KEYENCE

557GB

Safety Laser Scanner

SZ-V Series
User's Manual

Introduction

This user's manual describes handling, operation, and precautionary information for the SZ-V Series Safety Laser Scanner (“SZ-V”). Read this user's manual thoroughly before operating the SZ-V in order to understand the device features.
Always keep this manual in a safe place for future reference.
Also, ensure that the end user of this product receives this user's manual.
In this manual, “SZ-V04 type” is used to represent a comprehensive SZ-V unit that uses SZ-VU04 as the Display unit; “SZ-V32 type” is used to represent a comprehensive SZ-V unit that uses SZ-VU32 as the Display unit; and “SZ-V32N type” is used to represent a comprehensive SZ-V unit that uses SZ-VU32N as the Display unit.
“Model” (page 124)

This manual is the original instruction manual.

Symbols

The following symbols alert you to important messages. Be sure to read these messages carefully.

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

🕮 It indicates the reference pages in this manual or the reference pages in separate manuals.

Safety Information for SZ-V Series

General precautions

DANGER

- SZ-V 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-V is operating correctly in terms of functionality and performance before the start of machine and the operation of the SZ-V.
- KEYENCE does not guarantee the function or performance of the SZ-V if it is used in a manner that differs from the SZ-V specifications contained in this user's manual or if the SZ-V is modified by the customer.
- When using the SZ-V to protect machine operators against a hazard or hazardous zone or when using the SZ-V 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-V 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-V 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-V 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-V.
- “Machine operators” refers to personnel who have received appropriate training from the responsible personnel and are qualified to operate the machine correctly.
- "Maintenance personnel" refers to personnel who have received appropriate training from the responsible personnel, the responsible personnel can send approved settings to the SZ-V, and are qualified to operate the machine correctly.
- Maintenance personnel and machine operators must have specialized training for the SZ-V, and they must understand and fulfill the safety regulations in the country or region in which they are using the SZ.
- If the SZ-V fails to operate, maintenance personnel and machine operators must immediately stop the use of the machine and the SZ-V and report this fact to the responsible personnel.
- The SZ-V 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-V after performing a sufficient risk assessment for the target machine.
- Be sure to absolutely confirm that there is nobody in the hazardous zone, before you remove the SZ-V from the machine for replacement or disposal.

Important

- When disposing the SZ-V, always follow the applicable requirements of the laws, rules, regulations and standards in the country or region where the SZ-V is used.
- The SZ-V should be processed as an industrial waste product when being disposed.

Precautions on use

Operators

DANGER

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

Environment of use

DANGER

- Do not use the SZ-V in an environment (temperature, humidity, interfering light, etc.) that does not conform to the specifications contained in this user's manual.
- Do not use a device that emits strong electromagnetic waves near the SZ-V.
- The SZ-V 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-V 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-V 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-V has not undergone the model certification examination in accordance with Article 44-2 of the Japanese Industrial Safety and Health Law. The SZ-V, 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-V is to be installed must be susceptible to an emergency stop at all operating points during its operation cycle. Do not use the SZ-V for machines with irregular stop times.
- The SZ-V 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-V 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-V 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.

DANGER

- SZ-V must be installed in such a way that the screws do not loosen due to vibration and/or shock. The screw loosen may cause the displacement of detection plane and SZ-V cannot 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-V 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-V is installed.
- When changing the minimum detectable object size and response time for SZ-V, the safety distance must be recalculated, and the SZ-V must be reinstalled based on the result of recalculation to keep the required safety distance.
- The SZ-V 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-V. 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-V or to remain in a position between the protection zone of the SZ-V and the hazardous zone or hazard.
- You must always perform the pre-check tests after installing the SZ-V 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 point monitoring function must be applied when the SZ-V 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 muting is a function to allow a temporary automatic suspension of the safety function while the SZ-V 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-V 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-V 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-V.
- 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 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-V 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.
- The override is a function to allow a temporary manual suspension of the SZ-V safety functions. Therefore, additional safety measures are required for the whole machine system on which the SZ-V 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-V 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-V 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 function and override 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-V is used.
- Securely tighten mounting brackets and cable connectors used for the installation of the SZ-V 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-V. This may lead to the loss of the detection capability of the SZ-V.
- If the object to be detected moves perpendicular to the detection plane, SZ-V cannot detect the object moving at speed over 1.6m/s, regardless of the encoder setting.

Circuit design and wiring

DANGER

- Always turn off the power to the SZ-V when performing electrical wiring.
- You must fulfill the electrical standards and regulations in the country or region in which the SZ-V is being used when you perform the electrical wiring.
- To avoid the risk of electric shock, do not connect any of the SZ-V 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-V with the reinforced insulation or double insulation.
- If the power supply for the SZ-V is the converting type, the power supply for the SZ-V 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 +20% -30%.
  (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-V is used.
- Do not install the electric wiring of the SZ-V together with or in parallel with the high-voltage electrical or power lines.
- For the wiring between SZ-V 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 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 machine control system, it results in a significant harm to the machine operators, including serious injury or death, due to OSSD malfunction.
- If PNP/NPN selection is set as PNP, do not cause short-circuit between the OSSD and +24V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- If PNP/NPN selection is set as PNP, be sure to connect the load between the OSSD and 0 V to avoid a dangerous situation. If the load is incorrectly connected between the OSSD and +24V, the logic of OSSD operation will be reversed, and then OSSD will turn to the ON-state when the SZ-V detects an object in the specified protection zone. This is a dangerous situation.
- If PNP/NPN selection is set as NPN, do not cause short-circuit between the OSSD and 0V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.
- If PNP/NPN selection is set as NPN, be sure to connect the load between the OSSD and +24V to avoid a 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-V detects an object in the specified protection zone. This is a dangerous situation.
- In case of wiring, you must fulfill the requirements of Clause 9.4.3 in IEC60204-1 in order to protect against malfunction due to an OSSD 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 could result in the serious injury or death.
- The laser off input is not allowed to be connected to the safety output provided from the safety-related control system.
- 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

DANGER

- 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-V and before the machine startup.
- If the SZ-V 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-V.
- 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-V.

Safety Precautions on Laser Product

This product employs a semiconductor laser for its light source. Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

WARNING

- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Precautions on Class 1 Laser Product
  - Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled. Turn off the SZ-V before when you replace the window.

Precautions on Regulations and Standards

CE Marking

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

Machinery Directive

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

- EN61496-1 Type 3 ESPE
- EN61496-3 Type 3 AOPDDR
- EN61508 SIL2
- EN62061 SIL CL2
- EN ISO13849-1 Category 3, PLd
- EN60825-1 Class 1 Laser Product

EMC Directive

- EN55011 Class A
- EN61496-1 Type 3 ESPE

As Ethernet cable, use a Category 5e or higher STP (Shielded Twisted Pair) cable for connection to the network.

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

UL Certification and North American Regulations

SZ-V complies with the following UL, CSA, and North American standards and regulations, and has received UL certification and C-UL certification (CCN: NIPM/NIPM7, File No:322137):

- UL61496-1 Type 3 ESPE
- IEC61496-1 Type 3 ESPE
- IEC61496-3 Type 3 AOPDDR
- UL508
- UL1998
- CAN/CSA 22.2 No.14

SZ-V also complies with the following North American regulations.

- CDRH Part 1040.10 (Laser Notice No.50), Class 1 Laser Product
- FCC Part15 Subpart B, Class A Digital Device
- ICES-003, Class A Digital Apparatus

China GB Standards and Regulations

SZ-V complies with the following GB standards and regulations:

- GB19436.3

Other Supported Standards

The SZ-V 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.

- 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)

DANGER	**The SZ-V has not undergone the model certification examination in accordance with Article 44-2 of the Japanese Industrial Safety and Health Law. Therefore, the SZ-V 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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7.1 This Agreement will be governed by and construed in accordance with the substantive laws of Japan without regards to the principles of conflicts of law.
7.2 If any part of this Agreement is found void and unenforceable, it will not affect the validity of the balance of this Agreement, which shall remain valid and enforceable according to its terms and conditions.

Table of Contents

1. Before Use

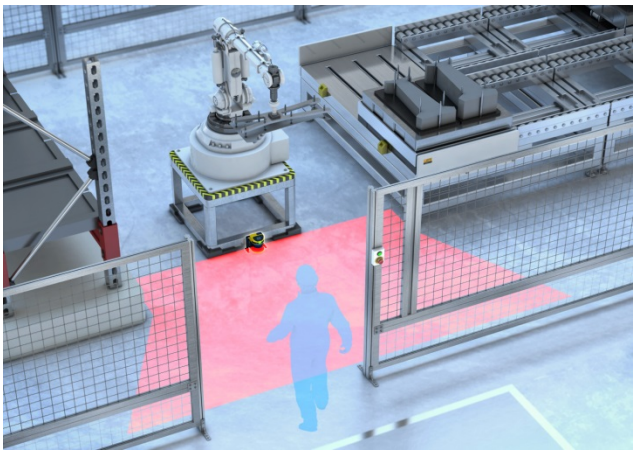
1-1 Overview of Applications

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

Applications for stationary installation

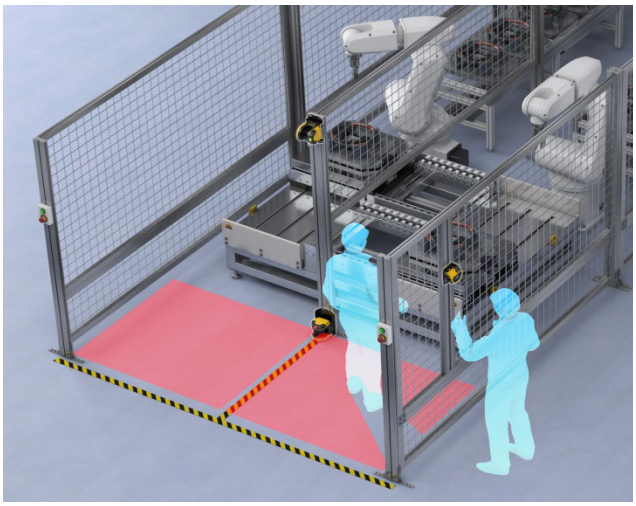
Protection against a hazardous area (Area protection: Horizontal detection plane)

If the SZ-V detects an object in the specified protection zone, the OSSD goes to the OFF-state to stop the machine hazard. If the SZ-V detects an object in the specified warning zone, the warning information related to the person approaching the protection zone can be provided by the SZ-V before stopping the hazard.
If an object is detected, the photos and video captured with the use of the camera can be saved. The saved photos and video can be checked on the unit's display or on a computer with a USB drive or via the network.



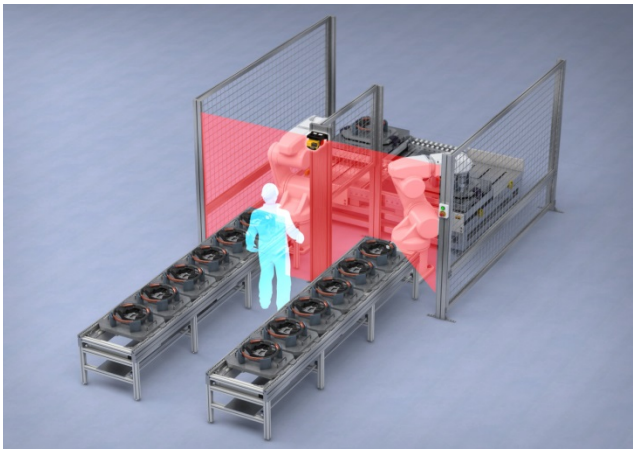
One SZ-V can provide protection for two different hazards (Area protection: Horizontal detection plane)

Two protection zones can be specified: protection zone A and protection zone B. OSSD 1/2 goes to the OFF-state if the SZ-V detects an object in protection zone A. Then, only hazard A stops operation. On the other hand, OSSD 3/4 goes to the OFF-state if the SZ-V detects an object in the protection zone B. Then, only hazard B stops operation. For the warning zone, two warning zones can be specified with the protection zones.



Protection against entrance into a hazardous area (Access protection: Vertical detection plane)

If the SZ-V detects someone passing through the specified protection zone, the OSSD goes to the OFF-state to stop the machine hazard. Even if the scanner head is installed in a high place, by installing the Display unit separately, SZ-V operation is easy.
Make sure to always use the reference points monitoring function with these types of applications. "Reference Point Monitoring Function" (page 57)

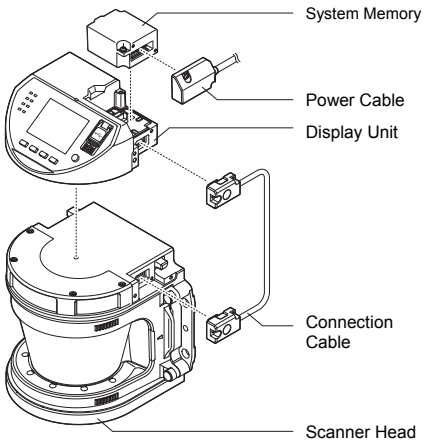


Application for movable installation

Mounting on an Automated Guided Vehicle (AGV)

If the SZ-V detects an object (someone or something) in the protection zone, the AGV stops because the OSSD goes to the OFF-state. The SZ-V can monitor whether there is an object in the protection zone by switching between the specified protection zones based on signals from external devices such as encoders. By installing several scanner heads on one Display unit, locations that are physically separated in several protection zones can be monitored at the same time.

1-2 Overview and Configuration

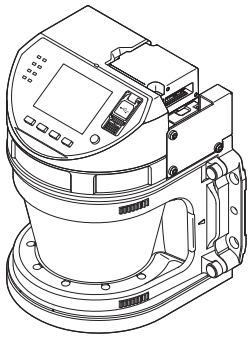


For details on part names and system configuration, see "Part Descriptions and Functions" (page 15).

1-3 Parts List

SZ-V

Integrated Models



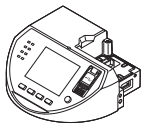
These models include the Display unit, scanner head, system memory, and connection cable.

Type	Model Name	Display Unit Model	Head Model
Multi-function Type (with camera)	**SZ-V04X**	SZ-VU04	SZ-VH1X
Multi-function Type	**SZ-V04**	SZ-VU04	SZ-VH1
Multi-bank Type (with camera)	**SZ-V32X**	SZ-VU32	SZ-VH1X
Multi-bank Type	**SZ-V32**	SZ-VU32	SZ-VH1
Network Type (with camera)	**SZ-V32NX**	SZ-VU32N	SZ-VH1X
Network Type	**SZ-V32N**	SZ-VU32N	SZ-VH1

The system memory and connection cable are the same for all models.
System memory: SZ-VSM Connection cable: SZ-VS005

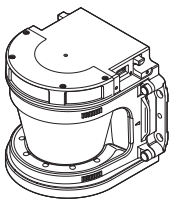
Separate Models

Display unit



Type	Model Name
Multi-function Type	SZ-VU04
Multi-bank Type	SZ-VU32
Network Type	SZ-VU32N

Scanner Head



Type	Model Name
With camera	SZ-VH1X
Standard	SZ-VH1

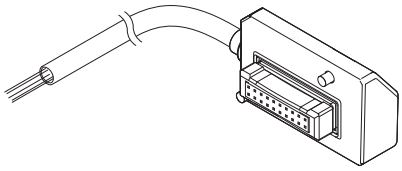
System Memory

Type	Model Name
System Memory	SZ-VSM

Cable

■ Power cable (18 core connector free)

Shape



Connector configuration 19.2 mm x 40.2 mm x thickness 18.6 mm
Cable φ5.8 mm, minimum bend radius 5 mm.

Model	Length
SZ-VP5	5 m
SZ-VP10	10 m
SZ-VP20	20 m
SZ-VP30	30 m

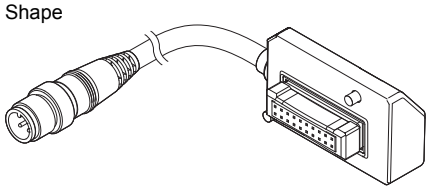
■ Power cable (PROFIsafe-dedicated, 2 core connector free)

Cable φ5.8 mm, minimum bend radius 5 mm.

Model	Length
SZ-VP10PW	10m

■ Power cable extension (M12 4-pin)

Shape

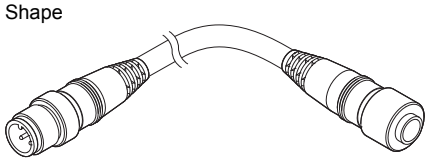


Cable φ5.8 mm, minimum bend radius 5 mm.

Model	Length
SZ-VPC03	0.3m

■ Extension cable (M12 4-pin)

Shape

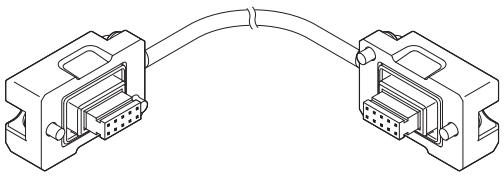


Cable φ5.8 mm, minimum bend radius 5 mm.

Model	Length
SZ-VCC10	10m

■ Connection cable

Shape



Connector configuration 29mm x 19mm x thickness 19 mm
Cable φ5.4 mm, minimum bend radius 5 mm.

Model	Length
SZ-VS005	0.05 m
SZ-VS5	5 m
SZ-VS10	10 m
SZ-VS20	20 m

The SZ-VS005 is bundled with fixing plates (for the standard and multi-bank models) to secure the Display unit and the scanner head.

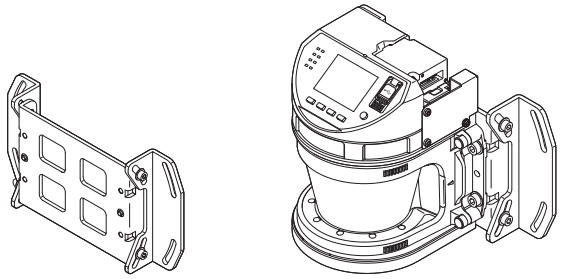
Cable length specification	
Power cable	30m [*1]
Connection cable	20 m each [*2]

*1 10 m or less when supplying power from a battery.
*2 When supplying power from a battery, the length of each connection cable should be 10 m or less when using two scanner heads, and 5 m or less when using three scanner heads.

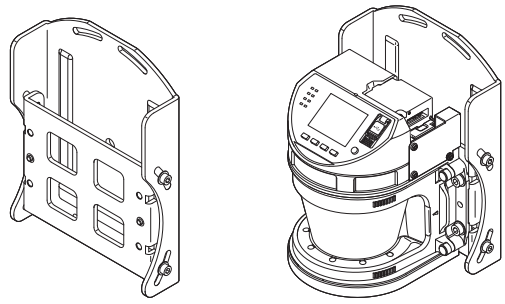
Mounting brackets

■ **For integrated setup and separate scanner head setup**

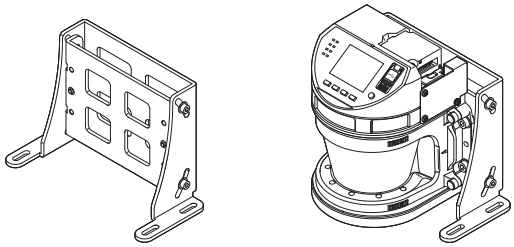
Adjustable angle bracket (horizontal) model: SZ-VB01



Adjustable angle bracket (vertical) model: SZ-VB02

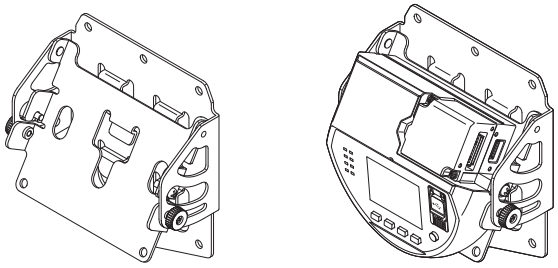


Floor bracket model: SZ-VB03

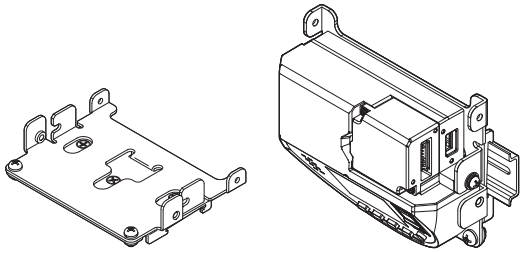


■ **For separate Display unit installation:**

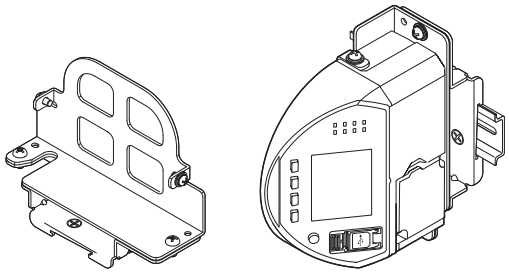
Display unit standard bracket model: SZ-VB11



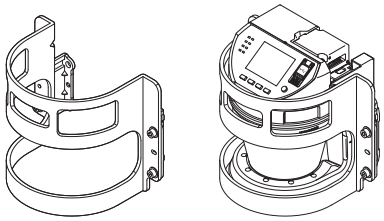
Display unit DIN rail mounting bracket (flat) model: SZ-VB12



Display unit DIN rail mounting bracket (slim) model: SZ-VB13



■ **Protection cover model: SZ-VB21**



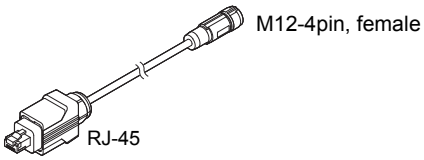
Other options

■ **USB cable**

Model	Length
OP-51580	2 m
OP-86941	5 m

■ **IP67 network cable**

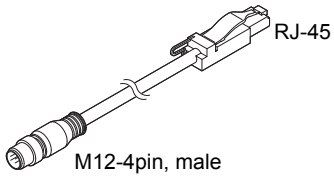
Main unit connection– cable (RJ45 – M12 4-pin female)



Model	Length
SZ-VNC03	0.3m

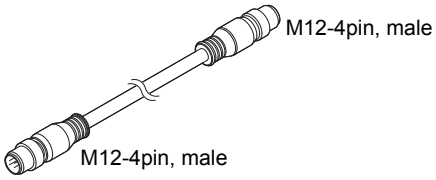
When extending the network cable, please choose appropriate type from below, depending on the connector shape of the equipment you would like to connect to.

RJ45 extension cable



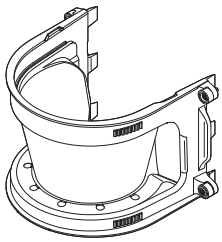
Model	Length
OP-88086	2m
OP-88087	5m
OP-88088	10m

M12 4-pin (male) extension cable



Model	Length
OP-88089	2m
OP-88090	5m
OP-88091	10m
OP-88092	20m

■ **Replacement window model: SZ-VHW**



■ **Configuration software <Safety Device Configurator>**

The configuration software includes dedicated configuration software for SZ-V series <SZ-V Configurator>. Configuration of SZ-V is done through SZ-V Configurator.
The configuration software can be downloaded from the KEYENCE homepage.
http://www.keyence.com
If you are using the machine in an environment where downloading software is not possible via the Internet, contact your nearest KEYENCE office or distributor.

