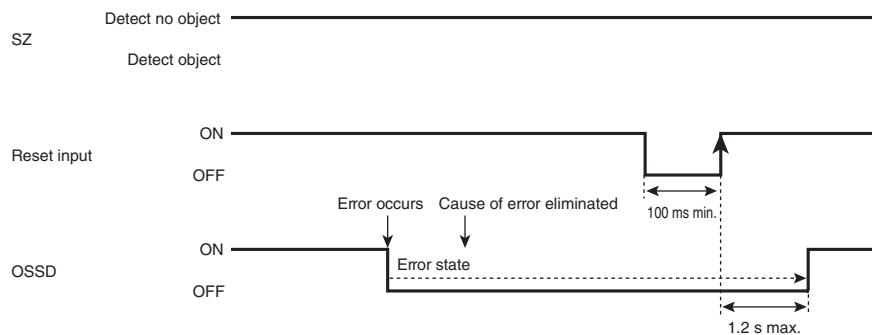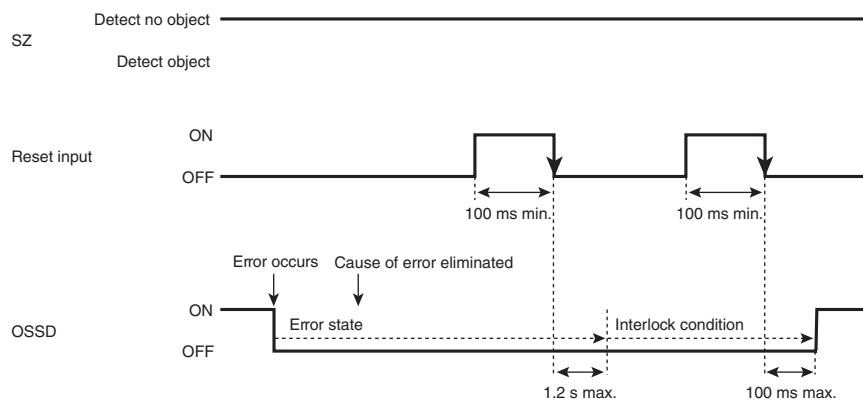
■ **<Time chart for reset operation>**
In case where the SZ goes back to the normal operation with reset operation.

● **"Automatic start mode"**

SZ
Detect no object
Detect object

Reset input
ON
OFF

Error occurs   Cause of error eliminated

100 ms min.

OSSD
ON
OFF
Error state

1.2 s max.

● **"Manual start mode"**

SZ
Detect no object
Detect object

Reset input
ON
OFF

100 ms min.   100 ms min.

Error occurs   Cause of error eliminated

OSSD
ON
OFF
Error state   Interlock condition

1.2 s max.   100 ms max.

8

Troubleshooting

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).

Troubleshooting

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.
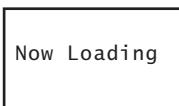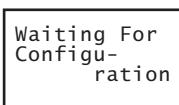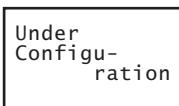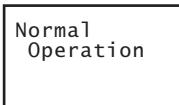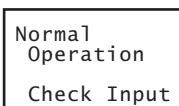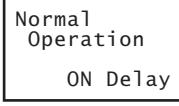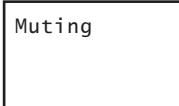
Note
- The SZ may recognize a problem due to the several self-diagnosis functions. In this case, you can see several error information on the information display. You should remove exact problem since these information are possibility.
- The SZ may recognize the consequent problem after it detects one 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).

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
Nothing in display	-	Normal operation	-	No power supply	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)
				"Turn off backlight" has been configured.	If you want to turn on the backlight, you should change the configuration through the SZ Cofigurator. 📖 "Non Safety-related Functions" (page 6-23)
		Broken		The SZ may be broken.	You should replace the SZ.
KEYENCE SZ Series Safety Laser Scanner	Lighting in red	Normal operation	-	This is indicated at start-up for a few seconds.	You should wait for normal operation.
		Broken	-	The OSSD keeps the OFF-state due to the detection of an error through the self-diagnosis at start-up unless you see "Now Loading" after this information. The SZ may be broken in this case.	You should replace the SZ unless you see "Now Loading" after this information.