1-4 Checking the Package Contents

For the standard models

Main unit (Display unit, scanner head, system memory, and connection cable)
Dynamic drawing sheet
Instruction manual

For the separate models (Display unit)

Main unit (Display unit)
Dynamic drawing sheet
Instruction manual

For the separate models (scanner head)

Main unit (scanner head)
Instruction manual

For the separate models (system memory)

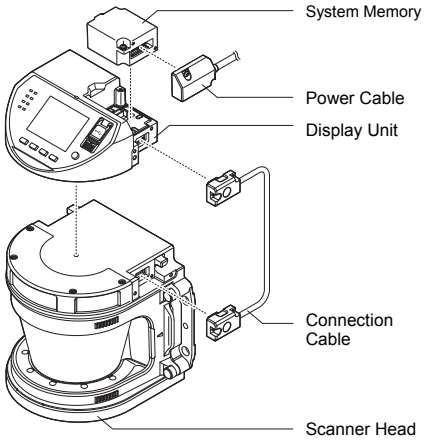
Main unit (system memory)
Instruction manual

Replacement window

Main unit (replacement window)
Gasket
Screw x 4
Instruction manual

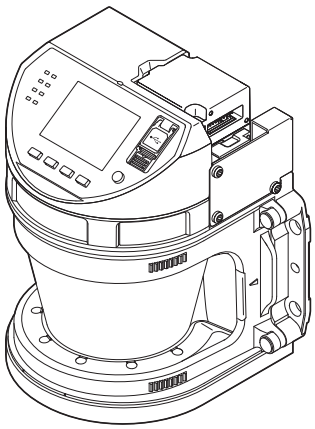
2. Part Descriptions and Functions

2-1 System Configuration



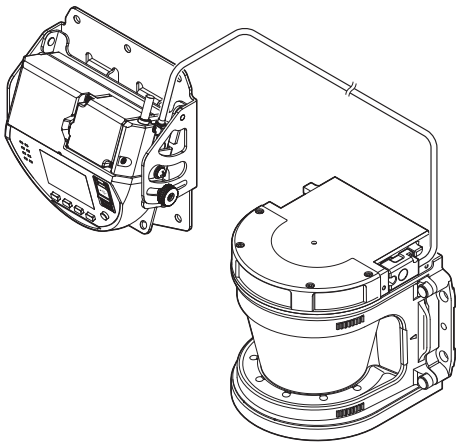
Display unit and scanner head

Integrated System



The Display unit and scanner head can be connected together prior to installation. At the time of shipping, the standard models (“Parts List” page 12) are already assembled and ready to be installed as an integrated unit.

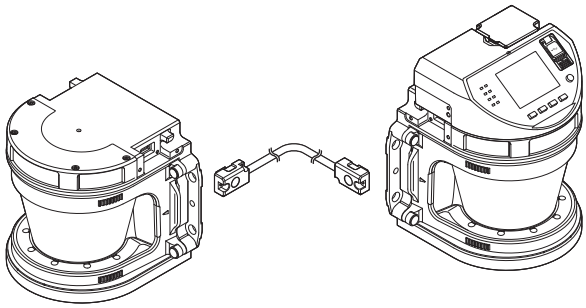
Separate System



The Display unit and scanner head can also be installed separately. When installing the Display unit and scanner head separately, connect the Display unit and scanner head with the connection cable.

Scanner head series connection

Up to three scanner heads can be connected to one Display unit. This allows multiple zones to be monitored as one.



Benefits of scanner head series connection

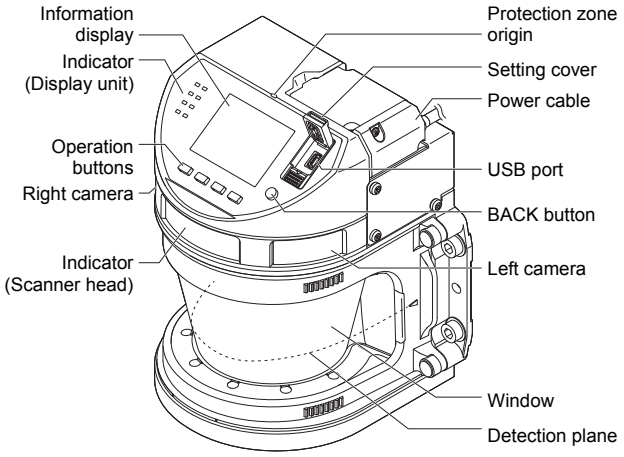
- The amount of wiring is greatly reduced with the need for only one Display unit.
- Scanner heads containing different minimum detectable objects, response times, and other settings can be used together.

Limitation

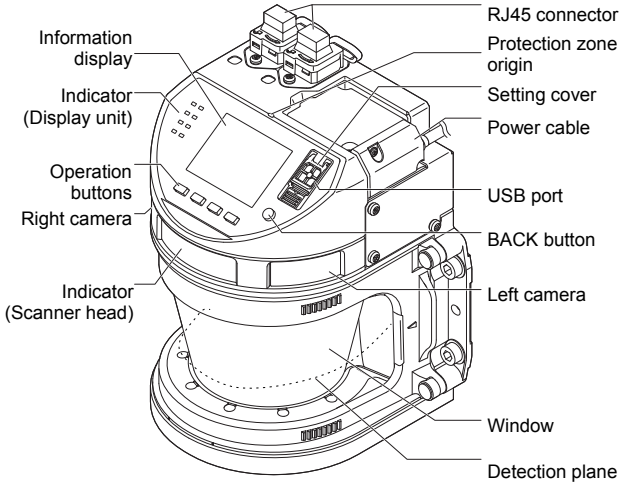
- Only three scanner heads can be connected to one Display unit.
- When adding scanner heads, the start-up time increases by one second for each scanner head.
- When supplying power from a battery, the length of each connection cable should be 10 m or less when using two scanner heads, and 5 m or less when using three scanner heads.

2-2 Part Description

SZ-V04 and SZ-V32

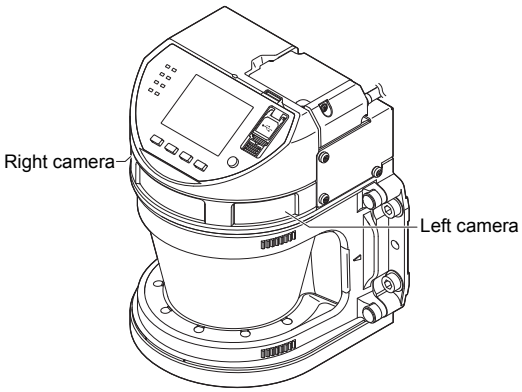


SZ-V32N

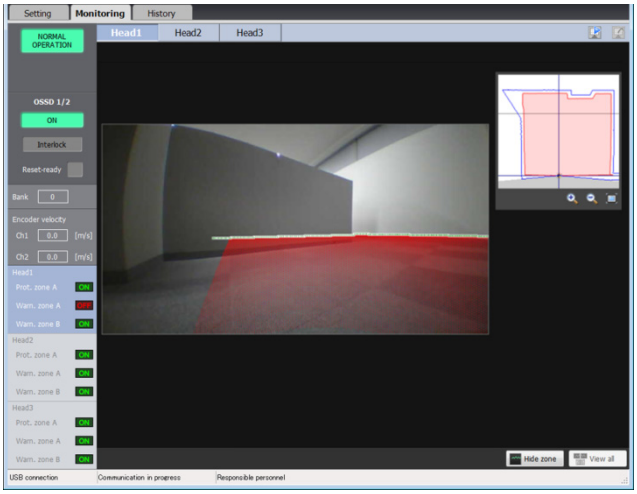


For details on the indicators, see “How to Read the indicators” (page 122)

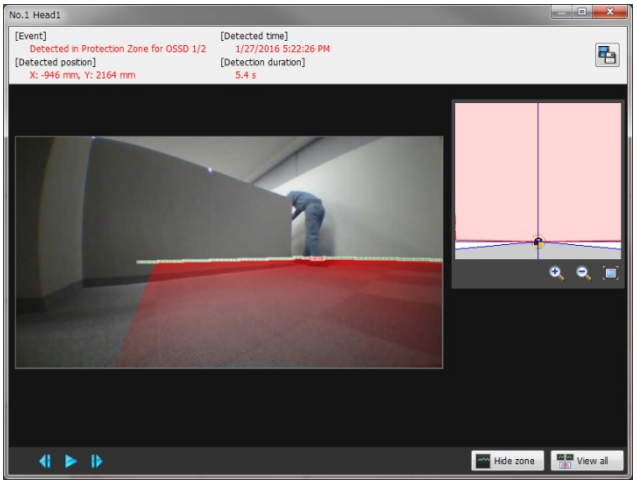
Camera



When using a scanner head with a camera, images taken with the camera can be monitored, and photos and videos of the moment that objects and/or people are detected can be saved.



Optical axis adjustment using the camera is also possible.

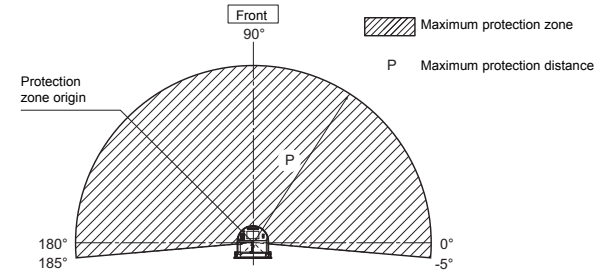


Check photos and videos of the moments objects and/or people are detected at a later time.
“Checking detection images and video in the protection zone” (page 99)

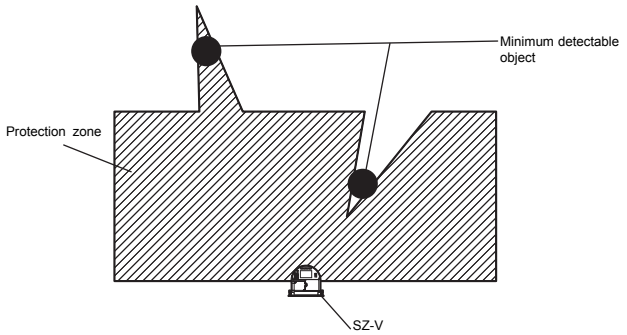
2-3 Protection zone

When the SZ-V detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state.
The maximum configurable distance varies depending on the operation mode and minimum detectable object size setting. ”Minimum detectable object” (page 45)
The protection zone settings are configured in the SZ-V Configurator. “Set the zone” (page 78)

Protection zone (top view)



■ Example of a protection zone



DANGER

- **The protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20).**
- **When either multi-OSSD function or bank switching function is enabled, every protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Multi-OSSD Function” (page 54), “Bank Switching Function” (page 49), “Safety Distances” (page 20)**
- **SZ-V cannot monitor anything behind the object that the SZ-V detects in the protection zone. (This is a blind area for the SZ-V.) The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ-V. If necessary, the additional countermeasure must be taken by the responsible personnel.**
- **As shown in the figure above, 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.**

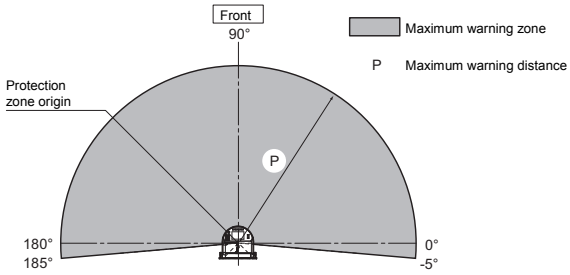
Reference

- Set the minimum detectable object size in the SZ-V Configurator. “Minimum detectable object” (page 45)
- Even if the object is smaller than the minimum detectable object size, it may be detected; however this is not guaranteed.
- Using the multi-OSSD function, allows for the setting of two protection zones individually for one scanner head. “Multi-OSSD Function” (page 54)

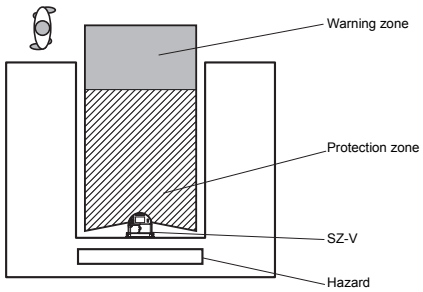
2-4 Warning zone

A warning zone can be configured separately from the protection zone. Prevent the unnecessary stoppage of the machine by configuring the warning zone larger than the protection zone, since the SZ-V can send an alert to an external device, such as an indicator, before the object (someone or something) enters the protection zone.
The maximum configurable distance varies depending on the operation mode and minimum detectable object size setting. “Minimum detectable object” (page 45)
The warning zone settings are configured in the SZ-V Configurator. “Set the zone” (page 78)

Warning zone (top view)



■ Example of warning zone



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.

Reference

- Set the minimum detectable object size in the SZ-V Configurator. “Minimum detectable object” (page 45)
- 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. 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. The OSSD does not go to the OFF-state even if the SZ-V detects an object in the warning zone
- The response time and the minimum detectable object size for the warning zone can be different from those for the protection zone.
- Two individual warning zones can be set for one scanner head.

3. Installation on a Machine

DANGER

- **The protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)**
- **When either multi-OSSD function or bank switching function is enabled, every protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)**
- **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 ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)**
- **SZ-V cannot monitor anything behind the object that the SZ-V detects in the protection zone. (This is a blind area for the SZ-V.) The responsible personnel must perform the risk assessment with taking into account this factor in case of installation of the SZ-V. If necessary, the additional countermeasure must be taken by the responsible personnel.**
- **The SZ-V 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-V. 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-V or to remain in a position between the protection zone of the SZ-V 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-V.**

3-1 Tips on installation

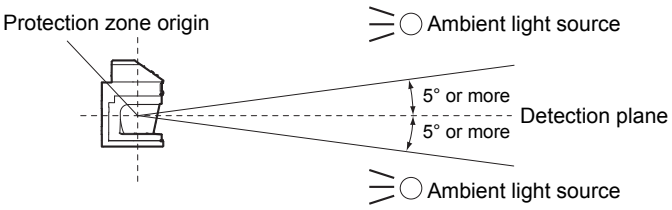
Note the following items when installing on a machine.

Light interference

Although there is no object in the protection zone, the OSSD might go to the OFF-state if an ambient light source, detailed below, is located at the detection plane, causing the SZ-V to perform a 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, ambient light sources should not be located within ±5° of the detection plane.

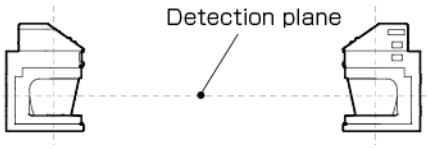


Mutual interference

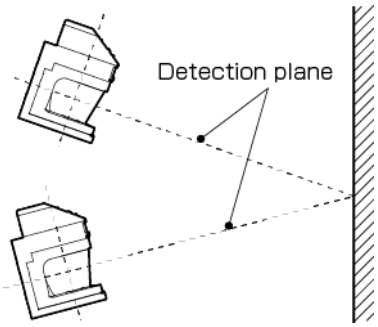
The OSSD might go to the OFF-state due to mutual interference if using multiple SZ-V units.

Installations where mutual interference is possible

1. Directly facing each other

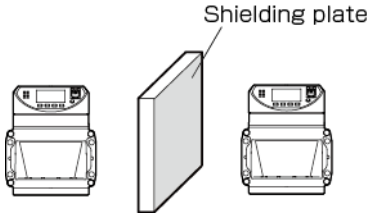


2. Interference caused by diffuse reflection

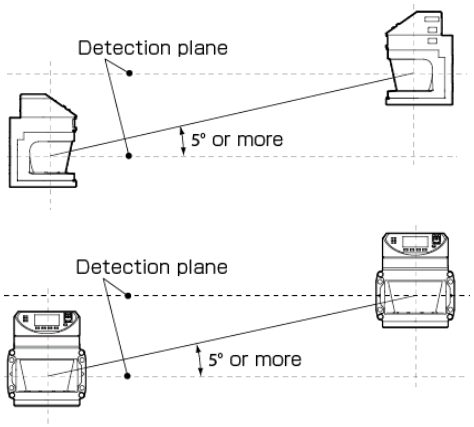


The SZ-V should be installed according to the following countermeasures in order to avoid mutual interference.

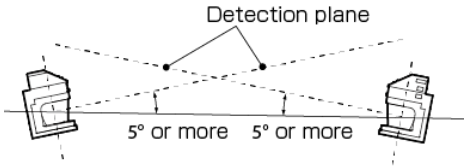
1. A shielding plate should be installed like below.



2. The height of installation should be like below.



3. The angle of installation should be like below.



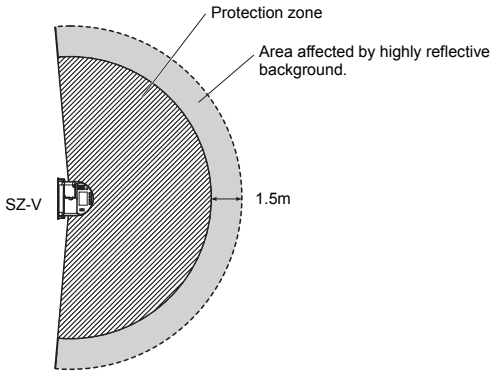
The following countermeasures may be taken to reduce the possibility of the mutual interference.

- Make the protection zone smaller, if possible. “Protection zone” (page 17)
- Make the minimum detectable object size larger, if possible. “Minimum detectable object” (page 45)
- Make the response time longer, if possible. “Response Time and Scan Cycle” (page 45)
- Change the scan cycles. “Mutual Interference Reduction Function” (page 58)

DANGER	**You must calculate the safety distance again in order to reinstall the SZ-V with appropriate safety distance if you want to apply the above countermeasure.**

Highly reflective backgrounds

The SZ-V goes into an alert state (alert for a highly reflective background) if it detects a highly reflective background within 1.5 m from the setting range of the protection zone. For more information about the alert state, see "Alert State” (page 135).



DANGER	**If there is a highly 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 safety distance.**

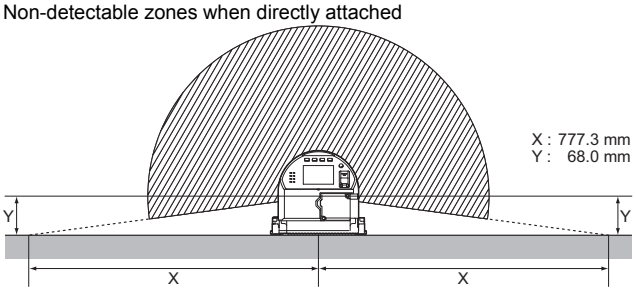
Reference Examples of highly reflective backgrounds:
Metallic glossy surfaces, retro-reflective sheets, and retro-reflective plates

Detection capability in close distance

Non-detectable zones

There are non-detectable zones near the SZ-V.

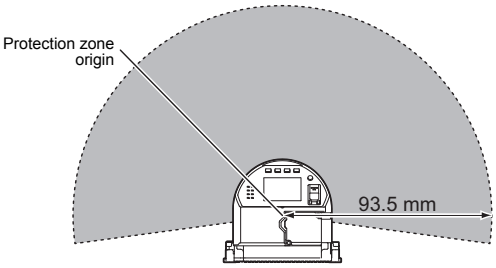
Non-detectable zones when directly attached



DANGER	**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-V.**

Zone with the limited detection capability

SZ-V might not detect an object with low reflectance located at the distance of 93.5mm or less from the protection zone origin. This is the zone with limited detection capability.



DANGER	**In case of installation of the SZ-V, 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.**

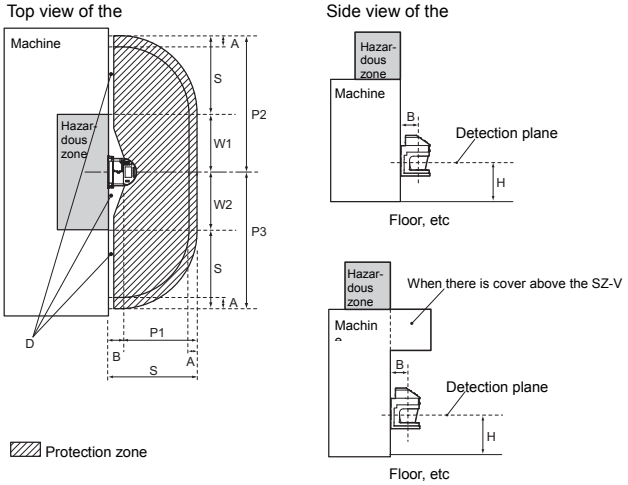
MI Error

When the reflection from a detection object or the background area is not detected for over 60°, an error will occur and [MI Error] will be displayed.
This function is to prevent people from interfering with the use of objects that emit very little reflection when very close to the SZ-V.

3-2 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-V 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)



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-V
D: Unprotected space

Safety distance calculation according to ISO13855 and IEC61496-3

S = K x T + C + A

S: Safety distance (mm)
K: Approach speed of the body or parts of the body (mm/s)
T: Overall Response time in second (t1 + t2) (s)
t1: SZ-V response time (s)
t2: Max. time required to stop the machine after receiving the OSSD signal from SZ-V (s) *
C: 1200 - 0.4 x H (850 mm or higher)
H: Height of detection plane (protection zone) above the reference plane, for example the floor (mm)
1000 ≥ H ≥ 15 x (d-50)
d: SZ-V minimum detectable object size (mm)
A: Additional safety distance (mm)

* When using PROFIsafe with the SZ-V32N type, please add the communication and processing time required for the stop signal to reach the machine after the SZ-V protection zone state turns OFF.

Example of safety distance calculation

K = 1600 mm/s	Approach speed of the body or parts of the body (Constant)
T = t1 + t2 = 0.82 s	Overall response time
t1 = 0.32 s	SZ-V response time (Changeable)
t2 = 0.5 s	Max. time required to stop the machine after receiving the OSSD signal from SZ-V
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 formula below. H ≥ 15 (d - 50 mm)
d = 70 mm	Minimum detectable object size (Changeable)
A = 100mm	Additional safety distance of SZ-V
B = 68 mm	Distance between the edge of the hazardous area and protection zone origin on the SZ-V
W1 = W2 = 1000mm	Width of the hazardous area

Safety Distances

S = K x T + C + A
= 1600 x 0.82 + 1080 + 100 = 2492 mm

Protection distances to be configured as the protection zones

P1 = S - B = 2424 mm
P2 = S + W1 = 3492 mm
P3 = S + W2 = 3492 mm

Safety distance calculation according to ANSI B11.19-2010 and IEC61496-3

Formula: Ds = K x T + Dpf + A

Ds: Safety distance.
K: The maximum speed that an individual can approach the hazard.
T: The total time that it takes for the hazardous motion to stop, or for the hazardous portion of the machine cycle to be completed. This value varies depending on machine type and/or the safeguarding device applied.
Dpf: Additional distance for horizontal sensing field applications without vertical sensing: 1200 mm / 48".
A: Additional safety distance (mm)

Example of safety distance calculation

K = 1600 mm/s	
T = t1 + t2 = 0.82 s	Overall response time
t1 = 0.32 s	SZ-V response time (Changeable)
t2 = 0.5 s	Max. time required to stop the machine after receiving the OSSD signal from SZ-V *
Dpf = 1200 mm	Additional distance
A = 100mm	Additional safety distance of SZ-V
B = 68 mm	Distance between the edge of the hazardous area and protection zone origin on the SZ-V
W1 = W2 = 1000mm	Width of the hazardous area

* When using PROFIsafe with the SZ-V32N type, please add the communication and processing time required for the stop signal to reach the machine after the SZ-V protection zone state turns OFF.