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Troubleshooting

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
Now Loading	Blinking in red	Normal operation		This is indicated for app. 20 seconds before starting normal operation. The SZ is under loading.*[1]	You should wait for starting normal operation.
		Error 3, or Broken	-	The OSSD keeps the OFF-state due to the detection of an error through the self-diagnosis at start-up unless you see "Normal Operation" after this information. In this case, (1) the SZ is in the error state of light interference, (2) the SZ is in the error state due to the strong vibration and shock, or (3) the SZ may be broken in this case.	(1) You should reinstall the SZ so as not to have light interference within ±5° to the detection plane. 📖 " Light interference" (page 3-3), 📖 " Mutual interference" (page 3-3) (2) You should install the SZ so as not to have the vibration and shock exceeding the specification. 📖 "9-2 Specifications" (page 9-3) (3) You should replace the SZ.
Waiting For Configu- ration	Lighting in red	Normal operation	22	The configuration is not completed.	You should perform the configuration of safety function through the SZ Configurator or manual configuration on the SZ. 📖 "Chapter 5 Manual Configuration on the SZ" (page 5-1) 📖 "Chapter 6 Configuration through the configuration software" (page 6-1)
Under Configu- ration	Blinking in red	Normal operation	21	(1) The configuration through the SZ Configurator is being transferred or initialized. (2) AUX output test is in execution.	(1) You should wait for completing the transferring or initialization. (2) You should complete the AUX output test. 📖 "Monitoring tools(M)" (page 6-50)
Normal Operation	Lighting in green, red, or orange*[2]	Normal operation	1	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.	If the OSSD goes to the OFF-state when nothing is present in the protection zone, see 📖 "Troubleshooting on the OSSD operation" (page 8-11).
Normal Operation Bank*	Lighting in green, red, or orange*[2]	Normal operation	4~7	It indicates the bank number in case of enabling the bank switching function. Asterisk (*) is the bank number.	📖 "2-11 Bank switching function" (page 2-20)
Normal Operation Check Input	Lighting in red	Normal operation	1	The OSSD is in the OFF-state due to the check input.	📖 "2-14 Check input function" (page 2-43)
Normal Operation ON Delay	Lighting in red	Normal operation	1	The OSSD is in the OFF-state due to restart delay (ON-delay).	The OSSD automatically goes to the ON-state after the configured delay time is passed. 📖 "Restart Delay (ON-delay)" (page 2-15)
Muting	Lighting in green	Normal operation	2	The SZ is under the temporary suspension of safety function due to muting, override, or suspension in teaching mode.	📖 "2-12 Temporary suspension of safety function" (page 2-27)
Muting Detection	Lighting in green	Normal operation	2	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.	📖 "2-12 Temporary suspension of safety function" (page 2-27)

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
`Interlock`	Lighting in red, or orange*2	Normal operation	3	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.	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)
`Interlock` `Reset Ready`	Lighting in red	Normal operation	3	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.	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.
`Interlock` `RST Ready1/2`	Lighting in red, or orange*2	Normal operation	3	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.	You should perform the reset operation for OSSD 1/2 in order to terminate the interlock condition. 📖 "2-7 Interlock" (page 2-12)
`Interlock` `RST Ready3/4`	Lighting in red, or orange*2	Normal operation	3	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.	You should perform the reset operation for OSSD 3/4 in order to terminate the interlock condition. 📖 "2-7 Interlock" (page 2-12)

`Alert`
`Window`
`Pollution`
	Lighting in green, red, or orange*2	Alert	9	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.	You should perform the cleaning according to 📖 "7-5 Cleaning the window" (page 7-9)

`Alert`
`Light`
`Interference`
	Lighting in green, red, or orange*2	Alert	10	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.	You should take a countermeasure according to 📖 "Light interference" (page 3-3), 📖 "Mutual interference" (page 3-3)

`Alert` `Muting Lamp`	Lighting in green, red, or orange*2	Alert	11	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.	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. 📖 "Muting lamp output" (page 2-40)

`Alert`
`AUX`
`Over current`
	Lighting in green, red, or orange*2	Alert	-	Alert: AUX Overcurrent 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.	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)

`Alert`
`High`
`Reflection`
	Lighting in green, red, or orange*2	Alert	10	Alert: High-reflective background There is a high reflective background behind the specified protection zone, which has impact to the detection capability.	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, 200 mm 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)

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Troubleshooting

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
Waiting For Bank Input	Blinking in red	Normal operation, or Error 1	8	The signal combination of bank inputs does not meet the specification.	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)
Error1 OSSD1 Error	Blinking in red	Error 2	12	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.	(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.
Error2 OSSD2 Error	Blinking in red	Error 2	12	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.	(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.
Error3 OSSD3 Error	Blinking in red	Error 2	12	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.	(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.
Error4 OSSD4 Error	Blinking in red	Error 2	12	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.	(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.
Error5 OSSD Over current	Blinking in red	Error 2	12	OSSD Overcurrent Error Overcurrent occurs on any of OSSD1 to 4.	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)
				In case of NPN output type cable, the SZ with positive grounding is connected to the PC with negative grounding through the USB cable.	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 must be be grounded in order to start normal operation.

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
Error6 EDM Error (OSSD1/2)	Blinking in red	Error 2	13	EDM Error for OSSD 1/2 <In case of EDM function applied> (1) EDM input is not connected to the external device correctly. (2) The external device connected to the OSSD is broken. <In case of EDM function not applied> (3) EDM input is not open-circuited.	(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.
Error7 EDM Error (OSSD3/4)	Blinking in red	Error 2	13	EDM Error for OSSD 3/4 <In case of EDM function applied> (1) EDM input is not connected to the external device correctly. (2) The external device connected to the OSSD is broken. <In case of EDM function not applied> (3) EDM input is not open-circuited.	(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.
Error8 Reset Error (OSSD1/2)	Blinking in red	Error 2	14	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 "Automatic". Or, the reset input is in the ON-state at start-up if the configuration of restart mode is "Manual".	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)
Error9 Reset Error (OSSD3/4)	Blinking in red	Error 2	14	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 "Automatic". Or, the reset input is in the ON-state at start-up if the configuration of restart mode is "Manual".	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)
Error10 Bank Error	Blinking in red	Error 2	15	Bank Error (1) The signal combination of bank inputs does not meet the specification. (2) The bank switching was not performed during the specified bank transition time. (3) The bank switching was not performed according to the specified bank sequence.	(1) You should check the wiring on the signal combination of bank inputs. (2) The bank switching should be performed during the specified bank transition time. (3) You should check the bank sequence and the configuration of bank sequence monitoring. 📖 "2-11 Bank switching function" (page 2-20), 📖 "Bank sequence monitoring" (page 2-26)
Error11 Window Error	Blinking in red	Error 1	16	Window Error Window may be polluted or damaged.	You should perform cleaning according to 📖 "7-5 Cleaning the window" (page 7-9) If you experience continuous errors after cleaning, you should replace the window. In this case, you should consult the nearest KEYENCE office.
		Error 3		Window may be broken. Or it may not be correctly positioned.	You should replace the window. In this case, you should consult the nearest KEYENCE office.
Error12 Check Point Error	Blinking in red	Error 1	17	Check Point Error The SZ detects no structure on the check points within the specified tolerance when the check input goes to the ON-state.	You should check whether the SZ or the structure on the check points is displaced or not. 📖 "Check point monitoring" (page 2-44)

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Troubleshooting

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Troubleshooting

Information on the display	Color of display	State	The number of pulses for state information	Description	Countermeasure
Error13 Muting Lamp Error	Blinking in red	Error 1	18	Muting Lamp Error (Disconnection) Muting lamp has a failure, such as disconnection or break.	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. ▭ "Muting lamp output" (page 2-40)
Error14 Muting Lamp Error	Blinking in red	Error 1	18	Muting Lamp Error (Overcurrent) Muting lamp has an overcurrent exceeding the rated current.	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. ▭ "Muting lamp output" (page 2-40)
Error15 Calibration Error	Blinking in red	Error 1	19	Calibration Error	You should consult the nearest KEYENCE office.
Error16 MI Error	Blinking in red	Error 1	23	MI Error (1) A structure with extremely low reflectance is located close to the SZ. (2) The SZ does not detect any diffuse reflection from the object to be detected or the structure outside the protection zone. The SZ generates an error if it does not detect anything exceeding 60 degrees.	(1) You should remove structure with low reflectance close to the SZ. (2) You should position a structure outside the protection zone so that the SZ detects diffuse reflection from the structure.
Error** SYSTEM Error	Blinking in red	Error 2 or Error 3	20	System Error The number from 17 to 46 is assigned to the asterisk (**) (1) The SZ is under EMC environment. (2) The SZ has light Interference. (3) The SZ has strong vibration or shock. (4) The power is disconnected during configuration. (5) The SZ is broken.	(1) You should check the wiring and EMC environment in the surrounding. (2) You should take a countermeasure to ▭ "Light interference" (page 3-3), or ▭ "Mutual interference" (page 3-3). (3) You should avoid strong vibration or shock. ▭ "9-2 Specifications" (page 9-3). (4) You should perform the configuration again. (5) You should replace the SZ.
Error47 COM Monitor Error	Blinking in red	Error 2	24	Communication monitoring error (only for the SZ-16D) It will occur only when the communication monitor function of a part of the RS-422A communication function is enabled.	Enact the command communication within the set communication monitor interval, then clear the timer, or, stop the communication monitor function.

*1 When the main body of the SZ is not Ver.2 or newer, it will take about 50 seconds.
*2 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

Situation	Description	Countermeasure
The OSSD goes to the OFF-state when nothing is present in the protection zone.	Light interference may occur.	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 6-43)
	Mutual interference due to another SZ may occur.	You should take a countermeasure according to the description in 📖 "Mutual interference" (page 3-3)
	The SZ may detect the floor or the surrounding (background) because the SZ is installed with some inclination.	You should adjust the SZ installation angle and position so that the SZ does not detect the floor or the surrounding (background).
	The background is close to the boundary of the specified protection zone.	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)
	The position of the SZ or the surroundings (background) has been changed.	You should restore the position of the SZ or the surroundings (background). You should perform the configuration on the protection zone again.
	The structure on the reference points is not present or is not located within the specified tolerance.	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. 📖 "Reference points monitoring function" (page 2-17)
	Laser shutdown function is activated.	You should switch the bank. 📖 "Laser Shutdown" (page 2-26)
	The SZ has a pollution on the window.	You should perform the cleaning according to 📖 "7-5 Cleaning the window" (page 7-9)
	The SZ detects particles in the air, such as dust, spatter or moisture.	You should take a countermeasure that the particles in the air do not go into the protection zone.

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Troubleshooting

Troubleshooting concerning USB connection

Situation	Description	Countermeasure
The USB cannot be connected to the SZ (You cannot log-in.)	USB cable is not connected to the SZ, or is disconnected.	You should check the USB cable and USB port on your personal computer.
	The power is not supplied to the SZ.	You should supply the power to the SZ.
	Mode switch is in the "B: Configuration on SZ".	You should change the mode switch to "A: Run / PC Communication".
	USB driver is not installed into your computer.	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\)
	In case of NPN output type cable, the SZ with positive grounding is connected to the PC with negative grounding through the USB cable.	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.
You cannot transfer the configuration.	The specified model in the SZ Configurator mismatches the actual SZ model.	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. When the model cannot be changed, create a new file. From "File (F)" choose "Create New File (N)".
	All configurations are not completed.	You should check the configuration.
	The specified protection zone or warning zone is configured beyond the specification.	You should check the configuration on the protection zone, warning zone, and minimum detectable object size.
	The power is not supplied to the SZ.	You should supply the power to the SZ.
You cannot perform the monitoring on the SZ.	The specified model in the SZ Configurator mismatches the actual SZ model.	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.
	The configuration is not completed.	You should start monitoring after you transfer the configuration to the SZ.