Safety Distances

S = K x T + Dpf + A
= 1600 x 0.82 +1200 + 100 = 2612 mm =102.9inch

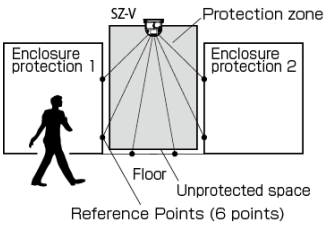
Protection distances to be configured as the protection zones

P1 = S - B = 2544 mm = 101 inch
P2 = S + W1 = 3612 mm = 143 inch
P3 = S + W2 = 3612 mm = 143 inch

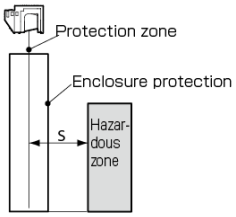
DANGER	**・ Additional countermeasures for protection must be provided if there is a space (D) between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ-V.** **・ There is a risk of inadvertent undetected access beneath the detection plane (protection 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-V. If necessary, the additional countermeasure must be taken by the responsible personnel.** **・ In the protection zone setting, you cannot select the object size of 150 mm when "H" (Height of detection plane) is 1,000 mm or less. You must select the object size of 70 mm or smaller if you want to use SZ-V for area protection (direction of approach is parallel to the protection zone.)** **・ If there is a highly 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. "Highly reflective backgrounds" (page 19)** **・ We recommend you should have a marking on the floor for indicating the specified protection zone.**

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

Top view of the machine



Side view of the machine



■ Safety distance calculation method based on ISO13855 and IEC61496-3

Formula: S = K × T + C

S: Safety distance (mm)
K: Approach speed of the body or parts of the body (mm/s)
T: Overall Response time in second (t1 + t2) (s)
t1: SZ-V response time (s)
t2: Max. time required to stop the machine after receiving the OSSD signal from SZ-V (s) *
C: Additional distance, taking into accounts the intrusion prior to actuation of protective equipment (mm).

* When using PROFIsafe with the SZ-V32N type, please add the communication and processing time required for the stop signal to reach the machine after the SZ-V protection zone state turns OFF.

Example of safety distance calculation

K = 1600 mm/s	Approach speed of the body or parts of the body
T = t1 + t2 = 0.58 s	Overall response time
t1 = 0.08 s	SZ-V response time (Changeable)
t2 = 0.5 s	Max. time required to stop the machine after receiving the OSSD signal from SZ-V
C = 850 mm (Constant)	
d = 70 mm	Minimum detectable object size (Changeable)

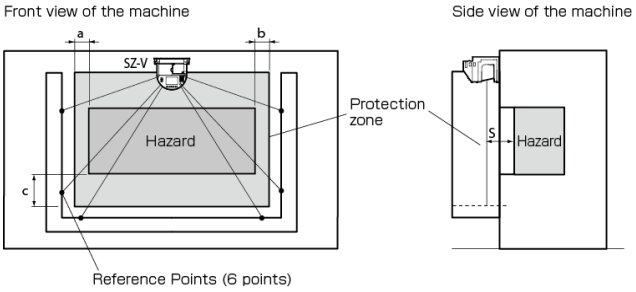
Safety Distances

S = K x T + C = 1600 x 0.58 + 850 = 1778mm

DANGER

- **Reference point monitoring function must be applied when the SZ-V 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. “Reference Points Monitoring Function” (page 57)**
- **The unprotected space between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ-V 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-V.**
- **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-V, 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.**

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



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.

■ Safety distance calculation method based on ISO13855 and IEC61496-3

Formula: S = K × T + C

S: Safety distance (mm)
K: Approach speed of the body or parts of the body (mm/s)
T: Overall Response time in second (t1 + t2)(s)
t1: SZ-V response time (s)
t2: Max. time required to stop the machine after receiving the OSSD signal from SZ-V (s) *
C: Additional distance in millimeters {8 x (d-14)}
d: SZ-V minimum detectable object size (mm)

* When using PROFIsafe with the SZ-V32N type, please add the communication and processing time required for the stop signal to reach the machine after the SZ-V protection zone state turns OFF.

Example of safety distance calculation

K = 2000 mm/s	Approach speed of the parts of the body, such as hands and arms.
T = t1 + t2 = 0.20 s	Overall response time
t1 = 0.08 s	SZ-V response time (Changeable)
t2 = 0.12 s	Max. time required to stop the machine after receiving the OSSD signal from SZ-V
C = 8 × (d-14) = 48 mm	
d = 20mm	Minimum detectable object size (Changeable)

Safety Distance

S = K x T + C = 2000 x 0.20+48 = 448mm

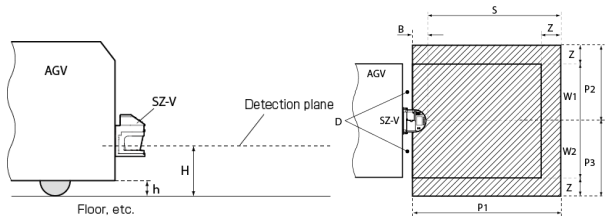
DANGER

- **Reference point monitoring function must be applied when the SZ-V 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. "Reference Points Monitoring Function" (page 57)**
- **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 20mm, 30 mm or 40 mm.**

Important

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 on an AGV (automated guided vehicle)



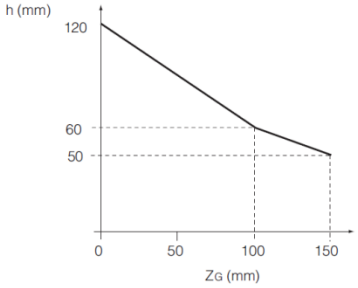
P1, P2, P3 : Protection distances to be configured as the protection zones
W1, W2 : Width of the AGV
B: Distance between the front edge of the SZ-V and protection zone origin on the SZ-V
D: Unprotected space
H: Height of detection plane (protection zone) above the reference plane in millimeters, for example the floor. "H" must be less than 200 mm.

■ **Safety distance calculation method based on ISO13855, IEC61496-3**

Formula: $S = V \times T + S_{brake} \times L + Z$

S: Safety distance (mm)
V: Maximum approach speed of the AGV (mm/s)
T: Overall Response time in second (t1 + t2)(s)
t1: SZ-V response time (s)
t2: Max. time required to stop the machine after receiving the OSSD signal from SZ-V (s) *
Sbrake: Required distance for braking AGV (mm)
L: Safety coefficient for required distance based on the wear of braking
Z: Additional distance $Z_{SZ-V} + Z_G$ (mm)
Z_{SZ-V}: Additional SZ-V safety distance (mm)
Z_G: Supplementary necessary distance, if "h" is not enough. (mm)
h: Space between the reference plane (floor) and the bottom of AGV. (mm)

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.



* When using PROFIsafe with the SZ-V32N type, please add the communication and processing time required for the stop signal to reach the machine after the SZ-V protection zone state turns OFF.

Example of safety distance calculation

V = 1500 mm/s
T = t1 + t2 = 0.22 s Overall response time
t1 = 0.12 s SZ-V response time (Changeable)
t2 = 0.1 s Max. time required to stop the machine after receiving the OSSD signal from SZ-V
S_{brake} = 1,300 mm Required distance for braking AGV
L = 1.1 Safety coefficient for required distance based on the wear of braking
$Z = Z_{SZ-V} + Z_G = 100+100 = 200$ mm Additional distance (mm)
Z_{SZ-V} = 100mm Additional safety distance of SZ-V
Z_G = 100 mm Supplementary necessary distance, if "h" is not enough.
h = 60 mm Space between the reference plane (floor) and the bottom of AGV.
B = 58 mm Distance between the front edge of the SZ-V and protection zone origin on the SZ-V
W1 = W2 = 1,000 mm Width of AGV

Safety Distances

$S = V \times T + S_{brake} \times L + Z$
$= 1500 \times 0.22 + 1300 \times 1.1 + 200$
$= 1960$mm

Protection distances to be configured as the protection zones

P1 = S + B = 2018 mm
P2 = W1 + Z = 1200 mm
P3 = W2 + Z = 1200 mm

DANGER	• **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-V.** • **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-V. If necessary, the additional countermeasure must be taken by the responsible personnel.** • **If there is a highly 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. "Highly reflective backgrounds" (page 19)**

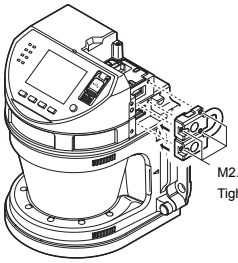
3-3 Connecting Units

Connecting separate model units

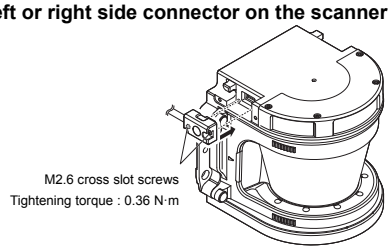
When purchased individually, it is necessary to connect the Display unit, scanner head, and system memory.

Reference
- For the standard models, display unit, scanner head, and system memory are connected prior to shipping.
- Please do not remove a packing on top of the connector part. Without the packing, specification of IP65 cannot be met anymore.

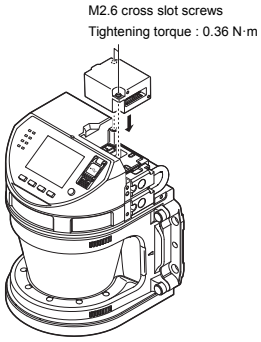
1. Connect the Display unit and scanner head with the connection cable.



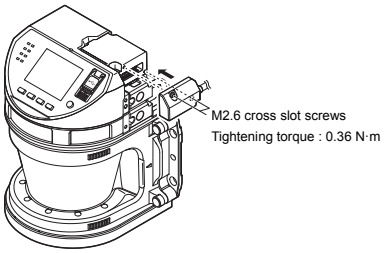
Point **The connection cable can be connected to either the left or right side connector on the scanner head.**



2. Connect the Display unit and System Memory.

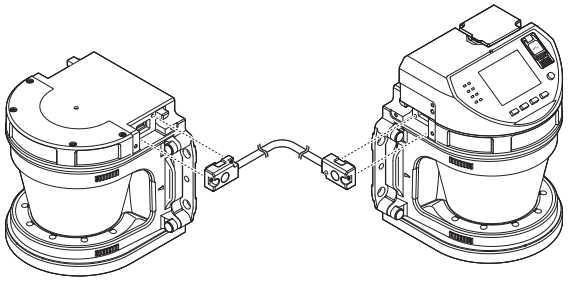


3. Connect the power cable to the display unit.



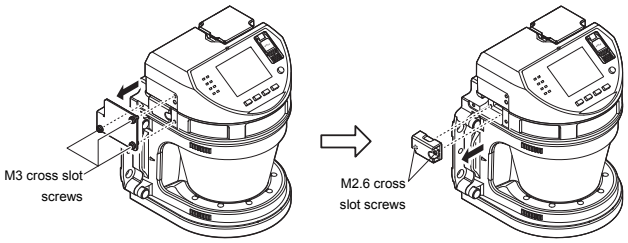
Adding Scanner Heads

Additional scanner heads require adding additional connection cables.



Adding scanner heads to a standard model

When adding a scanner head to a standard model, remove the metal plate that was attached at the time of shipping and attach the additional connection cable.

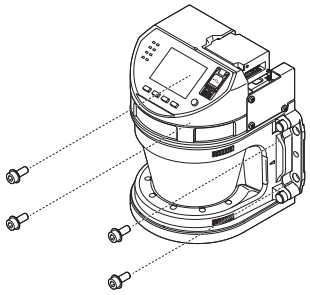


3-4 Mounting

Mounting for integrated setups

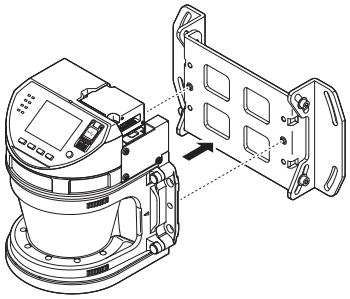
Wall mounting (direct mounting)

The four screw holes on the unit can be used for direct mounting. The appropriate screws must be purchased separately.
Recommended screw size: M6 (Thickness of SZ-V mounting part: 4.5mm)
Recommended tightening torque: 5.2 N·m

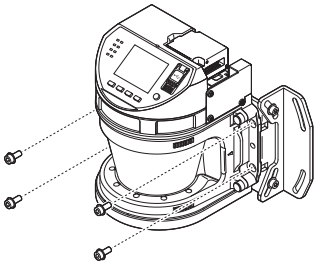


Mounting with adjustable angle mounting bracket (horizontal) SZ-VB01

1. As shown in the figure, mount scanner head on the adjustable angle mounting bracket.
   Adjust the position so that the position of the boss on the bracket meets the position of the hole on the scanner head.



2. Secure the scanner head to the adjustable angle bracket using the attached four hex-screws.
   Hex screw: Cross flat 4mm, length 12mm, M5
   Recommended tightening torque: 3.0N·m

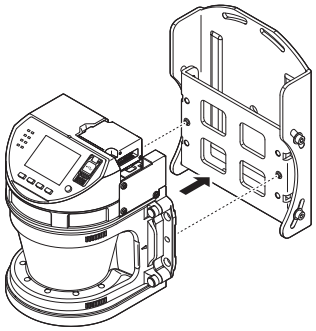


Screw to fix the bracket to a machine is not included. The appropriate screws must be purchased separately.

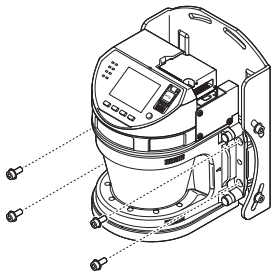
Recommended screw: M6 (mounting part thickness: 4mm)
Recommended tightening torque: 5.2N·m

Mounting with adjustable angle mounting bracket (vertical) SZ-VB02

1. As shown in the figure, mount scanner head on the adjustable angle mounting bracket.
   Adjust the position so that the position of the boss on the bracket meets the position of the hole on the scanner head.



2. Secure the scanner head to the adjustable angle bracket using the attached four hex-screws.
   Hex screw: Cross flat 4mm, length 12mm, M5
   Recommended tightening torque: 3.0N·m

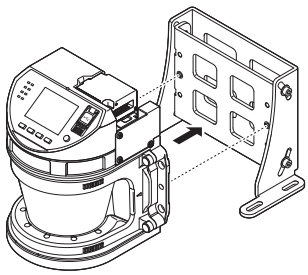


Screw to fix the bracket to a machine is not included. The appropriate screws must be purchased separately.

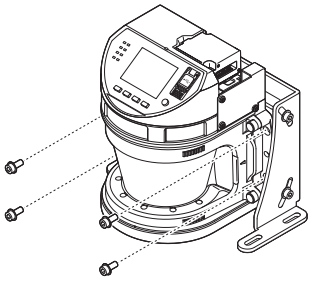
Recommended screw: M6 (mounting part thickness: 4mm)
Recommended tightening torque: 5.2N·m

Mounting with floor bracket SZ-VB03

1. As shown in the figure, mount scanner head on the floor mounting bracket.
   Adjust the position so that the position of the boss on the bracket meets the position of the hole on the scanner head.



2. Secure the scanner head to the floor bracket using the attached four hex-screws.
   Hex screw: Cross flat 4mm, length 12mm, M5
   Recommended tightening torque: 3.0N·m



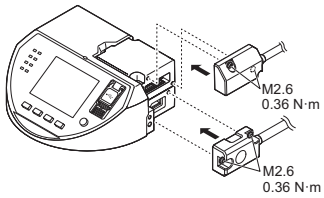
Screw to fix the bracket to a floor, etc is not included. The appropriate screws must be purchased separately.

Recommended screw: M6 (mounting part thickness: 4mm)
Recommended tightening torque: 5.2N·m

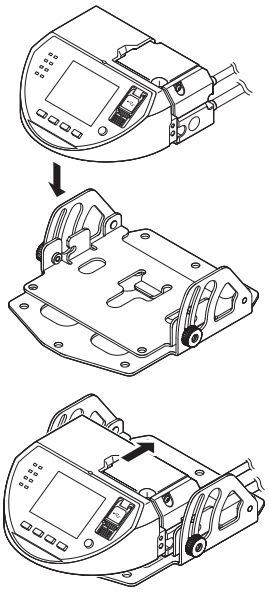
For separate setups: Mounting the Display unit

Mounting with display unit standard bracket SZ-VB11

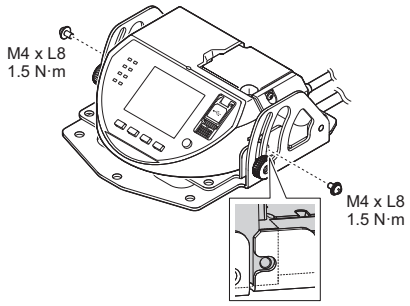
1. As shown in the figure, connect power cable and connection cable to the display unit.



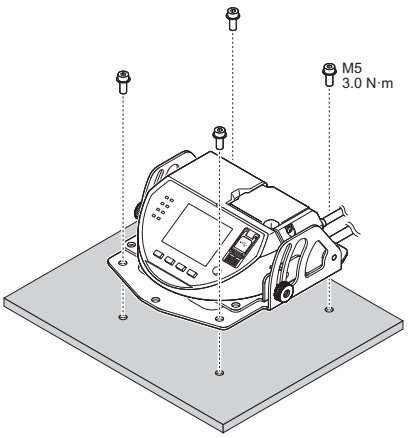
2. As shown in the figure, mount display unit on the bracket.



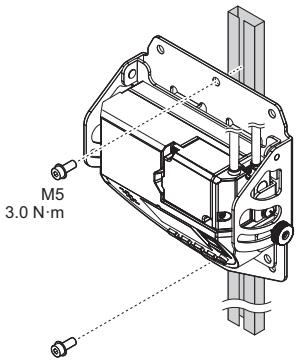
3. Fix display unit to the bracket using attached screws.
Recommended tightening torque: 1.5N·m



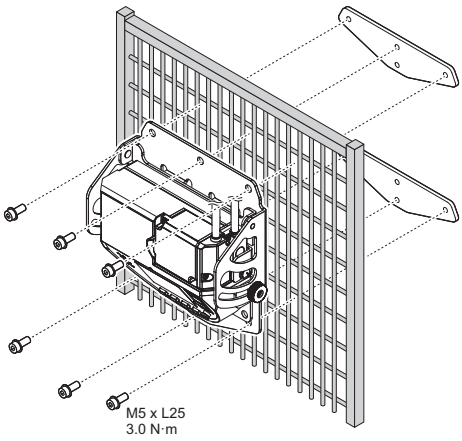
4. Mount the bracket.
(A) When mounting to a wall



(B) When mounting to an aluminum profile

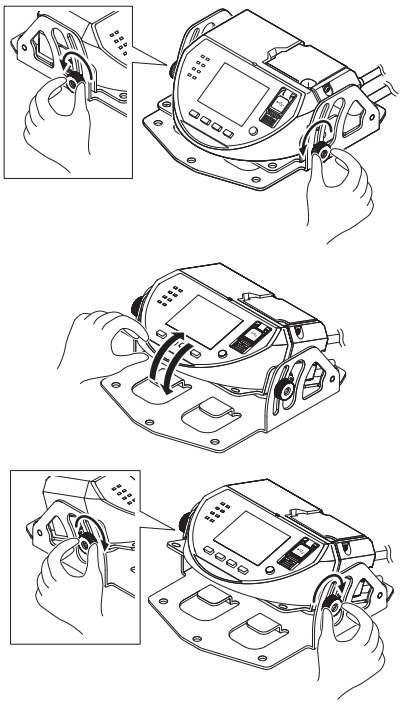


(C) When mounting to a fence

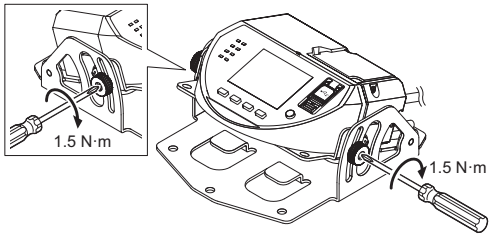


Screw dimension: M5 x L25
Recommended tightening torque: 3.0N·m

5. Adjust angle of display unit, if required.

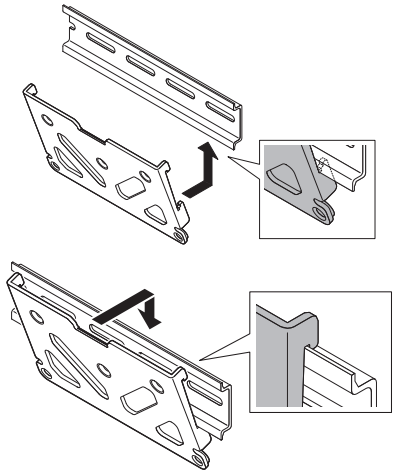


6. Fix display unit angle.
Recommended tightening torque: 1.5N·m

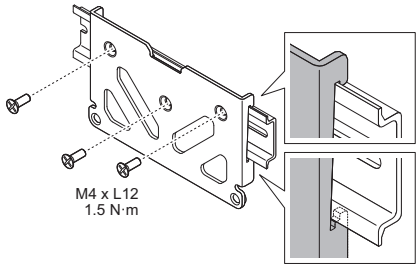


Mounting with display unit DIN rail mounting bracket (flat) (SZ-VB12)

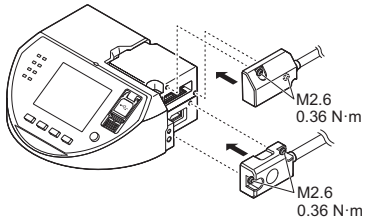
1. As shown in the figure, mount bracket to DIN rail.



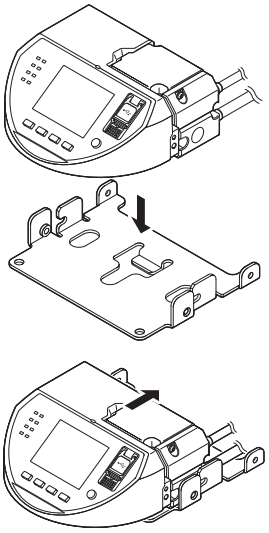
2. Fix the bracket to DIN rail using the attached screws.
Recommended tightening torque: 1.5N·m



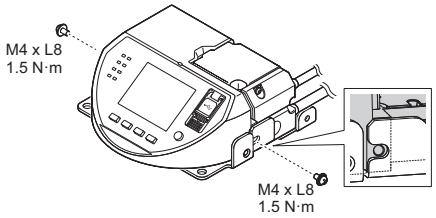
3. As shown in the figure, connect power cable and connection cable to the display unit.



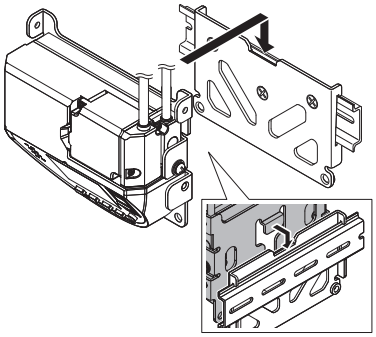
4. As shown in the figure, mount display unit on the bracket.