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Troubleshooting

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Specifications and Dimensions

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

                                     D: Communication type

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Specifications and Dimensions

9-2 Specifications

Model			SZ-01S	SZ-04M	SZ-16V/SZ-16D
Detection capability	Minimum detectable object size		Diameter 30, 40, 50, 70, 150 mm (depends on the setting) Reflectance 1.8 % min., Speed 1.6 m/s max.		
	Detectable angle		270° (-45° to 225°)		
	Response time (ON to OFF)	General scan cycle (Scan cycle A)	60 ms (2 scans) to 480 ms (16 scans)		
		Specific scan cycle (Scan cycle B)	66 ms (2 scans) to 528 ms (16 scans)		
	Response time (OFF to ON)	General scan cycle (Scan cycle A)	Response time (ON to OFF) + 125 ms		
		Specific scan cycle (Scan cycle B)			
	Maximum protection zone	Minimum detectable object size: 70/150 mm	4.2 m (-5° to 185°) 2.8 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 50 mm	3.0 m (-5° to 185°) 2.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 40 mm	2.4 m (-5° to 185°) 1.6 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 30 mm	1.8 m (-5° to 185°) 1.2 m (-45° to -5°, 185° to 225°)		
	Maximum warning zone *1 (non safety-related)	Minimum detectable object size: 70/150 mm	10.0 m (-5° to185°) 7.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 50 mm	7.5 m (-5° to 185°) 5.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 40 mm	6.0 m (-5° to 185°) 4.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 30 mm	4.5 m (-5° to 185°) 3.0 m (-45° to -5°, 185° to 225°)		
	Additional safety distance		100 mm*2		
Light source	Type, wavelength		Infrared laser diode, 905 nm		
	Laser class		Class 1 IEC / EN 60825-1 Class 1 CFR 21 1040.10, 1040.11 (Laser Notice No.50) Class 1 JIS C6802		
Rating	Power voltage		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		
	Power consumption		Max. 9.5 W (without load) Max. 39 W (with load)	Max. 9.5 W (without load) Max. 50W (with load)	Max. 10.5 W (without load) Max. 43 W (with load)
OSSD output	Output		PNP or NPN (Selectable according to the connector cable)		
			2 outputs	4 outputs	2 outputs
	Max. load current		500 mA*3		
	Residual voltage (during ON)		Max. 2.5 V (with a cable length of 5 m)		
	OFF-state voltage		Max. 2.0 V (with a cable length of 5 m)		
	Leakage current		Max. 1 mA*4		
	Max. capacitive load		2.2 μF (with a load resistance of 100 Ω)		
	Load wiring resistance		Max. 2.5 Ω*5		
Input (safety-related)	Input resistance		4.4 kΩ (for Input 1) 2.2 kΩ (for Input 2)	4.4 kΩ (for Input 1, 3, 4, and 5) 2.2 kΩ (for Input 2 and 6)	4.4 kΩ (for Input 1 and 3 to 10) 2.2 kΩ (for Input 2)
Non safety-related output (AUX output)	Output type		PNP / NPN totem-pole output		
			2 outputs	6 outputs	4 outputs
	Max. load current		50 mA		
	Residual voltage (during ON)		Max. 2.5 V (with a cable length of 5 m)		
Muting lamp output	(AUX6 output can be assigned for the muting lamp output)			Can be connected to the incandescent lamp (24 V DC, 1 to 5.5 W) and LED lamp (load current 10 to 230 mA)	

Model			SZ-01S	SZ-04M	SZ-16V/SZ-16D
RS-422A Communication (SZ-16D only)	Communication method				Full duplex
	Synchronization method				Start-stop
	Baud rate				9600/19200/38400/ 57600/125k/250k bps
	Date bit length				8 bit
	Parity check				None
	Stop bit length				1 bit
	Maximum number of connectable units				4 units (multi-drop link)
	Transmission distance				Max. 30 m
	Data transfer direction				LSB
Environmental resistance	Enclosure protection		IP65 (IEC60529)[*6]		
	Operating ambient temperature		-10 to +50 °C (No freezing)		
	Storage ambient temperature		-25 to +60 °C (No freezing)		
	Operating relative humidity		35% to 85 %RH (No condensation)		
	Storage relative humidity		35 % to 95 % RH		
	Surrounding light		incandescent lamp: 1500 lx or less[*7]		
	Vibration		10 to 55 Hz, 0.7 mm compound amplitude, 20 sweeps each in X, Y, and Z directions		
	Shock		100 m/s^2 (Approx. 10 G) 16 ms pulse, in X, Y, Z directions 1,000 times each axis		
Material	Main unit case		Aluminum die casting, SPHC (Bottom)		
	Window		Polycarbonate		
Cable length			30 m or less[*8]		
Approved standards	EMC	EMS	IEC61496-1, EN61496-1, UL 61496-1		
		EMI	EN55011 Class A, FCC Part15B Class A		
	Safety		IEC61496-1, EN61496-1, UL 61496-1 (Type 3 ESPE)		
			IEC61496-3, EN61496-3 (Type 3 AOPDDR)		
			IEC61508, EN61508, IEC62061, EN62061 (SIL2)		
			EN ISO13849-1:2015 (PL d, Category 3)		
			UL508, UL1998		