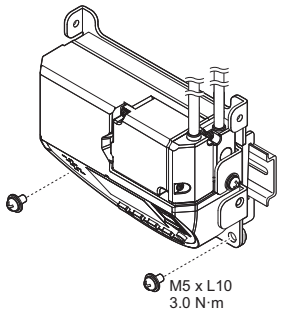
5. Fix display unit to the bracket using attached screws.
Recommended tightening torque: 1.5N·m



6. Mount the bracket with display unit to the bracket fixed on the DIN rail.

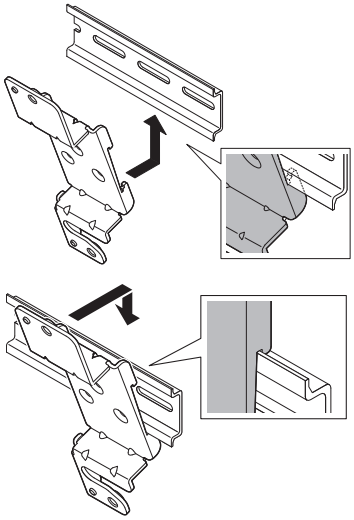


7. Fix the brackets together with attached screws.
Recommended tightening torque: 3.0N·m

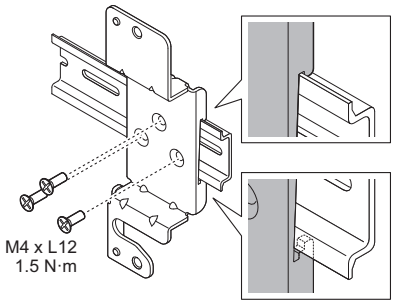


Mounting with display unit DIN rail mounting bracket (slim)
SZ-VB13

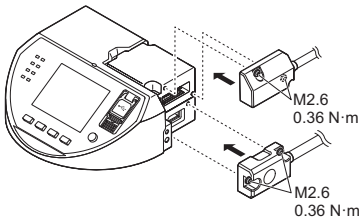
1. As shown in the figure, mount bracket to DIN rail.



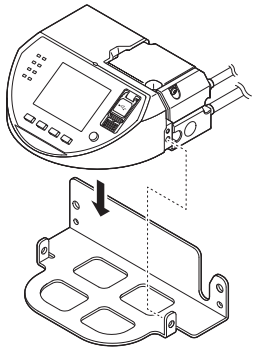
2. Fix the bracket to DIN rail using the attached screws.
Recommended tightening torque: 1.5N·m



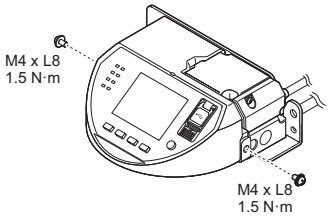
3. As shown in the figure, connect power cable and connection cable to the display unit.



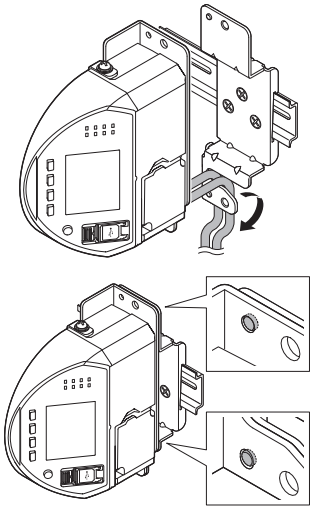
4. As shown in the figure, mount display unit on the bracket.



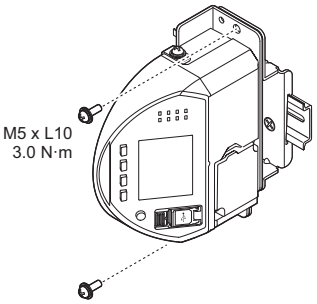
5. Fix display unit to the bracket using attached screws.
Recommended tightening torque: 1.5N·m



6. Mount the bracket with display unit to the bracket fixed on the DIN rail.



7. Fix the brackets together with attached screws.
Recommended tightening torque: 3.0N·m

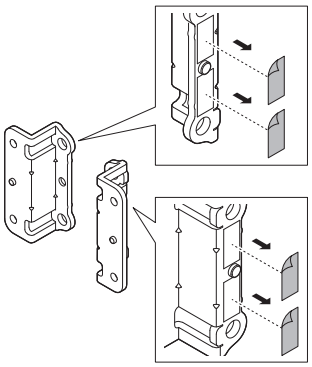


For separate setups or cascading: Mounting a scanner head

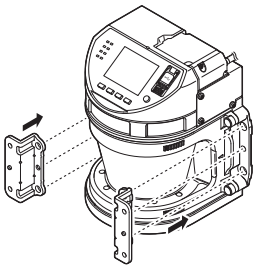
Mount the scanner head in the same manner as the integrated setup installation. The mounting brackets are also the same.

Mounting the protection cover

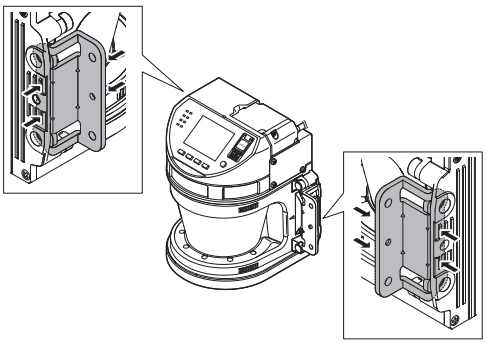
1. As shown in the figure, take away release paper on the bracket.



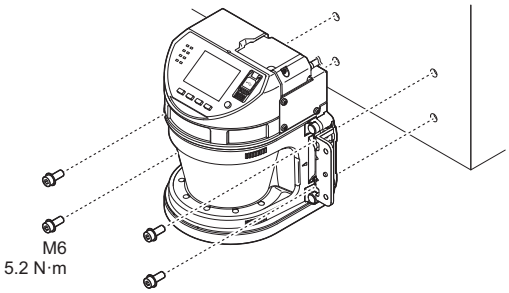
2. As shown in the figure, mount the bracket temporarily to scanner head using attached adhesive tape.



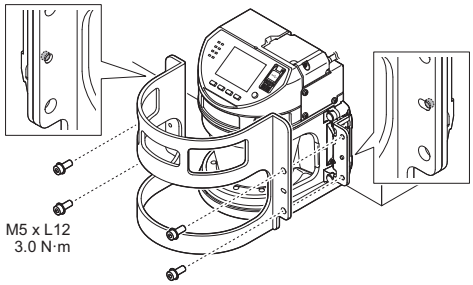
3.



4. As shown in the figure, secure scanner head and temporarily fixed bracket to machine. Screw to fix the bracket to a machine is not included. The appropriate screws must be purchased separately.
Recommended screw: M6 (mounting part thickness: 8mm)
Recommended tightening torque: 5.2N·m



5. Recommended tightening torque: 3.0N·m



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

Reference For more information on the dimensions of SZ-V or the mounting bracket, see “Dimensions” (page 129).

4. Wiring

DANGER

- **Always turn off the power to the SZ-V when performing electrical wiring.**
- **You must fulfill the electrical standards and regulations in the country or region in which the SZ-V is being used when you perform the electrical wiring.**
- **To avoid the risk of electric shock, do not connect any of the SZ-V 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-V with the reinforced insulation or double insulation.**
- **Do not install the electric wiring of the SZ-V together with or in parallel with the high-voltage electrical or power lines.**
- **For the wiring between SZ-V 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 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 machine control system, it results in a significant harm to the machine operators, including serious injury or death, due to OSSD malfunction.**
- **If you selected PNP/NPN select for PNP, do not cause short-circuit between the OSSD and +24V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.**
- **If you selected PNP/NPN select for PNP, be sure to connect the load between the OSSD and 0 V to avoid a dangerous situation. If the load is incorrectly connected between the OSSD and +24V, the logic of OSSD operation will be reversed, and then OSSD will turn to the ON-state when the SZ-V detects an object in the specified protection zone. This is a dangerous situation.**
- **If you selected PNP/NPN select for NPN, do not cause short-circuit between the OSSD and 0V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.**
- **If you selected PNP/NPN select for NPN, be sure to connect the load between the OSSD and +24V to avoid a 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-V detects an object in the specified protection zone. This is a dangerous situation.**
- **In case of wiring, you must fulfill the requirements of Clause 9.4.3 in IEC60204-1: 2005 in order to protect against malfunction due to an OSSD 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 could result in the serious injury or death.**
- **You cannot use the laser off input as safety output. Do not connect output from safety device that is part of the safety-related control system to the laser off input. If the laser off input is connected to the safety output, it may result in significant harm to 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.**

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

4-1 Power Supply

If the power supply for the SZ-V is the converting type, the power supply for the SZ-V 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 +20% -30%.
(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-V is used.

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

4-2 Wire color and assigned function

- Depending on the Display unit model and functions used, the cable colors and assigned functions vary.
- The functions assigned to the AUX outputs can be changed in the settings.

* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (Page 74).

Wire color and assigned function of SZ-V04 type

- Depending on whether the functions below are used or not determines which of the six types of wiring patterns is used.
  - “Multi-OSSD Function” (page 54)
  - “Bank Switching Function” (page 49)
  - “Muting function” (page 55)

Pattern (1) to (3) OSSD3/4: Not used

Wire color	Pattern (1)	Pattern (2)	Pattern (3)
Multi OSSD	Not used	Not used	Not used
Bank switching	Not used	Not used	Used (4 banks or less)
Muting	Not used	Used	Not used
Brown	+24 V		
Blue	0V		
Black	OSSD 1		
White	OSSD 2		
Gray	Not used		
Gray/Black	Not used		
Yellow	Reset input / Laser off input		
Red	EDM input		
Light blue	Not used	Muting input 1	Bank input A
Light blue / Black	Not used	Muting input 2	Bank input a
Yellow / Black	Not used	Override input	Bank input B
Red / Black	Not used	Not use	Bank input b
Orange	AUX output 1 (State information output 1)		
Orange / Black	AUX output 2 (State information output 2)		
Pink	AUX output 3		
Pink / Black	AUX output 4		
Green	AUX output 5		
Green / Black	AUX output 6	AUX output 6 (Muting lamp output)	AUX output 6

Pattern (4) to (6) OSSD3/4: Used

Wire color	Pattern (4)	Pattern (5)	Pattern (6)
Multi OSSD	Used	Used	Used
Bank switching	Not used	Used (2 banks or less)	Used (4 banks or less, or independent bank switching)
Muting	Not used	Not used	Not used
Brown	+24 V		
Blue	0V		
Black	OSSD 1		
White	OSSD 2		
Gray	OSSD 3		
Gray / Black	OSSD 4		
Yellow	Reset input (1/2) / Laser off input		Bank input b
Red	EDM input (1/2)		
Light blue	Not used	Bank input A	
Light blue / Black	Not used	Bank input a	
Yellow / Black	Reset input (3/4)		Bank input B
Red / Black	EDM input (3/4)		
Orange	AUX output 1 (State information output 1)		
Orange / Black	AUX output 2 (State information output 2)		
Pink	AUX output 3		
Pink / Black	AUX output 4		
Green	AUX output 5		
Green / Black	AUX output 6		

Wire color and assigned function of SZ-V32 type

- The way the “Bank Switching Function” (page 49) is used determines which of the four types of wiring patterns is used.

Pattern (1) to (4)

Wire color	Pattern (1)	Pattern (2)	Pattern (3)	Pattern (4)
Bank switching	Not used	Used	Used	Used
Bank switching method		Single or Binary		Encoder
Available no. of banks		Single: 8 banks or less Binary: 16 banks or less	Single: 10 banks or less Binary: 32 banks or less	
Brown	+24 V			
Blue	0V			
Black	OSSD 1			
White	OSSD 2			
Gray	AUX output 1 (State information output)			
Gray / Black	AUX output 2 (State information output)			
Yellow	Reset input / Laser off input			
Red	EDM input			
Light blue	Not used	Bank input A		
Light blue / Black	Not used	Bank input a		
Yellow / Black	Not used	Bank input D		Encoder input 1A
Red / Black	Not used	Bank input d		Encoder input 2A
Orange	Not used	Bank input B		
Orange / Black	Not used	Bank input b		
Pink	Not used	Bank input C		Encoder input 1B
Pink / Black	Not used	Bank input c		Encoder input 2B
Green	AUX output 3		Bank input E	Encoder input 1A-
Green / Black	AUX output 4		Bank input e	Encoder input 2A-

Wire color and assigned function of SZ-V32N type

■ **When PROFIsafe is not used**

・ Depending on whether the functions below are used or not determines which of the five types of wiring patterns is used.
  ・ “Bank Switching Function” (page 49)
  ・ “Muting function” (page 55)

Patterns 1 and 2 when not using bank switching

Wire color	Pattern (1)	Pattern (2)
Bank switching	Not used	Not used
Muting	Not used	Used
Brown	+24 V	
Blue	0V	
Black	OSSD 1	
White	OSSD 2	
Gray	AUX output 1 (State information output 1)	
Gray / Black	AUX output 2 (State information output 2)	
Yellow (Input1)	Reset input / Laser off input	
Red (Input2)	EDM input	
Light blue (Input3)	Not used	Muting input 1
Light blue / Black (Input4)	Not used	Muting input 2
Yellow / Black (Input5)	Not used	Override input
Red / Black (Input6)	Not used	
Orange (Input7)	Not used	
Orange / Black (Input8)	Not used	
Pink (Input9)	Not used	
Pink / Black (Input10)	Not used	
Green	AUX output 3	
Green / Black	AUX output 4	AUX output 4 (Muting lamp output)

Patterns 3 to 5 when using bank switching

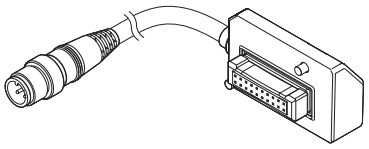
Wire color	Pattern (3)	Pattern (4)	Pattern (5)
Bank switching	Used	Used	Used
Bank switching method	Single or binary		Encoder
Available number of banks	Single: 8 banks or less Binary: 16 banks or less	Single: 10 banks or less Binary: 16 banks or less	
Muting	Not used	Not used	Not used
Brown	+24 V		
Blue	0V		
Black	OSSD 1		
White	OSSD 2		
Gray	AUX output 1 (State information output 1)		
Gray / Black	AUX output 2 (State information output 2)		
Yellow (Input1)	Reset input / Laser off input		
Red (Input2)	EDM input		
Light blue (Input3)	Bank input A		
Light blue / Black (Input4)	Bank input a		
Yellow / Black (Input5)	Bank input D		Encoder Input 1A
Red / Black (Input6)	Bank input d		Encoder Input 2A
Orange (Input7)	Bank input B		
Orange / Black (Input8)	Bank input b		
Pink (Input9)	Bank input C		Encoder Input 1B
Pink / Black (Input10)	Bank input c		Encoder Input 2B
Green (AUX3/Input11)	AUX output 3	Bank input E	Encoder Input 1A-
Green / Black (AUX4/Input12)	AUX output 4	Bank input e	Encoder Input 2A-

■ **When PROFIsafe is used**

Wire color	Function
Brown	+24 V
Blue	0V

* When using PROFIsafe, use the dedicated PROFIsafe power cable (SZ-VP10PW). When using a non-PROFIsafe power cable, please note that all non-power wires will be deactivated.

Wire color and assigned function when the power cable extension (M12 4-pin) is used



M12 connector pin layout

Pin number	Color	Function
(1)	Brown	+24 V
(2)	White	OSSD2
(3)	Blue	0V
(4)	Black	OSSD1

4-3 Examples of wiring

Functions differ depending on the Display unit model that is selected. Wiring differs depending on the functions that are used.
The type of wiring that will need to be performed is determined by the procedure below.

1. Select the type that is to be used (SZ-V04 type, SZ-V32 type, and SZ-V32N type)
2. Select the functions that are going to be used. Determine the appropriate wiring pattern to use and the detailed connection method.

Wiring for the SZ-V04 type

Determining the wiring pattern to use

1. Depending on whether the functions below are used or not determines which of the six types of wiring patterns is used.
- "Bank Switching Function" (page 49)
- "Multi-OSSD Function" (page 54)
- "Muting function" (page 55)

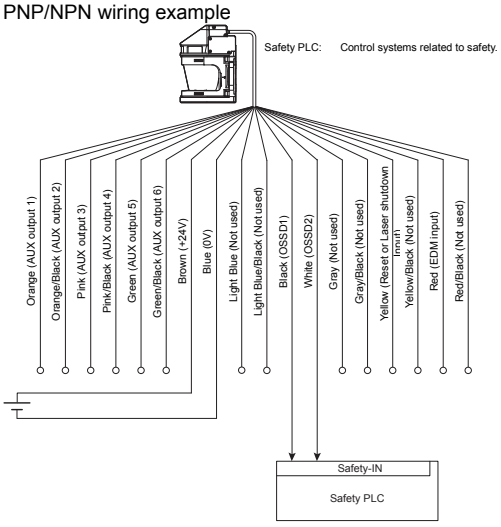
	Pattern (1)		Pattern (2)	Pattern (3)	Pattern (4)	Pattern (5)	Pattern (6)	
OSSD3/4 function	Not used		Not used	Not used	Multi-OSSD	Multi-OSSD	Multi-OSSD	Independent bank switching
Bank switching function	Not used		Not used	Not used	Not used	Used (2 banks or less)	Used (4 banks or less)	Used (2 banks)
Muting	Not used		Used	Not used	Not used	Not used	Not used	Not used
Examples of wiring	Example 1 (Page 33)	Example 2 (Page 34)	Example 3 (Page 34)	Example 4 (Page 35)		Example 5 (Page 35)	Example 6 (Page 36)	

2. The detailed connection method differs depending on whether the functions below are used or not.
- "Select PNP or NPN" (page 46)
- "Interlock function" (page 47)
- "EDM Function" (page 48)

SZ-V04 wiring example 1

OSSD3/4	Not used
Bank switching	Not used
Muting	Not used
Interlock	Not used
EDM	Not used

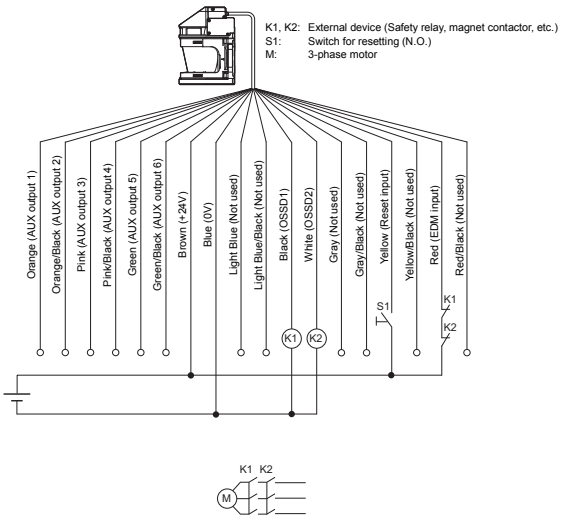
PNP/NPN wiring example



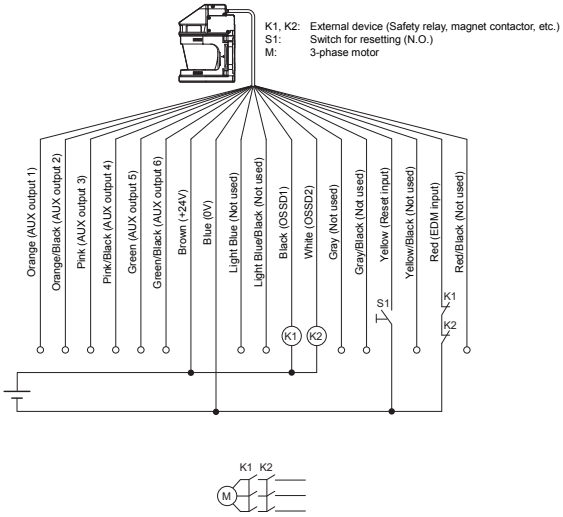
SZ-V04 wiring example 2

OSSD3/4	Not used
Bank switching	Not used
Muting	Not used
Interlock	Used
EDM	Used

PNP wiring example



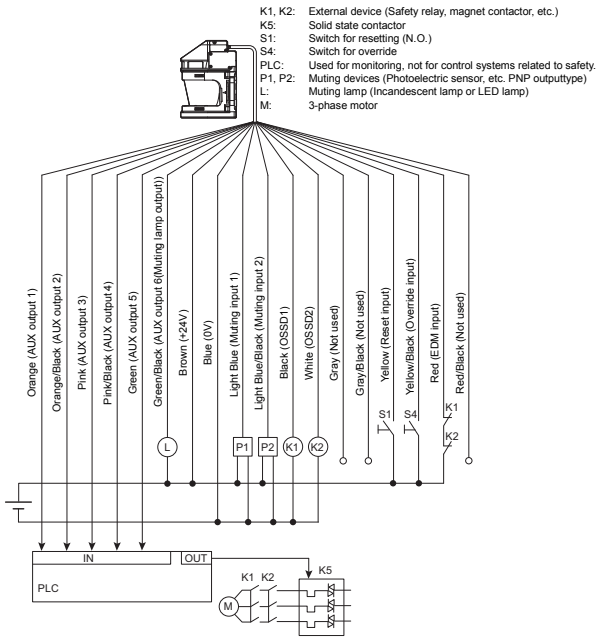
NPN wiring example



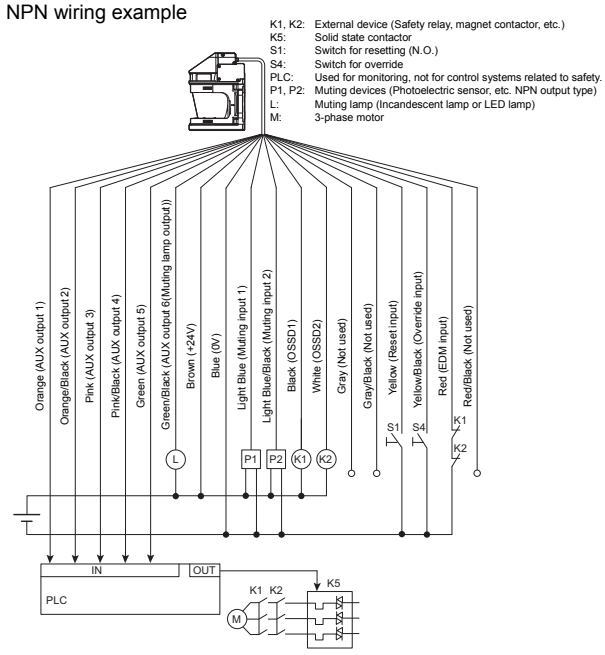
SZ-V04 wiring example 3

OSSD3/4	Not used (usage not possible)
Bank switching	Not used (usage not possible)
Muting	Used
Interlock	Used
EDM	Used

PNP wiring example



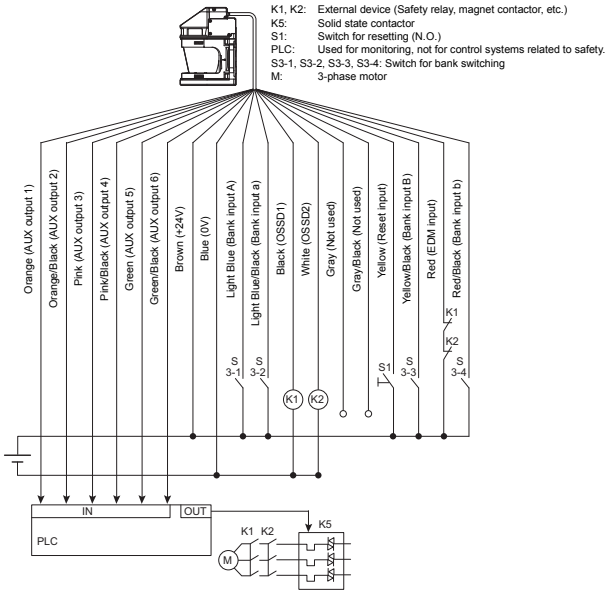
NPN wiring example



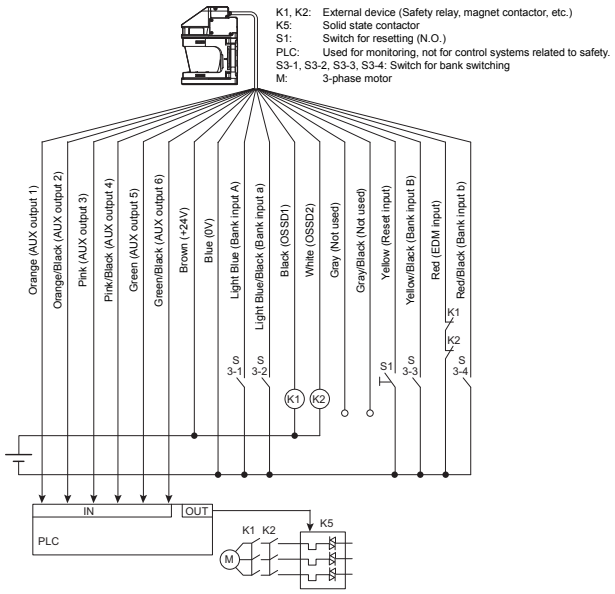
SZ-V04 wiring example 4

OSSD3/4	Not used
Bank switching	Used
Muting	Not used (usage not possible)
Interlock	Used
EDM	Used

PNP wiring example



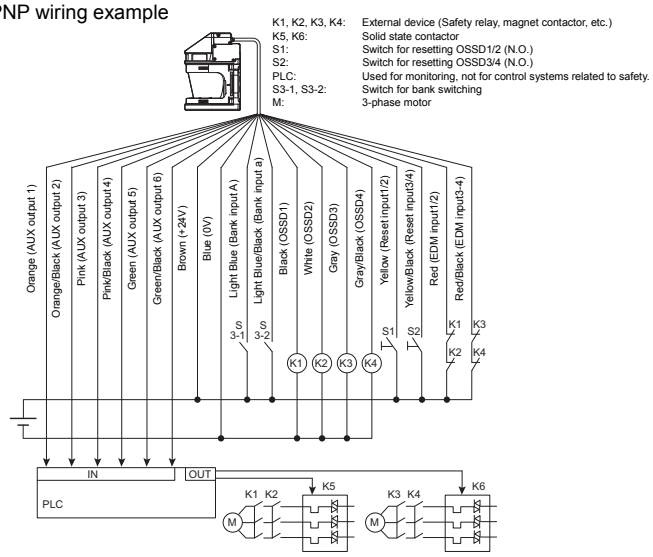
NPN wiring example



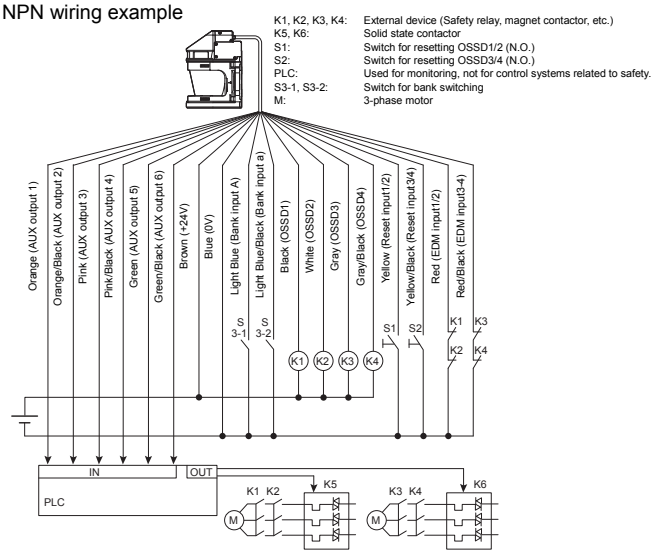
SZ-V04 wiring example 5

OSSD 3/4	Multi-OSSD function
Bank switching	Used
Muting	Not used (usage not possible)
Interlock	Used
EDM	Used

PNP wiring example



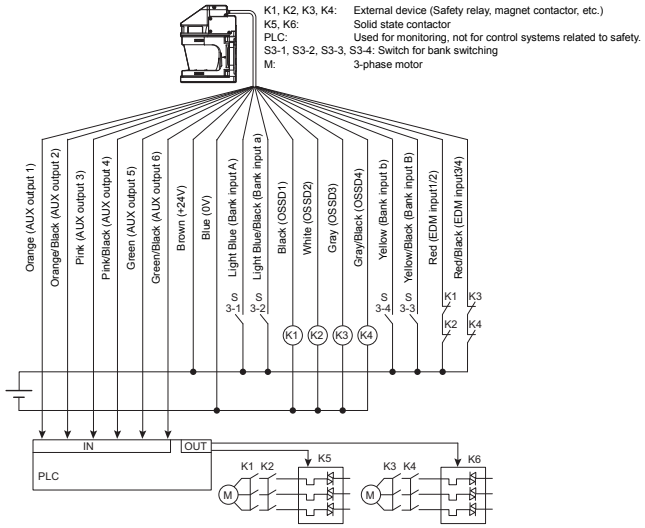
NPN wiring example



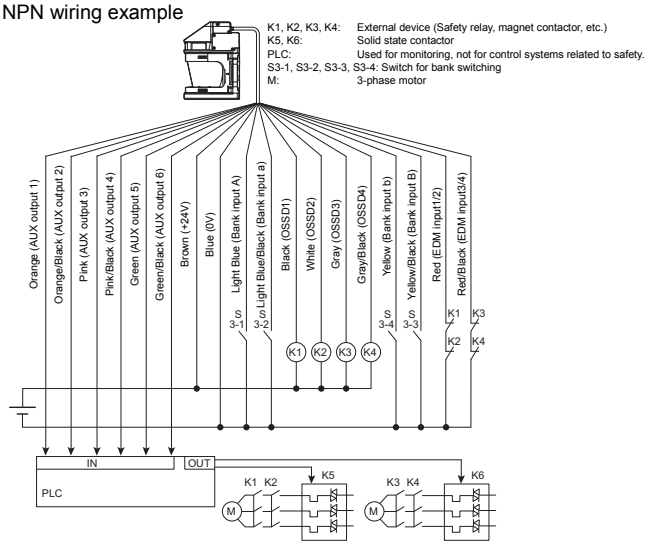
SZ-V04 wiring example 6

OSSD3/4	Independent bank switching
Bank switching	Used
Muting	Not used (usage not possible)
Interlock	Not used (usage not possible)
EDM	Used

PNP wiring example



NPN wiring example



Wiring for the SZ-V32 type

Determining the wiring pattern to use

1. Depending on how the “Bank Switching Function” (page 38) is used determines which of the four types of wiring patterns is used. “Bank Switching Function” (page 49)

	Pattern (1)	Pattern (2)	Pattern (3)	Pattern (4)
Bank switching	Not used	Used	Used	Used
Bank switching method		Switching through wiring input (single input or binary input)	Switching through wiring input (single input or binary input)	Switching through encoder input
Available number of banks		Single: 8 banks or less Binary: 16 banks or less	Single: 10 banks or less Binary: 32 banks or less	
Examples of wiring	Example 1 (Page 37)	Example 2 (Page 38)	Example 3 (Page 38)	Example 4 (Page 39)

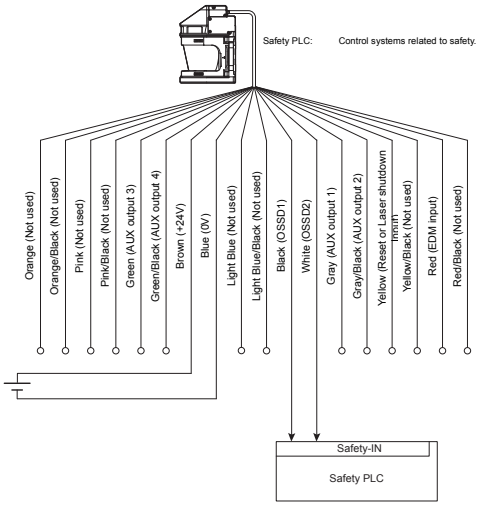
2. The detailed connection method differs depending on whether the functions below are used or not.

- “Select PNP or NPN” (page 46)
- “Interlock function” (page 47)
- “EDM Function” (page 48)

SZ-V32 wiring example 1

Bank switching	Not used
Interlock	Not used
EDM	Not used

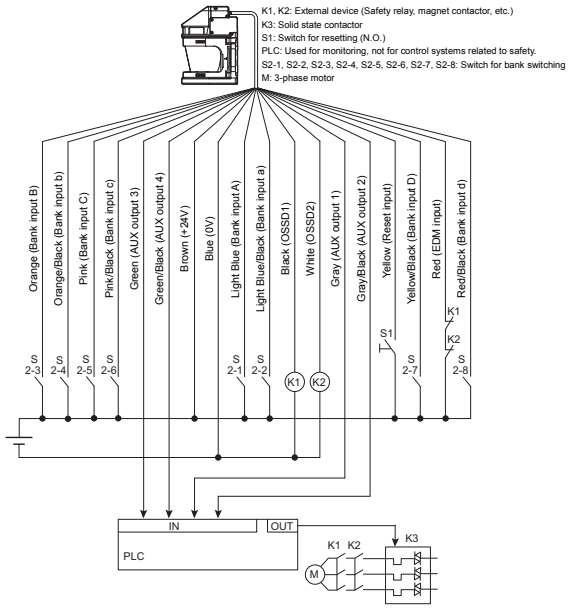
PNP/NPN wiring example



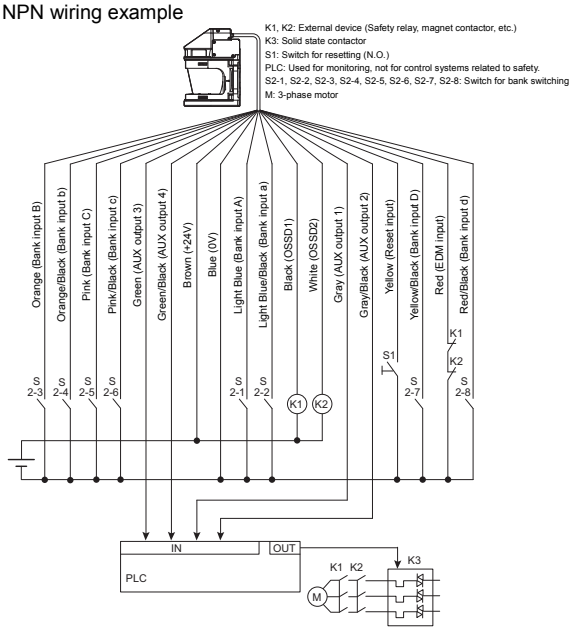
SZ-V32 wiring example 2

Bank switching	Used
Bank switching method	Switching through wiring input
Number of banks to used	Single input: 8 or less
	Binary input: 16 or less
Interlock	Used
EDM	Used

PNP wiring example



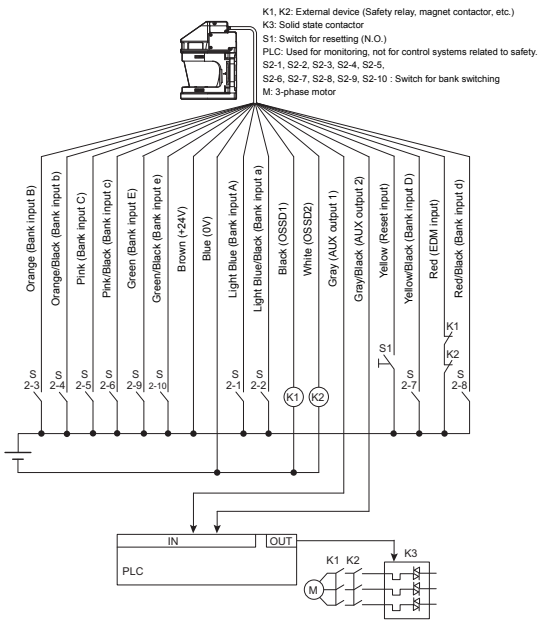
NPN wiring example



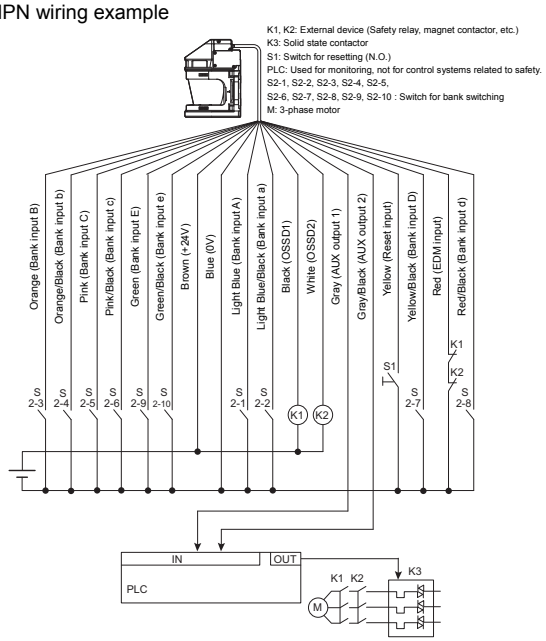
SZ-V32 wiring example 3

Bank switching	Used
Bank switching method	Switching through wiring input
Number of banks to used	Single input: 9, 10
	Binary input: 17 to 32
Interlock	Used
EDM	Used

PNP wiring example



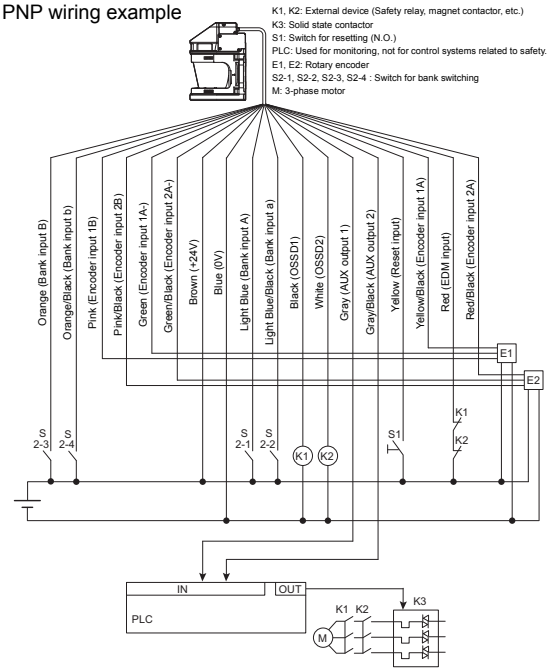
NPN wiring example



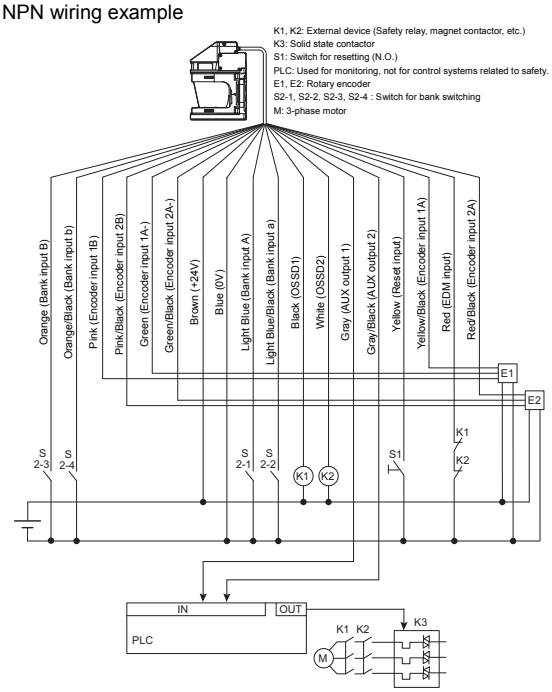
SZ-V32 wiring example 4

Bank switching	Used
Bank switching method	Switching through encoder input
Interlock	Used
EDM	Used

PNP wiring example



NPN wiring example



Wiring for the SZ-V32N type

Determining the wiring pattern to use

1. Depending on whether the functions below are used or not determines which of the six types of wiring patterns is used.

- “Bank Switching Function” (page 49)
- “Muting function” (page 55)
- PROFIsafe communication

	Pattern (1)	Pattern (2)	Pattern (3)	Pattern (4)	Pattern (5)	Pattern (6)
PROFIsafe	Not use	Not use	Not use	Not use	Not use	Used
Bank switching	Not used	Not used	Used	Used	Used	
Bank switching method			Switching through wiring input (single input or binary input)	Switching through wiring input (single input or binary input)	Switching through encoder input	
Available number of banks			Single: 8 banks or less Binary: 16 banks or less	Single: 10 banks or less Binary: 32 banks or less		
Muting	Not used	Used	Not used	Not used	Not used	
Examples or wiring	Example 1 (Page 40)	Example 2 (Page 41)	Example 3 (Page 41)	Example 4 (Page 42)	Example 5 (Page 42)	Example 6 (Page 43)

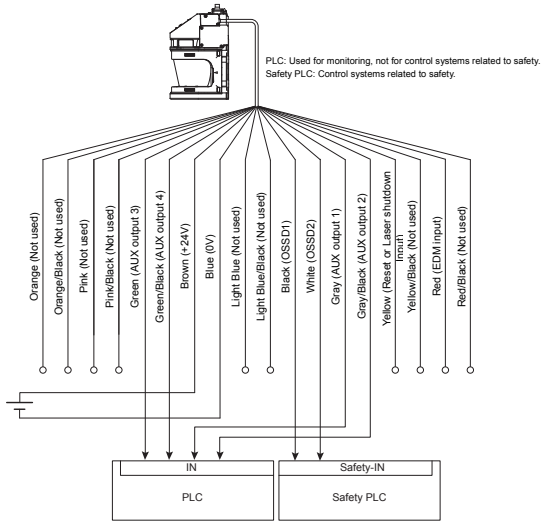
2. The detailed connection method differs depending on whether the functions below are used or not.

- “Select PNP or NPN” (page 46)
- “Interlock function” (page 47)
- “EDM Function” (page 48)

SZ-V32N wiring example 1

Bank switching	Not used
Muting	Not used
Interlock	Not used
EDM	Not used

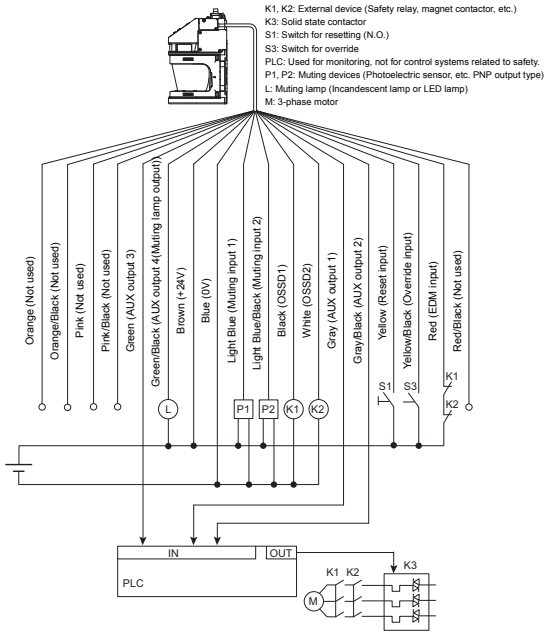
PNP/NPN wiring example



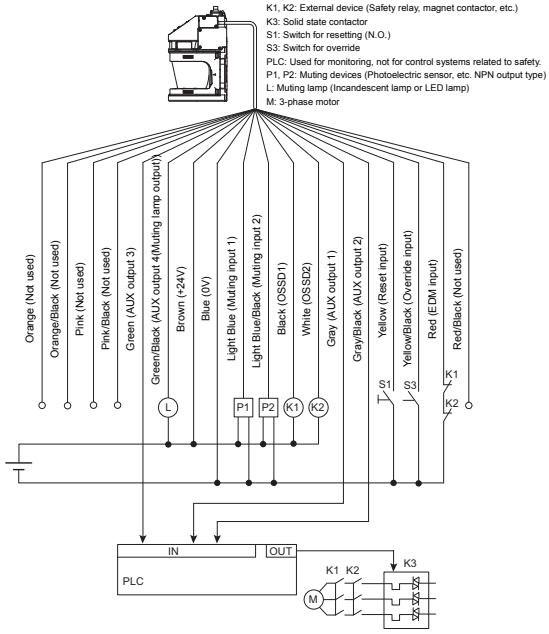
SZ-V32N wiring example 2

Bank switching	Not used (usage not possible)
Muting	Used
Interlock	Not used
EDM	Not used

PNP wiring example



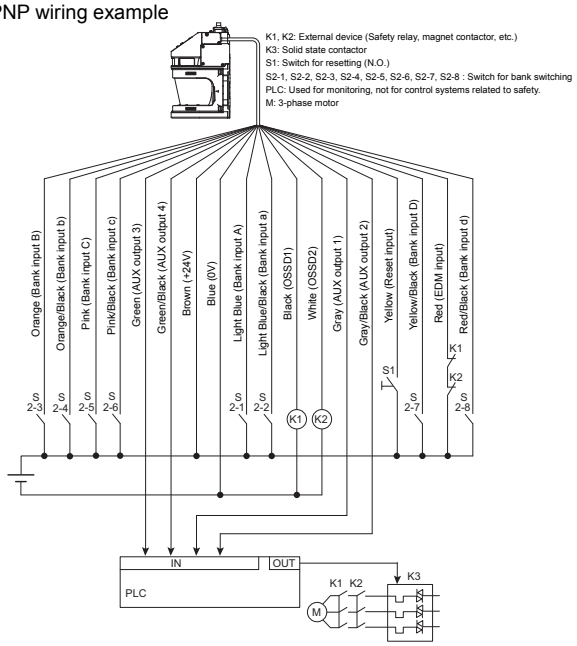
NPN wiring example



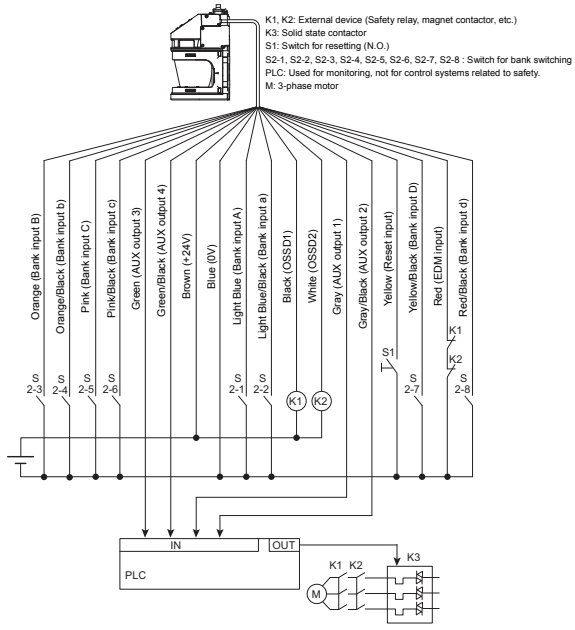
SZ-V32N wiring example 3

Bank switching	Used
Bank switching method	Switching through wiring input
Number of banks to used	Single input: 8 or less
	Binary input: 16 or less
Muting	Not used (usage not possible)
Interlock	Not used
EDM	Not used