*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 For the load current calculation of the OSSD output and the AUX output, make sure it is 1.5 A or less when using converter power supply (or 1.0 A or less when the cable length is 25 m or more), and 1.0A or less when using a battery (or 0.5 A or less when the cable length is 5 m or more).
*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 When the setting cover is open, or the connector cable is not connected, the IP65 certification cannot be met. In addition, the SZ-16D doesn't fulfill the requirements of IP65 degree of protection with the connector cable for the RS-422A communication unattached.
*7 The SZ should not be installed so as to have light interference within ±5° to the detection plane.
*8 It must be 10 m or less if the power is supplied by the battery,
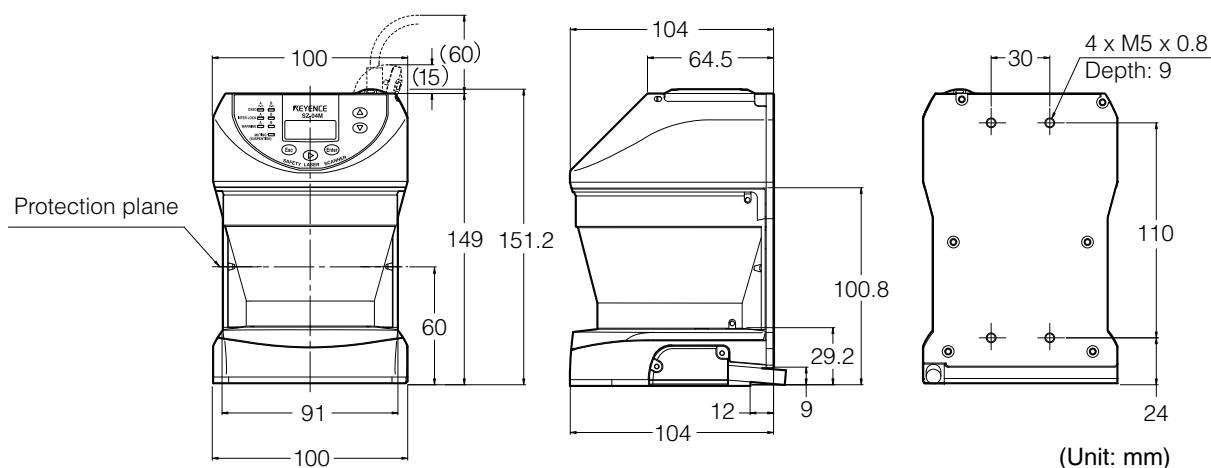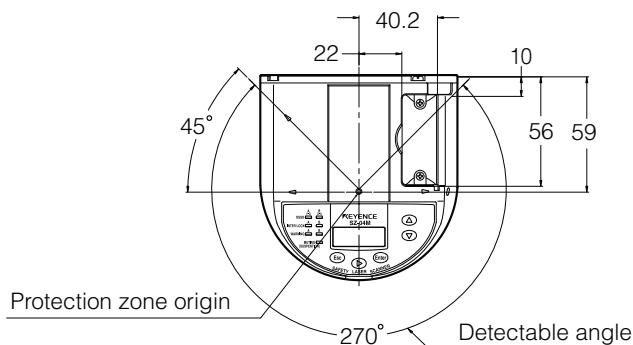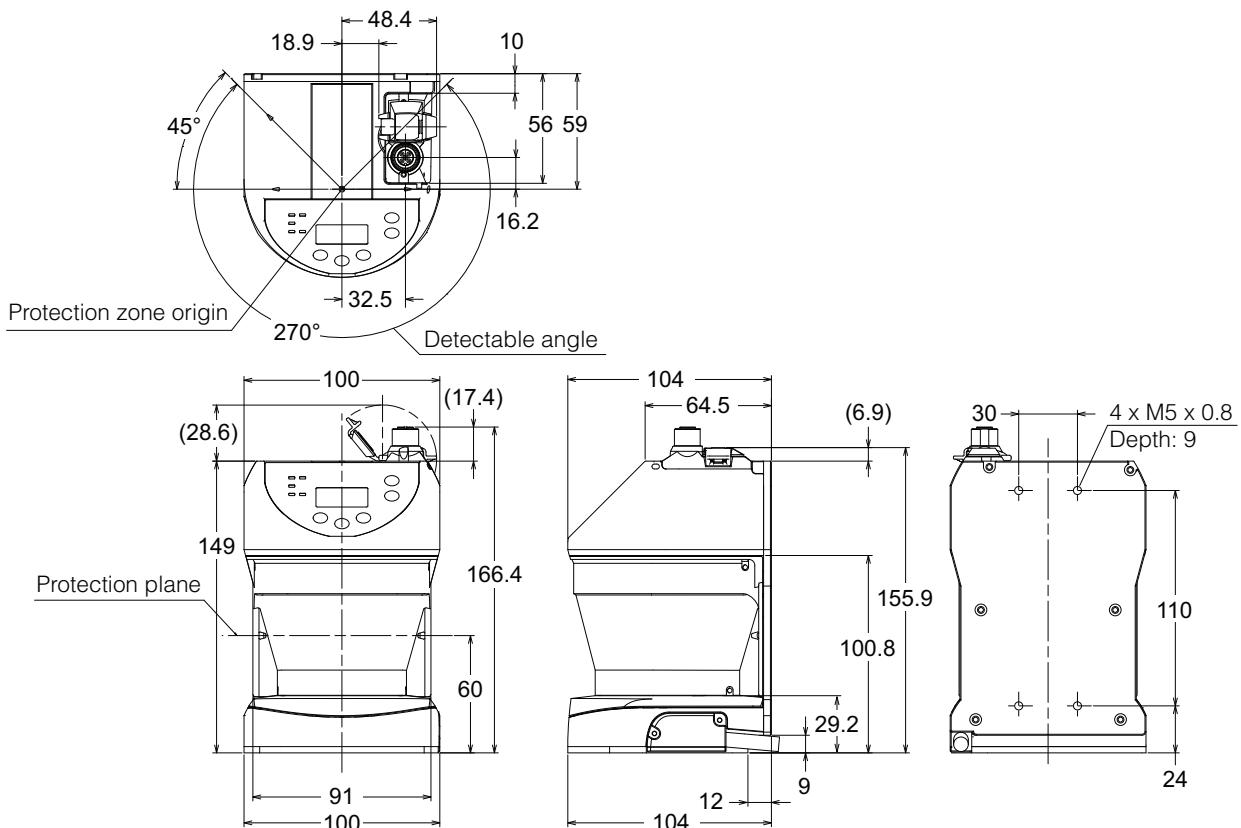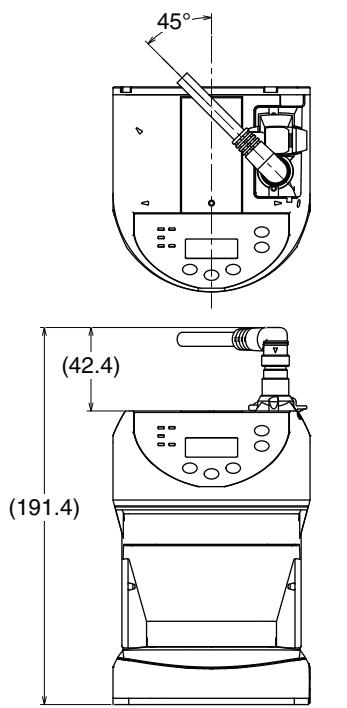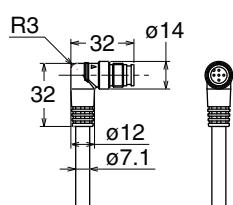
9

Specifications and Dimensions

9-3 Dimensions

SZ main unit

■ SZ-01S/SZ-04M/SZ-16V

Protection zone origin

Detectable angle

270°

Protection plane

(Unit: mm)

■ **SZ-16D**

Protection zone origin
270°
Detectable angle

Protection plane
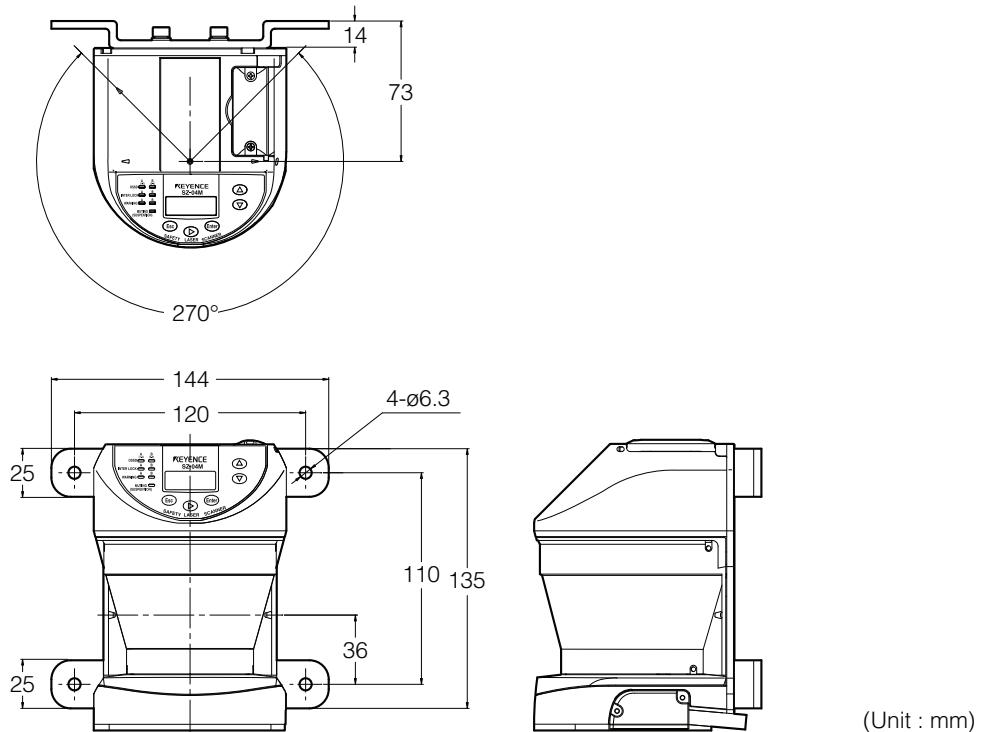
When M12 connector is connected