PNP wiring example



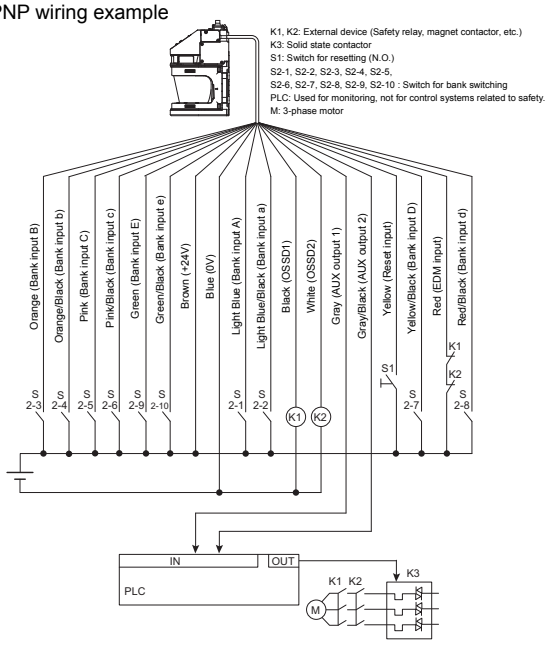
NPN wiring example



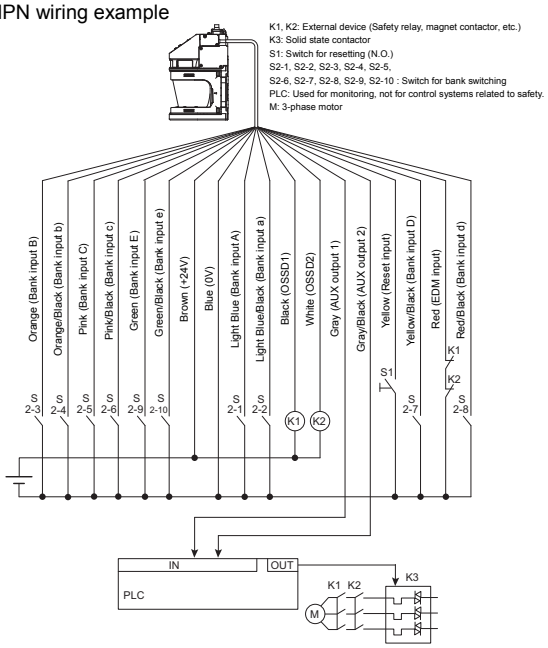
SZ-V32N wiring example 4

Bank switching	Used
Bank switching method	Switching through wiring input
Number of banks to used	Single input: 9, 10 Binary input: 17 to 32
Muting	Not used (usage not possible)
Interlock	Not used
EDM	Not used

PNP wiring example



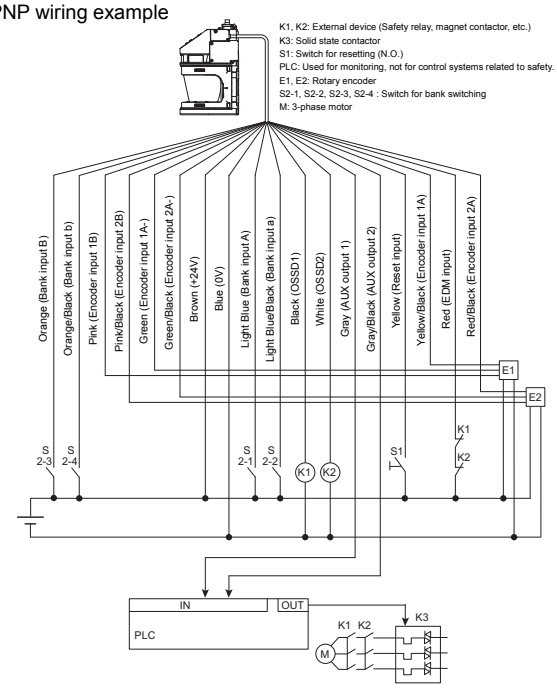
NPN wiring example



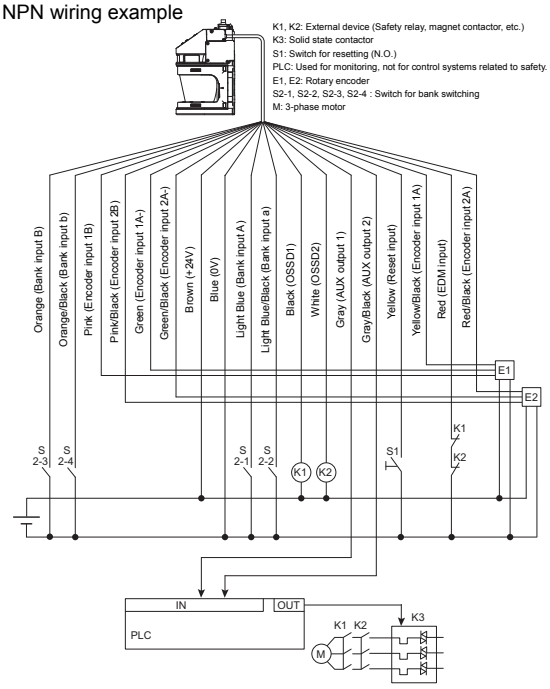
SZ-V32N wiring example 5

Bank switching	Used
Bank switching method	Switching through encoder input
No. of banks to used	(no restrictions)
Muting	Not used (usage not possible)
Interlock	Not used
EDM	Not used

PNP wiring example

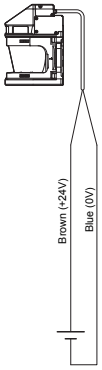


NPN wiring example



SZ-V32N wiring example 6

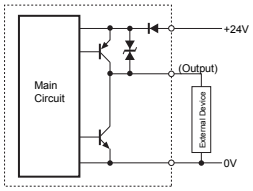
PROFIsafe : Used



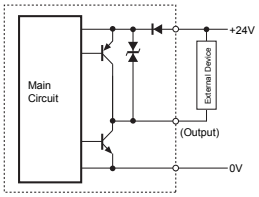
4-4 Input and Output Circuit

OSSD output circuit (Safety output)

PNP output

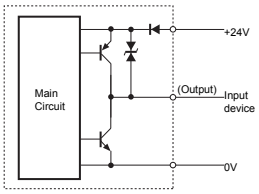


NPN output



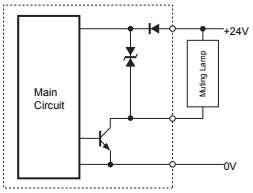
AUX output circuit

Common for both PNP and NPN output



Muting lamp output circuit

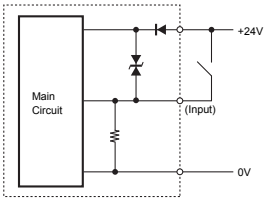
NPN output



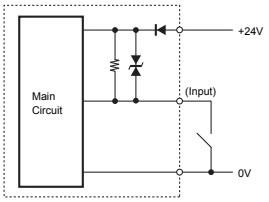
*Muting lamp output will always be a NPN output regardless of PNP/NPN selection.

Input circuit

PNP input



NPN input



5. Basic Functions

5-1 OSSD

The OSSD is a safety output for the safety-related part of a machine control system.
When the SZ-V detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state. “Protection zone” (page 17)
OSSD 1/2 is a pair of safety outputs that performs the output in the same state. Similarly, OSSD 3/4 is also a pair of safety outputs that performs the output in the same state.
The SZ-V 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-V detects no objects in the protection zone.).
The internal control circuit receives a feed-back signal (OFF-signal) based on the self-diagnosis, the SZ-V determines that its OSSD is operating normal. If the OFF-signal is not returned to the internal control circuit, the SZ-V determines that there is a problem with the OSSD or wiring and goes to the error state.

The number of OSSDs available depends on the SZ-V type.

Type	OSSD 1	OSSD2	OSSD3 *1	OSSD4 *1
SZ-V04 type	○		○	
SZ-V32 type	○			
SZ-V32N type *2	○			

*1 For more information about OSSD3/4, see “Multi-OSSD Function” (page 54).
*2 When using PROFIsafe with the SZ-V32N, use the Protection Zone State from the PROFIsafe input data as the safety outputs used in the safety-related control systems. When the SZ-V detects an object (someone or something) in the protection zone, the Protection Zone State goes to the OFF-state.

OSSD operation

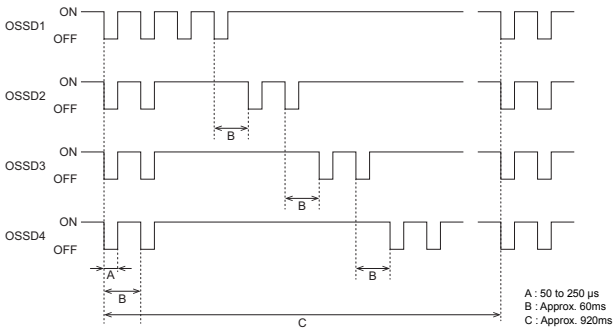
Depending on the state of the SZ-V, the state of the OSSD differs.

SZ-V State	OSSD state
Starting	OFF
Normal operation	ON. However, it turns OFF in the following conditions: 1. A person or object is detected in the protection zone(s) by any of the scanner heads *1 2. A reference point is not detected by one of the scanner heads *1 3. The laser off input is ON 4. The laser shutdown bank is selected 5. Interlock-reset-ready state 6. Waiting for bank input state 7. During ON-delay
Error State	OFF
Other states *2	OFF

*1 When multi-OSSD is being used, any scanner head that is linked with that OSSD.
*2 Other states refers to any of the following states:
- Waiting for configuration
- Transferring settings
- Calibrating the window
- Clearing system configuration information
- Testing AUX output
- Changing the password
- Initializing
- Other cases where detection is not performed

Point **The alert state does not affect the OSSD state**

Timing chart for self-diagnosis pulse



DANGER
- **For the wiring to a safety-related machine control system, the output of both OSSD 1 and OSSD 2 must be used by the safety-related machine control system in order to create a safety system.**
- **Similarly, the output of both OSSD 3 and OSSD 4 must be used a machine control system if you assign a function to either OSSD 3 or 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.**

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

Reference For the input and output circuit diagram, see “Input and Output Circuit” (page 43).

5-2 Operation modes

In the SZ-V, two types of operation modes can be chosen from in accordance with the application.

Operation mode	Standard Mode (Default Setting)	High Speed Mode
Advantages	• The maximum protection zone can be large • Not easily affected by suspended matter such as dust	• The response time can be faster
Disadvantages	• The response time is slower	• The maximum protection zone is smaller

Reference The size of the maximum protection zone differs depending on the minimum detectable object settings as well. “Minimum detectable object” (page 45)

5-3 Minimum detectable object

The minimum detectable object size can be selected for the SZ-V. Depending on the minimum detectable object size that is selected, the maximum configurable distance for the protection zone and warning zone differs.

Minimum detectable object size (mm)	Operation mode: Standard (Default Setting)		Operation mode: High Speed	
	Maximum protection zone distance (m)	Maximum warning zone distance (m)	Maximum protection zone distance (m)	Maximum warning zone distance (m)
φ20 mm	1.6 m	21 m	1.1 m	15 m
φ30 mm	2.9 m	23 m	2.0 m	18 m
φ40 mm	4.3 m	24 m	2.9 m	20 m
φ50 mm	5.6 m	25 m	3.8 m	21 m
φ70 mm	8.4 m	26 m	5.7 m	23 m
φ150 mm	8.4 m	26 m	5.7 m	23 m

* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

DANGER

- **The necessary safety distance varies depending on the minimum detectable object size you specify. The protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)**
- **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.).**

Reference Even if an object is smaller than the minimum detectable object size, it may still be detected; however this is not guaranteed.

5-4 Response Time and Scan Cycle

The response time of the SZ-V is the time from when an object (someone or something) enters the protection zone, to when the OSSD goes to the OFF-state due to the detection of the object. The response time can be selected by the user.
The response times that can be selected differ based on the following settings:

- “Operation modes” (page 44)
- “Mutual Interference Reduction Function” (page 58)

Response time

Operation mode: Standard Default Setting			Operation mode : High-speed		
Scan cycle A (Default Setting)	Scan cycle B	Scan cycle C	Scan cycle A	Scan cycle B	Scan cycle C
160 ms	168 ms	176 ms	80 ms	84 ms	88 ms
240 ms	252 ms	264 ms	120 ms	126 ms	132 ms
320 ms	336 ms	352 ms	160 ms	168 ms	176 ms
400 ms	420 ms	440 ms	200 ms	210 ms	220 ms
480 ms	504 ms	528 ms	240 ms	252 ms	264 ms
560 ms	588 ms	616 ms	280 ms	294 ms	308 ms
640 ms	672 ms	704 ms	320 ms	336 ms	352 ms
720 ms	756 ms	792 ms	360 ms	378 ms	396 ms
800 ms	840 ms	880 ms	400 ms	420 ms	440 ms
880 ms	924 ms	968 ms	440 ms	462 ms	484 ms
960 ms	1008 ms	1056 ms	480 ms	504 ms	528 ms
1040 ms	1092 ms	1144 ms	520 ms	546 ms	572 ms
1120 ms	1176 ms	1232 ms	560 ms	588 ms	616 ms
1200 ms	1260 ms	1320 ms	600 ms	630 ms	660 ms
1280 ms	1344 ms	1408 ms	640 ms	672 ms	704 ms

* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).
* When PROFIsafe is used with the SZ-V32N, 6 ms is added to the response time.

With faster response time, it is possible to shorten the safety distance. ”Safety Distances” (page 20)
With slower response time, it is possible to decrease the possibility of the OSSD turning OFF due to dust or ambient light.

DANGER

- **The necessary safety distance varies depending on the response time you specify. The protection zone must be configured so as to ensure the safety distance, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)**
- **The response time must be 90 ms or less when the SZ-V is used for the detection for access protection (trip device using whole-body detection with normal approach). The SZ-V may not detect the person in the protection zone if the specified response time is more than 90 ms.**

Reference

- Only one scan cycle can be set for a scanner head. The protection zone and warning zone response times for a scanner head can only be chosen from the same scan cycle.
- Response times can be individually set for the protection zone and warning zone.
- When using the multi-OSSD function, response times of Protection Zone A and Protection Zone B can be set individually.
- When using two warning zones, response times of Warning Zone A and Warning Zone B can be set individually.

5-5 Select PNP or NPN

The input and output circuit polarity can be selected from NPN or PNP.
- Not configured (default setting), PNP, NPN

*The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

DANGER

- **If you selected PNP/NPN select for PNP, do not cause short-circuit between the OSSD and +24V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.**
- **If you selected PNP/NPN select for PNP, be sure to connect the load between the OSSD and 0 V to avoid a dangerous situation. If the load is incorrectly connected between the OSSD and +24V, the logic of OSSD operation will be reversed, and then OSSD will turn to the ON-state when the SZ-V detects an object in the specified protection zone. This is a dangerous situation.**
- **If you selected PNP/NPN select for NPN, do not cause short-circuit between the OSSD and 0V. Otherwise, OSSDs keep staying at the ON-state and it causes a dangerous situation.**
- **If you selected PNP/NPN select for NPN, be sure to connect the load between the OSSD and +24V to avoid a 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-V detects an object in the specified protection zone. This is a dangerous situation.**

Important

You cannot use SZ-V if PNP/NPN selection is set to “Not configured”. Make sure to select either “PNP” or “NPN”. This is not necessary when PROFIsafe communication is used with the SZ-V32N.

5-6 AUX Output

AUX outputs are outputs that can inform the user of the SZ-V operations. The number of available AUX outputs and application functions vary based on the model.

Maximum AUX output count

	SZ-V04 type	SZ-V32 type	SZ-V32N type
Number of AUX outputs	**6**	**4***	**4***

Depending on the combination of functions that are used, the number of AUX outputs can vary.

Functions assigned to AUX outputs

For details about each function, see the relevant reference page.

	SZ-V04 type	SZ-V32 type	SZ-V32 N type
Not used	○	○	○
State information output *1 (Page 60)	○	○	○
Error output (Page 64)	○	○	○
Alert output (Page 64)	○	○	○
Error or alert output (Page 64)	○	○	○
Muted or override condition output (Page 56)	○	--	○
Muting lamp output *2 (Page 56)	○	--	○
OSSD state output (Page 61)	○	○	○
Detection in the protection zone output output (Page 65)	○	○	○
Detection in the warning zone output output (Page 65)	○	○	○
Interlock-Reset-Ready Output (Page 66)	○	○	○
Encoder error output (Page 64)	--	○	○
Transition to Normal Operation Output (Page 66)	○	○	○

*1 The state information output uses two outputs: AUX 1 and AUX 2. AUX 3 through 6 cannot be used for the state information output.
*2 For the muting lamp output, the SZ-V04 type uses AUX 6 and the SZ-V32N type uses AUX 4. Any of other AUX outputs cannot be used for the muting lamp output.

DANGER

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

Reference

- In the following states, the AUX outputs are forcibly set to OFF (state of high impedance).
  - Starting
  - Waiting for configuration
  - Transferring settings
  - Calibrating the window
  - Clearing system configuration information
  - Changing the password
- For the input and output circuit diagrams, see “
- Input and Output Circuit” (page 43).

5-7 Interlock function

Interlock is a function that prevents the OSSD from automatically going into the ON-state from the OFF-state. This prevents the unintended start-up and/or the unintended restart of the machine if the interlock is applied to the SZ-V. It is necessary to perform the reset operation in order for the SZ-V to go back to normal operation from the interlock condition. To use the interlock function, configure the interlock function settings in the SZ-V Configurator and connect a reset switch to the reset input terminal.
When using PROFIsafe with the SZ-V32N, control of the Reset bits of the PROFIsafe Output data is required to perform the reset operation.
*For details on wiring, see “Wiring” (page 30).
*The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

Reference When you are using the Multi-OSSD function, you can configure the interlock function for both OSSD 1/2 and OSSD 3/4. “Multi-OSSD Function” (page 54)

Interlock

For the interlock function settings, select from the following three variations:

At start-up	At restart	Notes
Automatic	Automatic	Default Setting
Manual	Automatic	
Manual	Manual	

In this manual, start-up and restart refer to the following.
Start-up:
- At start-up (when the power is supplied, after the SZ-V loads and the machine transitions to normal operation),
- When the SZ-V is restored from an error state through a reset operation,
- When configuration is completed with the SZ-V Configurator.

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

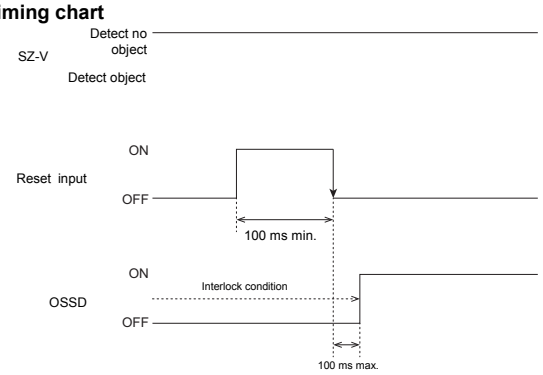
Here, Automatic and Manual refer to the following operations:
Automatic:
The OSSD goes to the ON-state automatically if the SZ-V detects no object in the protection zone at start-up or during restart.
Manual:
The OSSD keeps the OFF-state at start-up or during restart (interlock state).

■ Terminating the interlock state

It is necessary to perform a reset operation when the SZ-V detects no object in the protection zone, in order for the machine to start operation. After the reset operation, the OSSD goes to the ON-state, and then the interlock state is disabled.

Point **How to use automatic and manual restart appropriately:**
- **Automatic: This mode is used for machines where nobody can enter or approach the hazardous area by simply passing through the protection zone, or if the safety-related part of the control system other than the SZ-V, such as a safety relay unit, can ensure the safety with other means.**
- **Manual: Unexpected or unintended start-up of the machine or system can/should be prevented. Prevents automatic restart of the machine even if a person or object leaves the SZ-V protection zone. In both cases, the machine can be started with a start switch or the likes after a safety check is complete.**

■ Timing chart



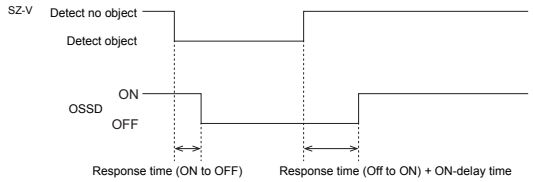
DANGER
- **Be sure to absolutely confirm that there is nobody in the hazardous zone before the interlock condition is terminated (i.e. the machine system restarts) by the interlock reset mechanism. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.**
- **If you set the interlock function to "Automatic/Automatic", you must prevent unintended start-up/restart and ensure the safety with machine control system except for the SZ-V.**
- **Make sure that the reset input does not short-circuit to other inputs or outputs.**

Reference
- The OSSD keeps the OFF-state during an error state regardless of the configuration of the interlock function. “Troubleshooting” (page 135)
- When using the interlock function (if the start or restart mode is set to "Manual/Automatic" or "Manual/Manual"), some functions are no longer available. “Functions That Cannot Be Set Together“ (page 146)

ON-delay

The time from when the object detected by the SZ-V is removed from the protection zone and when the OSSD goes back to the ON-state. This ON-delay time can be set from 2 seconds to 60 seconds in one second increments (default setting: 2 seconds).
However, if the ON-delay function is not used, the OSSD goes back to the ON-state after passing the response time (OFF to ON). “Response Time and Scan Cycle” (page 45)

■ Timing chart

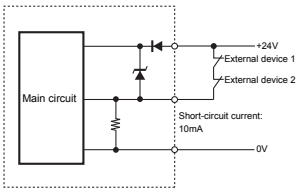


Reference
- The ON-delay does not work if the OSSD goes back to the ON-state due to the termination of the laser off input. “Operation Check Function” (page 57)
- The ON-delay does not work if the OSSD goes back to the ON-state due to the override input. “Override function” (page 56)

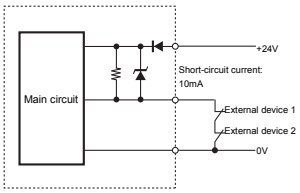
5-8 Monitoring External Devices (EDM Function)

The SZ-V can monitor the state of external devices, such as a safety relay or contactors that are connected to the OSSD, in order to detect the failure of the external device. This monitoring function is called the EDM function.
To use the EDM function, wiring between the SZ-V and the N.C. (Normally Closed) contacts of the external device(s) must be performed according to the following diagrams.
The EDM input must be open-circuited if EDM is not applied to the SZ-V. If wiring is incorrectly performed, "Unused Wire error" occurs on the SZ-V.

When PNP is set

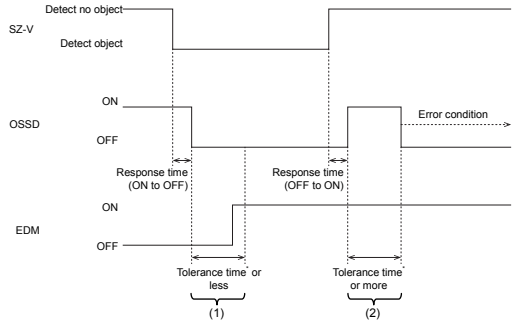


When NPN is set



Default setting: "Not used"

Timing chart



(1) The SZ-V continues normal operation because the SZ-V detects the operation of an external device within the tolerance time* after the operation of OSSD 1/2 (ON to OFF).
(2) The SZ-V detects an error on the external device and generates the error state of "EDM error", because the SZ-V does not detect the operation of external device within the tolerance time. “Troubleshooting” (page 135)

* The EDM tolerance time can be changed in the SZ-V Configurator. For details of the settings procedure, see “Configuring the settings” (page 74).
- 0.15 seconds, 0.3 seconds (default setting), 0.6 seconds, and 3 seconds

Reference
- When OSSD3/4 are enabled, EDM can also be applied to OSSD 3/4. “Multi-OSSD Function” (page 54)
- For more details about the EDM error, see “Error State” (page 135).
- When PROFIsafe is used with the SZ-V32N, the EDM function cannot be used.

6. Advanced Functions

6-1 Switching Protection Zones (Bank Switching Function)

The number of zones can be set in the SZ-V. The bank switching function is a function that can switch a set of warning and protection zones (Bank) according to external inputs (bank inputs).
The bank refers to a combination of protection zone, warning zone and reference points.
When multiple scanner heads are used, protection zones, warning zones, and reference points can be set for each scanner head.

Bank switching methods

The following three bank switching methods are available:
- Switching through wiring inputs (single input)
- Switching through wiring inputs (binary input)
- Switching through rotary encoder inputs (encoder input)

Number of configurable banks

The maximum number of configurable banks, and the number of protection and warning zones configurable per bank varies depending on the model of Display unit that is used and the functions used.
- "Multi-OSSD Function" (page 54)
- "Independent bank switching" (page 54)

- **The maximum number of banks and zones for the SZ-V04 type**

Functions	Bank switching method	Maximum no. of configurable banks	Per bank	
			No. of protection zones	No. of warning zones
Not used	Single	4	1	2
	Binary	4	1	2
Multi-OSSD function	Single	2	2	2
	Binary	4	2	2
Multi-OSSD Independent bank switching	Single	2 *1	2 *2	2 *2

*1 Two banks are configurable for both OSSD 1/2 and OSSD 3/4
*2 One protection zone and one warning zone is available for both OSSD 1/2 and OSSD 3/4. "Independent bank switching" (page 54)

- **The maximum number of banks and zones for the SZ-V32 type and SZ-V32N *1 type**

Bank switching method	Maximum no. of configurable banks	Per bank	
		No. of protection zones	No. of warning zones
Single input	10	1	2
Binary	32	1	2
Encoder	32 *2	1	2

*1 When the PROFIsafe communication is used, the bank switching function cannot be used. If you want to use the multiple bank function, use the "All Banks Function" (page 53).
*2 A combination of 4-bank wire switching (single input) and 8-velocity range.

Banks can be switched according to the signal combination of bank inputs (ON/OFF state combination). Appropriate protection zones can be selected by configuring the SZ-V to switch the banks corresponding to the hazard and/or hazardous area.

DANGER

Someone may be able to approach the hazard and/or hazardous area without passing through the SZ-V 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 bank transition time, in order to establish the appropriate control system for bank switching.

Reference

By designating one bank as the "laser shutdown bank" it is possible to stop the SZ-V laser and control the standby state when this bank is selected. "Operation Check Function" (page 57)

Details on the bank switching methods

Switching through wiring input (single input)

Banks are switched based on the signal state (ON/OFF) of the bank input wires. As shown in the following table, it is possible to switch from bank 0 to bank 9 according to the signal combination of bank inputs (bank input A to E and bank inputs a to e).
*For details on wiring, see "Wiring" (page 30).

	Bank input									
	A	a	B	b	C	c	D	d	E	e
Bank 0	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Bank 1	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Bank 2	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Bank 3	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Bank 4	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Bank 5	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
Bank 6	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Bank 7	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
Bank 8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
Bank 9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

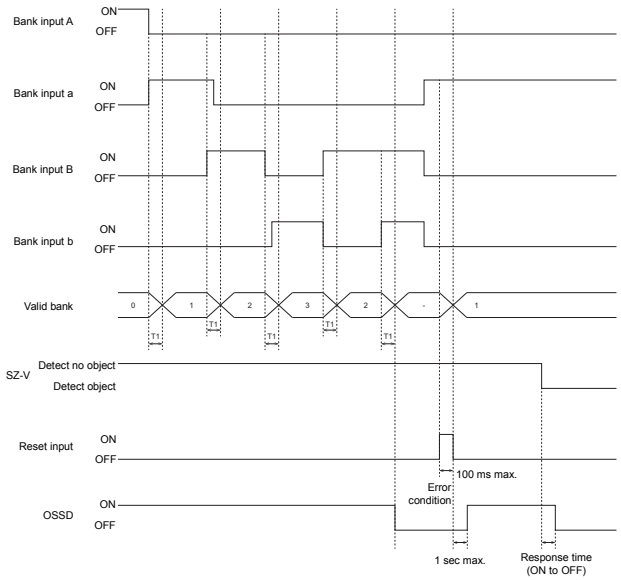
Reference

- When using single input with the SZ-V04 type, the maximum number of configurable banks is 4. Banks 4 to 9 cannot be used.
- When using independent bank switching with the SZ-V04 type, the bank switching method differs. "Independent bank switching" (page 54)
- To use more than 11 banks with the SZ-V32 type or the SZ-V32N type, single input cannot be used. Binary input switching should be used.
- The SZ-V does not start operation if the signal combination of bank inputs is different from the combinations shown above at start-up, because the SZ-V goes to the state of "Waiting for bank input". The SZ-V starts operation automatically if the signal combination of bank inputs is the same as one of the combinations shown above.
- If the signal combination of bank inputs is different from the combination shown above during normal operation, the SZ-V changes to "Bank input error."
- Bank switching must be performed according to the bank transition time specified in the SZ-V Configurator. The SZ-V goes to the error state of "Bank error" if the time does not meet the specified bank transition time.
- For details on the error state, see "Error State" (page 135).
- Individually insulate any bank inputs that are not used.

Point

Here, start-up refers to the following:
- **At start-up (when the power is supplied after SZ-V loading and the machine transitions to normal operation),**
- **When the SZ-V is restored from error state through a reset operation,**
- **When configuration is completed with the SZ-V Configurator.**

■ **Timing chart**



Reference
- T1 is sum of the following parameters:
  - Bank transition time
  - Scan cycle (80ms for standard mode, 40ms for High speed mode)
  - Communication overhead (15ms)
- Bank transition time can be selected from the following: 0.02/0.05/0.1 (default setting)/0.25/0.5/1/2.5/5 (seconds)
- If the bank switching function is used for types which the muting function is available (SZ-V04 type and SZ-V32N type), the muting function cannot be used.

Switching through wiring input (binary input)

Banks are switched based on the signal state (ON/OFF) of the bank input wires. As shown in the following table, it is possible to switch from bank 0 to bank 31 according to the signal combination of bank inputs (bank inputs A to E and bank inputs a to e).

※ For details on wiring, see “Wiring” (page 30).

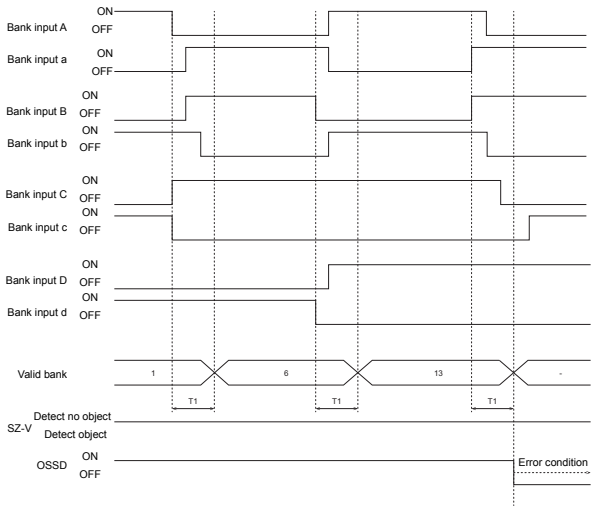
	Bank input									
	A	B	C	D	E	a	b	c	d	e
Bank 0	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON
Bank 1	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Bank 2	OFF	ON	OFF	OFF	OFF	ON	OFF	ON	ON	ON
Bank 3	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
Bank 4	OFF	OFF	ON	OFF	OFF	ON	ON	OFF	ON	ON
Bank 5	ON	OFF	ON	OFF	OFF	OFF	ON	OFF	ON	ON
Bank 6	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	ON	ON
Bank 7	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
Bank 8	OFF	OFF	OFF	ON	OFF	ON	ON	ON	OFF	ON
Bank 9	ON	OFF	OFF	ON	OFF	OFF	ON	ON	OFF	ON
Bank 10	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Bank 11	ON	ON	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
Bank 12	OFF	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON
Bank 13	ON	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	ON
Bank 14	OFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF	ON
Bank 15	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
Bank 16	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF
Bank 17	ON	OFF	OFF	OFF	ON	OFF	ON	ON	ON	OFF
Bank 18	OFF	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF
Bank 19	ON	ON	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
Bank 20	OFF	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF
Bank 21	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Bank 22	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF
Bank 23	ON	ON	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
Bank 24	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF
Bank 25	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	OFF
Bank 26	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
Bank 27	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
Bank 28	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF
Bank 29	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF
Bank 30	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF
Bank 31	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF

Reference
- Bank No. is represented with binary code consisting of the signal combination of bank inputs A, B, C, D, and E. For bank inputs a, b, c, d, and e, these are inverted signals from bank inputs A, B, C, D, and E.
- The SZ-V does not start operation if the signal combination of bank inputs is different from the combinations shown above at start-up, because the SZ-V goes to a state of "Waiting for bank input". The SZ-V starts operation automatically if the signal combination of bank inputs is the same as one of the combinations shown above. If the signal combination of bank inputs is different from the combination shown above during normal operation, the SZ-V changes to "Bank input error."
- Bank switching must be performed according to the bank transition time was specified through the SZ-V Configurator. The SZ-V goes to the error state of "Bank error" if the time does not meet the specified bank transition time.
- When using binary inputs with the SZ-V04 type, the maximum number of configurable banks is 4. Banks 4 to 31 cannot be used.
- If the total number of banks is 16 or less (that is, when bank 0 to bank 15 are enabled), the SZ-V does not check the state of bank input E and bank input e because they are not related to bank switching.
- If the total number of banks is 8 or less (that is, when bank 0 to bank 7 are enabled), the SZ-V does not check the state of bank input D/E and bank input d/e because they are not related to bank switching.
- If the total number of banks is 4 or less (that is, when bank 0 to bank 3 are enabled), the SZ-V does not check the state of bank input C, D, E and bank input c, d, e because they are not related to bank switching.
- If the total number of banks is 2 or less (that is, when bank 0 to bank 1 are enabled), the SZ-V does not check the state of bank input B, C, D, E and bank input b, c, d, e because they are not related to bank switching.
- For details on the error state, see “Error State” (page 135).
- Individually insulate any bank inputs that are not used.

Point

Start-up refers to the following:
- **At start-up (SZ-V loading completes after power is supplied and the machine transitions to normal operation),**
- **When the SZ-V is restored from an error state through a reset operation,**
- **When configuration is completed with the SZ-V Configurator.**

■ Timing chart



Reference
- T1 is sum of the following parameters:
  - Bank transition time
  - Scan cycle (80ms for standard mode, 40ms for High speed mode)
  - Communication overhead (15ms)
- The bank transition time can be selected from the following: 0.02/0.05/0.1 (default setting)/0.25/0.5/1/2.5/5 (seconds)
- If the bank switching function is used on types which the muting function is available (SZ-V04 type and SZ-V32N type), the muting function cannot be used.

Switching through rotary encoder input (encoder input)

This is a function that is available when encoders are connected to the SZ-V. Zones can be switched in accordance with velocity information received from two independent encoders. The velocity range (velocity bank) is configurable in 8 stages.
By combining single input wiring inputs, it is possible to switch between up to 4 wiring banks.
With combination of 8 velocity banks and 4 wiring banks, it is possible to switch between maximum 32 banks.

Wiring bank	A	ON	OFF	OFF	OFF
	a	OFF	ON	OFF	OFF
	B	OFF	OFF	ON	OFF
	b	OFF	OFF	OFF	ON
Velocity bank	Velocity range1	Bank0	Bank8	Bank16	Bank24
	Velocity range2	Bank1	Bank9	Bank17	Bank25
	Velocity range3	Bank2	Bank10	Bank18	Bank26
	Velocity range4	Bank3	Bank11	Bank19	Bank27
	Velocity range5	Bank4	Bank12	Bank20	Bank28
	Velocity range6	Bank5	Bank13	Bank21	Bank29
	Velocity range7	Bank6	Bank14	Bank22	Bank30
	Velocity range8	Bank7	Bank15	Bank23	Bank31

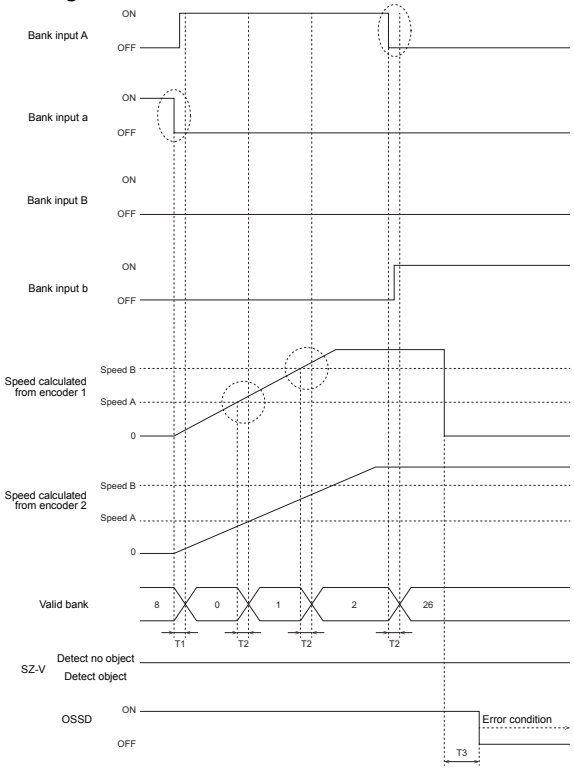
Encoders must meet the following conditions:
- Power voltage of DC 24 V
- A rotary encoder that has A and B phase, as well as an A- output (A phase inverse output)
- Complimentary output
- Maximum pulse frequency: 100 kHz

The settings can be configured as follows in accordance with the type of encoder that is used and the application:

Encoder Velocity Setting (Number of pulses per 1mm of AGV travel)	• 5 to 100 (pulses/mm) • Default: 5 (pulses/mm)
Allowable Variation	• 0 to 45 % • Default: 25%
Maximum Variation Time	• 10 s • 30 s (default) • 1 min

For details on each setting, see “Encoder settings” (page 76).

■ **Timing chart**

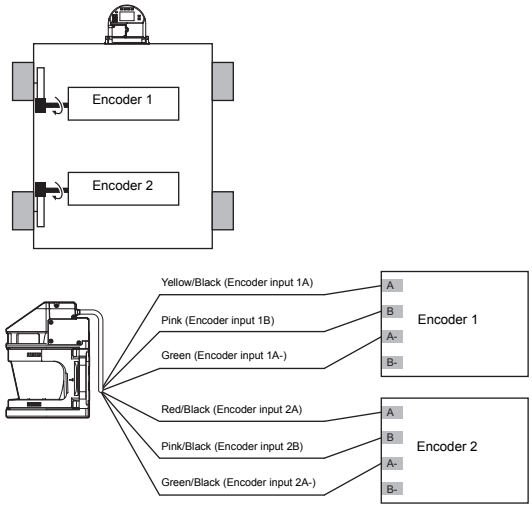


- T1 is sum of the following parameters:
  - Bank transition time
  - Scan cycle (80ms for standard mode, 40ms for High speed mode)
  - Communication overhead (15ms)
- The bank transition time can be selected from the following: 0.02/0.05/0.1 (default setting)/0.25/0.5/1/2.5/5 (seconds)
- T2 is sum of the following parameters:
  - Encoder velocity recognition time (72ms)
  - Scan cycle (80ms for standard mode, 40ms for High speed mode)
  - Communication overhead (15ms)
- T3 depends on type of error:
  - Encoder Mismatch Error: Maximum variation time
  - Error related to one encoder only: 400ms

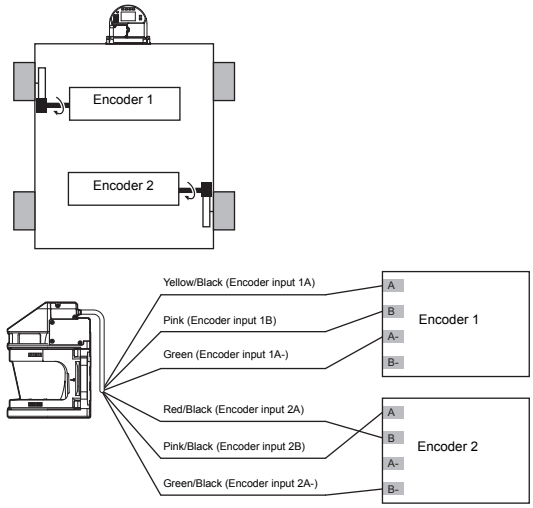
Reference

- When the velocity of the two encoders is not the same, the higher velocity is used as the determined velocity.
- It is possible to receive an output for an encoder error. “Encoder error output” (page 64)
- For the SZ-V04 type, encoder input switching cannot be selected.
- If the bank switching function is used on the SZ-V32N type, the muting function cannot be used.
- During normal operation, the SZ-V results in an error if one of the following conditions is met.
  1. The encoder velocity exceeds the set velocity range.
  2. An input is received that exceeds the maximum pulse frequency (100 kHz).
  3. The velocity difference between the two encoders is more than the allowable variation and exceeds the maximum variation time.
  4. The encoder velocity is zero and one of the following mismatches is detected:
     a. Encoder input 1A and 1A- mismatch
     b. Encoder input 2A and 2A- mismatch
- The direction of rotation of two encoders must be same, when AGV is moving. If encoders are used in an application where the direction of rotation of two encoders are different, wiring needs to be adjusted like the example below.

Two encoders are rotated in the same direction.



Two encoders are rotated in the different direction



■ Number of pulses per 1mm of AGV travel

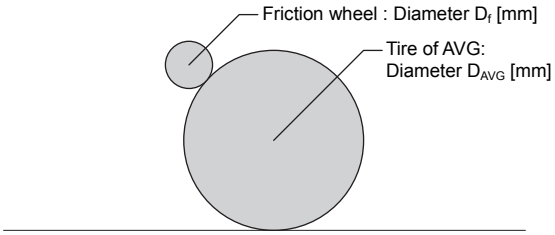
Calculation method

$P = p/(r \times D_{AGV} \times \pi)$

P: Number of pulses per 1mm move of AGV [pulses/mm]
p: Number of pulses per one rotation of encoder [pulses]
r: Number of AGV tire rotations per one rotation of encoder
D_{AGV}: Diameter of AGV tire [mm]

Calculation example

When using a friction wheel attached to an encoder.
D_f: Diameter of friction wheel [mm]



p = 1000 [pulses] Number of pulses per one rotation of encoder
D_{AGV} = 450 [mm] Diameter of AGV tire
D_f = 54 [mm] Diameter of friction wheel
$r = D_f/D_{AGV} = 54/450 = 0.12$ Number of AGV tire rotation per one rotation of encoder

Number of pulses per 1mm move of AGV

$P = p/(r \times D_{AGV} \times \pi) = 1000/(0.12 \times 450 \times \pi) = 5.9$ [pulses/mm]

DANGER	**If the object to be detected moves perpendicular to the detection plane, SZ-V cannot detect the object moving at speed over 1.6m/s, regardless of the encoder setting.**

6-2 Using Multiple Banks When PROFIsafe is Utilized (All Banks Function)

When using PROFIsafe with the SZ-V32N, up to 16 banks can be used simultaneously. The detection state of the protection zones and the detection zones can be read out individually.

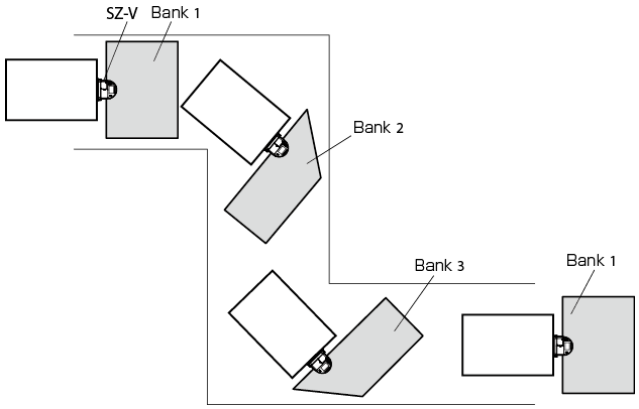
Reference
- Detection judgement is performed using single sampling. If one bank is specified separately, it can be judged using multisampling.
- When using All Banks, a “Laser shutdown bank” cannot be designated.

6-3 Monitoring the Zone Switching Sequence (Bank Sequence Monitoring Function)

The SZ-V can monitor the sequence of bank switching so that the OSSD goes to the OFF-state due to an error state if the SZ-V detects a signal combination of bank inputs in an unexpected sequence. This prevents machine operation with an unintended protection zone selected through the use of the bank sequence monitoring.
For each bank, 3 bank numbers can be assigned to follow. The SZ-V goes to the error state of "Bank sequence 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 to specify the proper bank sequence for the machine application.

*The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

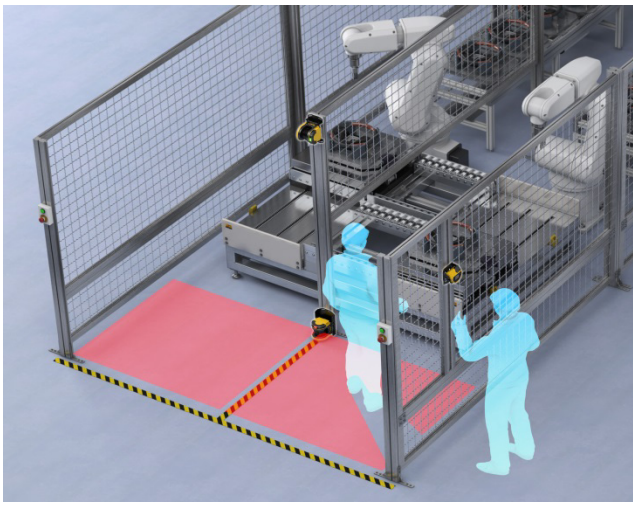
<Application example>
When the AGV which mounts the SZ-V moves a certain pth as shown in the following figure, the SZ-V can switch the bank in the following sequence, bank 1 → bank 2 → bank 3 → bank 1.
The AGV can stop because the SZ-V goes to the error state of “Bank sequence error” if the bank number 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.



Reference For details on the error state, see “Error State” (page 135).

6-4 Protecting Two Zones at the Same Time (Multi-OSSD Function)

When using the multi-OSSD function, it is possible to set two independent protection zones for one scanner head.
The two protection zones are called Protection Zone A and Protection Zone B. OSSD 1/2 goes to the OFF-state if the SZ-V detects an object in protection zone A. OSSD 3/4 goes to the OFF-state if the SZ-V detects an object in protection zone B. “Protection zone” (page 17)



* The settings are configured in the SZ-V Configurator. For details of the settings procedure, see “Configuring the settings” (page 74).