M12 connector section

(Unit: mm)

Specifications and Dimensions

9
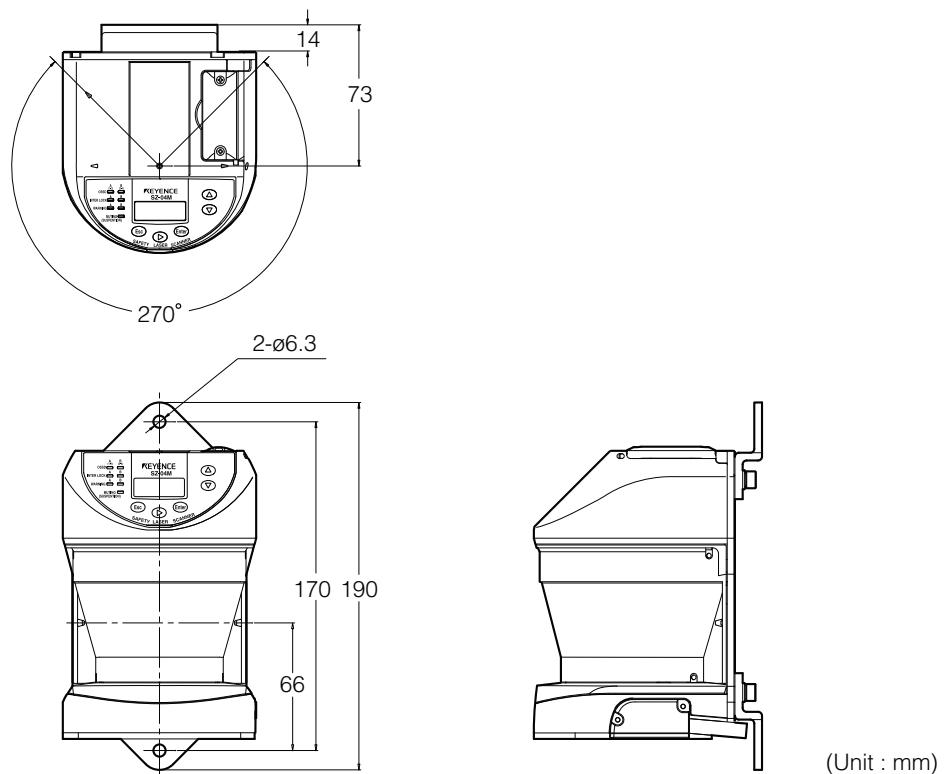
When using the mounting bracket
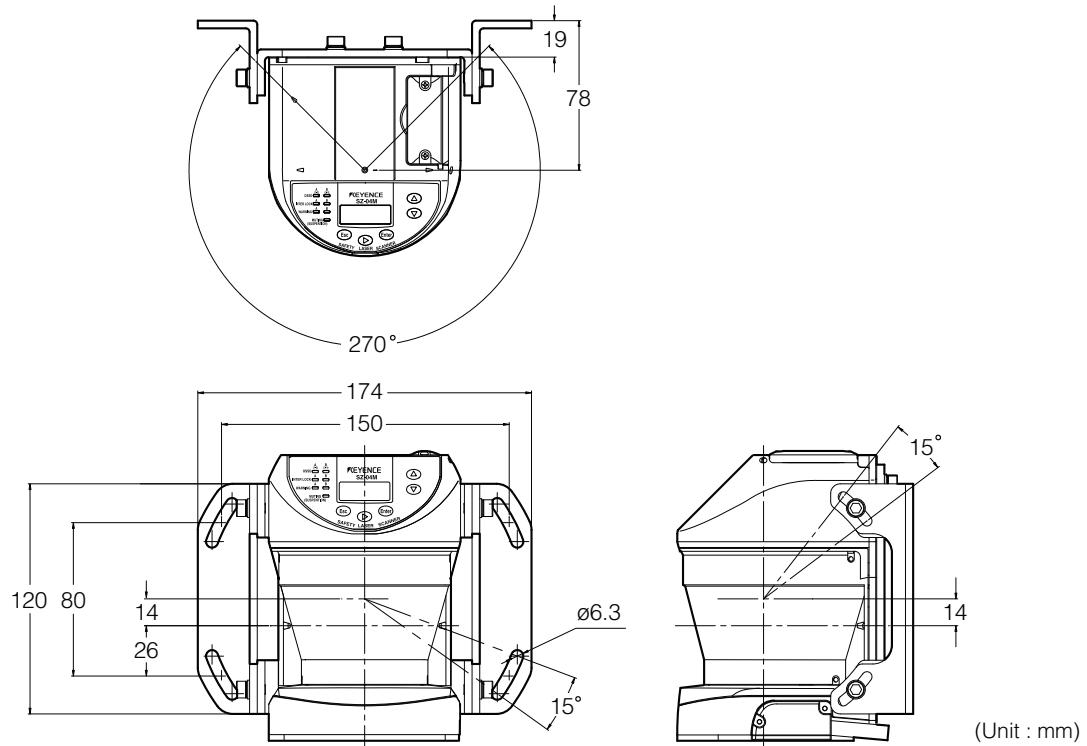
■ Horizontal mounting bracket (Model: OP-86935)
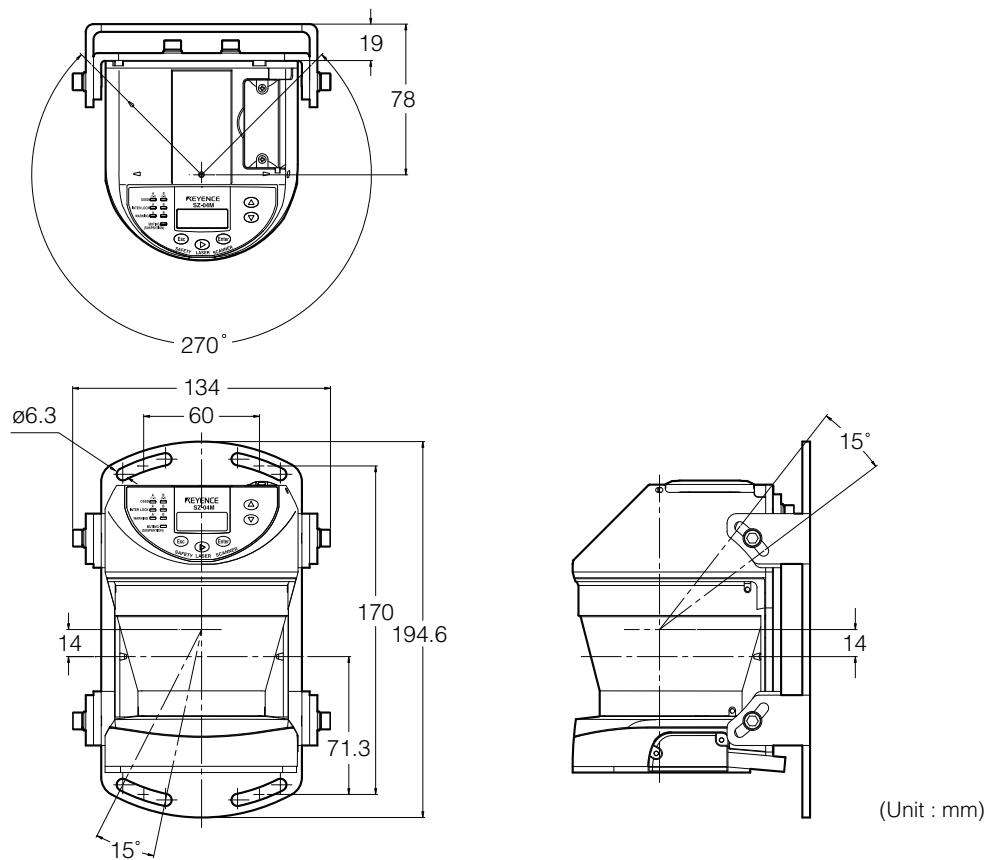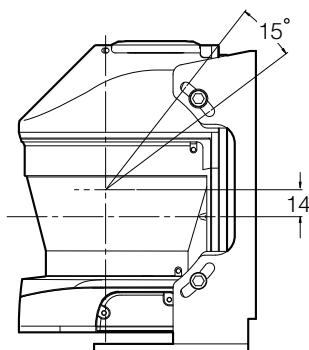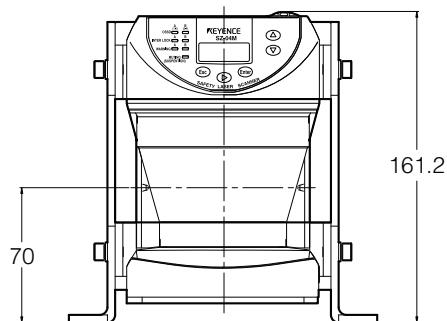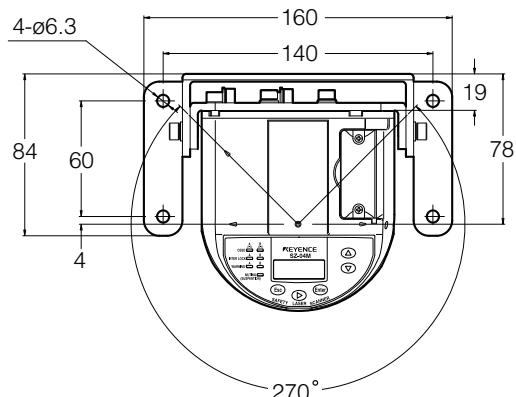
270°

14
73

144
120
4-ø6.3
25
110 135
36
25

(Unit : mm)

■ Vertical mounting bracket (Model: OP-86936)

270°

14
73

2-ø6.3

170 190
66

(Unit : mm)

9

Specifications and Dimensions

■ **Horizontal mounting bracket with angle alignment (Model: OP-86937)**

270°

174
150
120 80
14
26
ø6.3
15°
15°
14

(Unit : mm)

■ **Vertical mounting bracket with angle alignment (Model: OP-86938)**

19
78
270°

134
60
ø6.3
14
170
194.6
71.3
15°
15°
14

(Unit : mm)

■ **L-shaped mounting bracket with angle alignment (Model: OP-86939)**

(Unit : mm)

Revision History

Date of creation	Version	Revision contents
February 2009	Official release	
April 2009	2nd	
December 2009	3rd	Content added
December 2010	Revised first edition	Model addition, contents addition
October 2012	2nd	Contents revised
July 2016	3nd	
March 2017	4th	

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