When adding more scanner heads, it is possible to assign each scanner head a protection zone for OSSD 1/2 and OSSD 3/4.
“OSSD output selection” (page 75)

DANGER	**If you control two hazard sources independently, you must fully consider the SZ-V installation position and orientation. If there is unprotected space where the operator can approach into the hazardous area, you must take additional countermeasure against the hazard.**

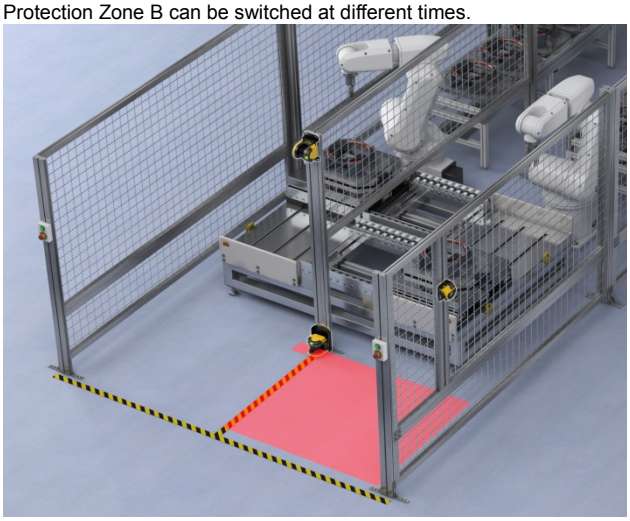
Reference

- Even when using the multi-OSSD function, maximum number of warning zones is two.
- To switch the protection zone for OSSD 1/2 (Protection Zone A) and the protection zone for OSSD 3/4 (Protection Zone B) at different times, use the independent bank switching function. “Independent bank switching” (page 54)

Independently switching two zones (Independent bank switching)

The independent bank switching function can be used in combination with the bank switching function.
“Bank Switching Function” (page 49)

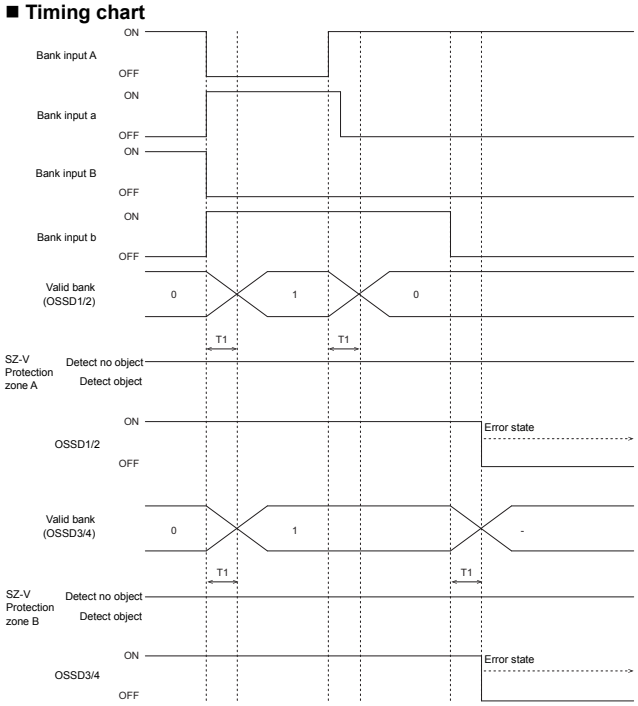
Normally when the bank switching function is used, the protection zone for OSSD 1/2 (Protection Zone A) and the protection zone for OSSD 3/4 (Protection Zone B) switch at the same time. However, if the independent bank switching function is used, Protection Zone A and Protection Zone B can be switched at different times.



* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

OSSD 1/2 Protection zone A	OSSD 3/4 Protection zone B	Bank input			
		A	a	B	b
Bank 0	---	ON	OFF	--	--
Bank 1	---	OFF	ON	--	--
---	Bank 0	--	--	ON	OFF
---	Bank 1	--	--	OFF	ON

■ **Timing chart**



Reference Certain functions cannot be used at the same as the independent bank switching function.
“Functions That Cannot Be Set Together” (page 146)

6-5 Temporarily Disabling the Safety Function

The SZ-V04 type and the SZ-V32N type have a function that can temporarily disable the safety function when specific conditions are met. While the specific signals, which fulfill that condition, are activated, the OSSD keeps the ON-state even if the SZ-V detects something or someone in the protection zone, or if the SZ-V detects a change of position monitored through the reference points monitoring function.

DANGER	**The conditions, SZ-V settings, peripheral devices, and the installation of those devices in order to disable the SZ-V safety function 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-V 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.**

Reference

- The state of suspension of safety function can be checked through the muting indicator and AUX output signal. The configuration of AUX outputs is necessary to check the state of suspension through AUX output signals.
  - Checking through a PLC: “Muted or override condition output” (page 56)
  - Checking an indicator light or lamp: “Muting lamp output” (page 56)
- Certain functions cannot be used if the muting function is used. “Functions That Cannot Be Set Together” (page 146)

Temporarily disabling the safety function (Muting function)

A muting zone can be configured anywhere in the protection zone. The SZ-V goes to the muted condition when the conditions for initiation of muting are fulfilled. The OSSD keeps the ON-state even if the SZ-V 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-V detects an object in the protection zone where the muting zone is not configured.)
For example, it is not necessary to stop the machine when an AGV enters the hazardous area by configuring the muting zone in the protection zone where the AGV would pass through.
The muting input terminals on the SZ-V must be connected to muting devices to use the muting function.

Restrictions on the muting device

- Output must be N.O. (normally open)
- Must be a contact output or PNP/NPN output which corresponds to the settings selected in the selection of PNP or NPN.
- Do not use one muting device with multiple outputs in place of two or more muting devices (always one output for one device).
- 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.

1. Muting inputs go to the ON-state within the specified sequence and within the specified time between them.
2. The SZ-V detects no objects in the protection zone.
3. The OSSD is in the ON-state.

Conditions for termination of muting

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

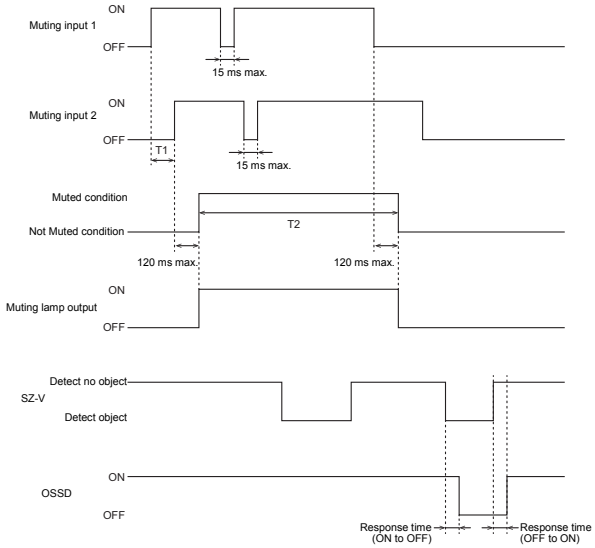
1. Either of muting inputs go to the OFF-state for more than 0.015 sec.
2. The SZ-V goes into an error state.
3. The laser off input goes to the ON-state ("Operation Check Function” (page 57)).
4. The power supply is interrupted.
5. The maximum muting period of time has passed.

Configuring muting conditions

The settings can be configured as follows in accordance with the application:

Sequence of muting inputs	• Muting input 1 to Muting input 2 fixed (default) • Muting input 2 to Muting input 1 fixed • Not specified
Time period between muting inputs	• 0.04 to 3.0 (default) • 0.04 to 5.0 • 0.04 to 10.0 • 0.04 to (not specified)
Maximum muting period of time	• Approx. 1 minute • Approx. 5 minutes (Default) • Approx. 10 minute • Not specified

■ **Timing chart**



T1: Time period between muting inputs (default: 0.04 to 3s) Configurable from SZ-V Configurator.
T2: Maximum muting period of time (default: 5 min) Configurable from SZ-V Configurator.

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. Moreover, based on this result, enact additional safeguards if necessary. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.**

Point

Consider the potential danger due to the muting sensor unexpectedly failing. Also, note the following when “Not specified” is selected for both the maximum muting period and time between muting inputs.

- **If the time between muting inputs exceeds 3 seconds, the muting state will be terminated approximately 5 minutes later. (If the time between muting inputs is within 3 seconds, the muting state continues and is unlimited as per the settings.)**

Reference

Upon start up, the SZ-V starts from the muting terminated state regardless of the muting input state. The SZ-V is unable to power on into a muted state.

Restarting after a suspended disabled state (Override function)

With the safety function temporarily disabled by the muting function, the OSSD goes to the OFF-state if that suspension is interrupted for any reason. If this occurs while an object is still in the protection zone, then the machine remains stopped because the muting function cannot initiate again since the SZ-V detects an object in the protection zone. The override is a helpful function suitable for such a situation. The SZ-V goes to the override condition when the conditions for initiation of override are met. When override is activated, an object in the protection zone can be easily removed.
All of the scanner heads and protection zones go into the override state when this function is activated and the safety function is disabled. (It is not possible to suspend the safety function for only a part of the protection zone or to disable just one scanner head.)

Conditions for initiation of override

Override is initiated when the reset input* goes to the ON-state within 0.04 to 1 sec. after the override input goes to the ON-state, and if all of the following conditions are met:

1. The SZ-V is not in an error state.
2. At least one scanner head detects an object in the protection zone.
3. The OSSD is in the OFF-state. (Including interlock condition)
4. Either muting input or both muting inputs are in the ON-state.

*If the operation check function with laser off input is used, the laser off input must go in the ON-state instead of the reset input for the initiation of override.

Conditions for termination of override

The override condition is terminated if one of the following conditions is met:

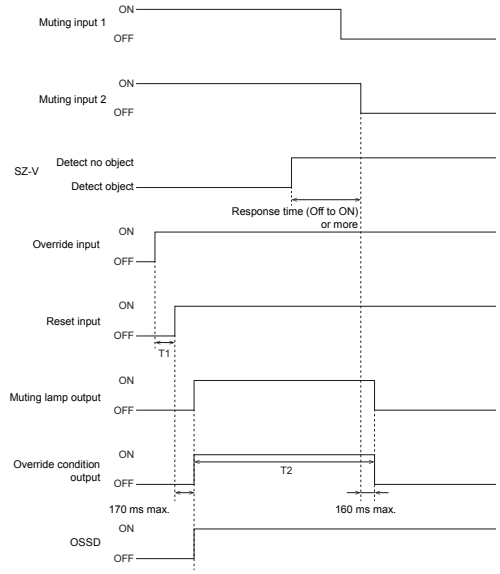
1. All muting inputs go to the OFF-state.
2. Either override input or reset input goes to the OFF-state.
3. The SZ-V goes into an error state.
4. Maximum override period of time has passed.

Configuring override conditions

The settings can be configured as follows in accordance with the application:

Maximum override period of time	• 1 minute (default), 5 minutes, 10 minutes

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



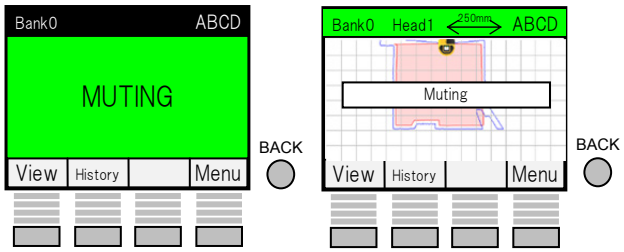
T1: 0.04 to 1s Cannot be changed
T2: Maximum override period of time (default: 1 min) Configurable from SZ-V Configurator

Displaying the disabled state

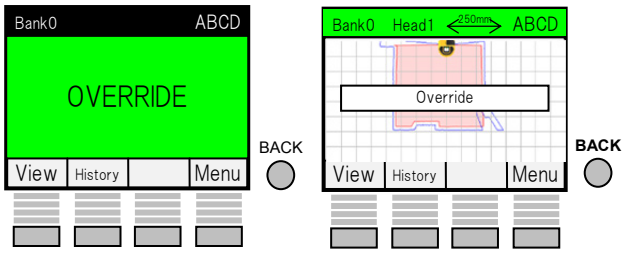
The disabled state of the safety functions can be displayed on the SZ-V or output to an external device.

Checking the state on the SZ-V display

Muting state



Override state



Using an output to display the state on an external device

By assigning the following functions to an AUX output, it is possible to check whether the SZ-V safety function is disabled by signaling the state.

*The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

■ Muted or override condition output

The AUX Output goes to the ON-state if the safety function is temporarily disabled by the muting function or override function.

■ Muting lamp output

In addition to functioning in the same manner as the muted or override condition output, a muting lamp can be controlled directly with the SZ-V.

The following conditions must be fulfilled if a muting lamp is connected 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

DANGER	**Muting, override state output, or muting output cannot be used as a safety output for safety-related control systems. Misuse of this function as safety output could result in the significant harm to the machine operators, including serious injury or death.**

Reference

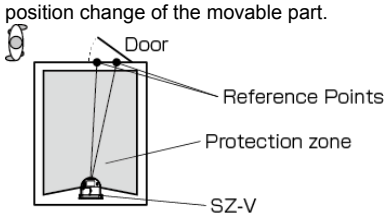
- The muting lamp output can only be assigned to AUX 6 (AUX 4 for the SZ-32N).
- The muting lamp output will always be a NPN output, even if the selection of PNP or NPN is PNP.
- Alerts about muting lamp failure, such as a blowout of the lamp, disconnection or overcurrent, can be signaled through the alert output, error output, or state information output. “State information output” (page 60)
- The performance of SZ-V under the muting lamp failure can be defined as either error (muting lamp error) or alert. The SZ-V goes to the error state in case of muting lamp failure in accordance with the default configuration.

6-6 Monitoring Doors and Other Locations That Change (Reference Points Monitoring Function)

Reference points monitoring is a safety-related function where the SZ-V monitors the position change of a structure (such as protective guarding or a door) located at a specified reference point. Similar to when the SZ-V 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.
*The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

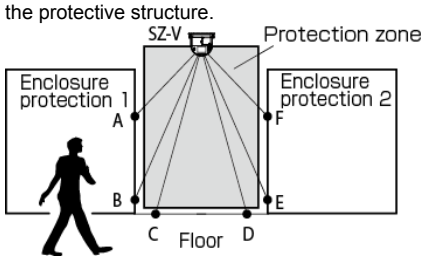
Examples of applications for detection for area protection

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



Examples of applications for detection for access protection

When the SZ-V is used in combination with other protective structures as safety measures, the configured protection zone may not ensure the safety, because an unintended area allowing possible approach points could be generated due to the displacement of protective structures or the SZ-V itself. With the reference point monitoring function, the SZ-V can monitor the position of the protective structure. Therefore, it can ensure the safety since the OSSD goes to the OFF-state in case of position changes of the protective structure.



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 each of the three structures (protective structure 1, protective structure 2 and the floor) for a total of six points (A to F).

DANGER	**Reference point monitoring function must be applied when the SZ-V 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 a space between the protection zone and the protective structure that the minimum detectable object is not detected by the SZ-V.**

Reference
- Maximum of 15 reference points can be set.
- When using bank switching function, maximum of 15 reference points can be set for protection zone of each bank.
- The OSSD turning OFF because an object or person was detected in the protection zone, or the reference point monitor function turning OFF the OSSD can be distinguished with the SZ-V display and the detection history. “Checking the Detection History” (page 97)
- The reference point monitoring function stops while the safety function is temporarily disabled.

6-7 Turning OFF the SZ-V OSSD (Operation Check Function)

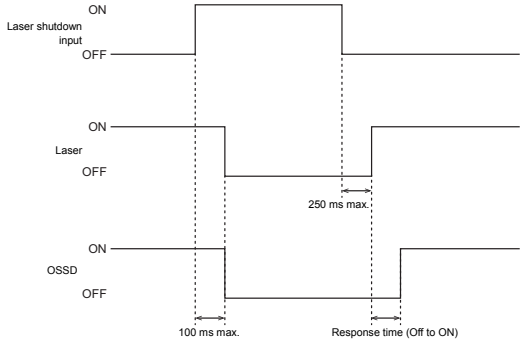
Using the operation check function stops the laser light and forcibly turns OFF the OSSD. By using the operation check function, all OSSDs can be turned OFF and it is possible to check whether the intended machine stopped. An AGV or machine can be temporarily stopped by putting the SZ-V into standby mode.

There are two ways to use the operation check function.
- Operation check with laser off input
- Operation check with bank switching

Operation check with laser off input

Use an external input to turn off the laser light and turn the OSSD OFF.

■ **Timing chart**



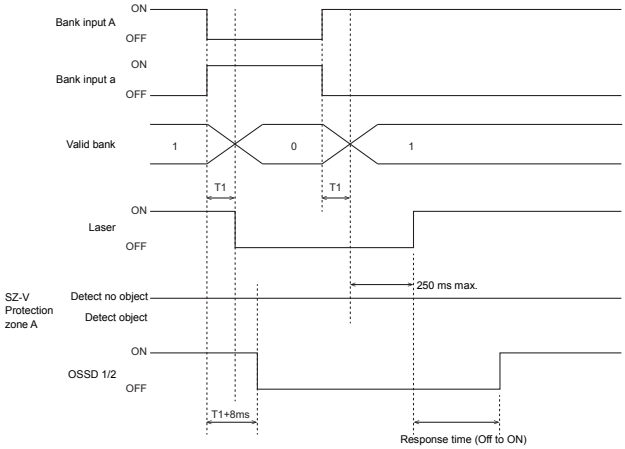
Reference If the Start/Restart mode settings are not “Automatic/Automatic", laser off input cannot be used. “Interlock function” (Page 47)

Operation check with bank switching

By designating one bank as the "laser shutdown bank," it is possible to stop the SZ-V laser and turn the OSSD OFF.

For example, if the laser shutdown bank is set to bank 0 and bank 0 is selected with the bank switching inputs, then the SZ-V stops the laser and turns the OSSD OFF. The SZ-V goes back to the normal operation if a different bank number is selected.

■ **Timing chart**



6-8 Reducing Interference Between SZ-Vs (Mutual Interference Reduction Function)

If multiple SZ-Vs are installed in close proximity, their scan cycles can be changed to reduce mutual interference. The scan cycle indicates the SZ-V's emission timing. SZ-V has three different scan cycles. Any cycle can be selected.
When installing two SZ-Vs close to each other, by applying different scan cycles, it is possible to prevent mutual interference between the two SZ-Vs. The possibility of mutual interference is reduced between three SZ-Vs if different scan cycles are set. The selectable response times vary depending on the scan cycle specified.
“Response Time and Scan Cycle” (page 45)

6-9 Reducing Power Consumption (Power Saving Mode)

If Power Saving Mode is selected and the SZ-V is not operated for a certain period of time, part of the display will turn off. In this way, power consumption is reduced.

If 30 seconds passes since the last key operation, the display turns off.
Scanner head: Scanner head state indicator
Display unit: Display backlight

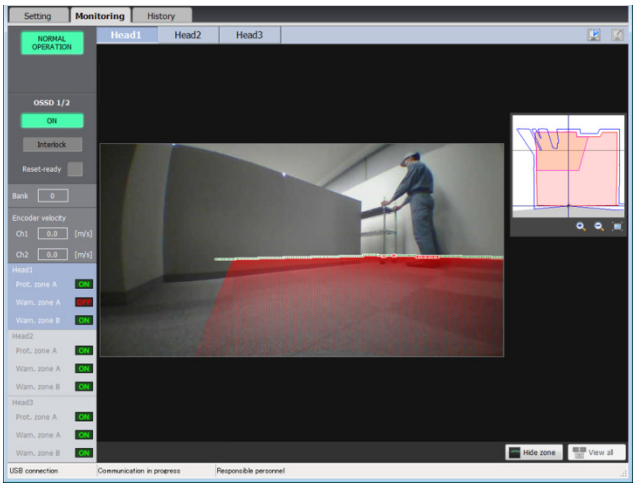
However, in the following cases, the display will not turn off:
- In the 30 seconds since the power was turned on
- During an error state

Default setting: Not used

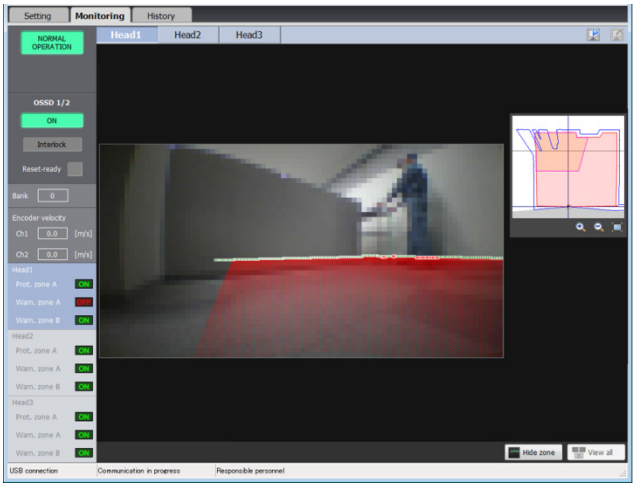
6-10 Privacy of Camera Images (Camera Blur Function)

Scanner heads with cameras have the ability to monitor images taken with the cameras, and save photos and videos of the moments that objects and/or people were detected.
Due to privacy considerations, if keeping detailed images is not desired, the camera image can be blurred using the camera blur function.

Without the camera blur function



With the camera blur function



∗ The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

6-11 Replacing damaged units without configuration transfer (System Memory)

All settings and zone data are saved in the system memory. Therefore, when replacing the Display unit or scanner head, it is possible to automatically copy all the settings and zone data to the new Display unit or scanner head by using the same system memory.
If an Display unit is replaced because it broke, the amount of transfer time is greatly reduced.

For details on the replacement procedure, see “Replacing the Display unit” (page 145).

Important **When connecting an SZ-V unit (Display unit and scanner head) to the system memory with the setting information, use an SZ-V unit that has never been connected to another system memory. If the SZ-V unit has been connected to another system memory, the SZ-V will experience an error (system configuration error) and not function properly.**

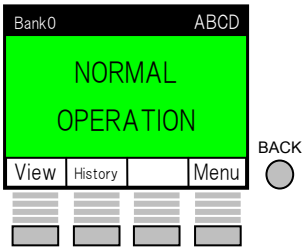
Reference
- To clear a system configuration error, it is necessary to use the configuration software (SZ-V Configurator) to delete the system configuration information on the SZ-V unit. “Clear system configuration” (page 106)
- Transferring new settings from the SZ Configurator can overwrite the system configuration information. “Setting Procedure” (page 73)
- Initializing the settings from the SZ Configurator, can also overwrite the system configuration information. “Initialization” (page 105)
- As the following data is not saved in system memory, it cannot be copied to a new SZ-V.
  - SZ-V panel brightness
  - Enable/disable use of the key lock function
  - Type of view selected before last power off (Status view, Monitor view, Camera view)

7. Checking Operation Status

7-1 Checking the Current Detection Status

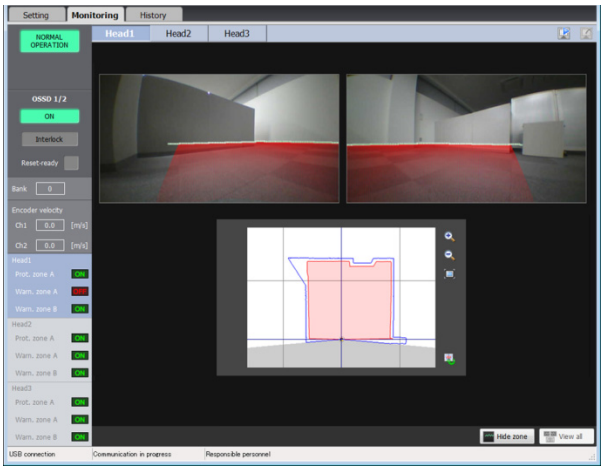
Checking on the SZ-V display

The state of the SZ-V can be checked on the Display unit display and with the indicators.
For details, see “How to Read the SZ-V Display” (page 112).



Checking on the SZ-V Configurator

The detection state can be checked on the SZ-V Configurator monitor.
For details, see “Monitoring Operations” (page 92).



Checking with outputs

Information that indicates the current state of the SZ-V can be checked through outputs by assigning following functions to AUX output.

* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

DANGER	**State information output and OSSD state output cannot be used as safety output to safety-related control systems. Misuse of this function as safety output could result in significant harm to the machine operators, including serious injury or death.**

State information output

The state information output is a function used to inform an external device of the current state of the SZ-V through two AUX outputs.
The state information output 1 is assigned to AUX output 1, while the state information output 2 is assigned to 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 the exact state of the SZ-V.
The state information output 1 goes to the ON-state for a certain interval. While the state information output 1 is in the ON-state, the SZ-V generates the pulse signals on state information output 2. If the pulses are counted on the state information output, the current state of the SZ-V can be received. (The state information output 1 goes back to the OFF-state when the SZ-V has completed generating the pulses on state information output 2.)
The following table shows the relationship between the number of pulses and the state of the SZ-V. Use this function for monitoring the SZ-V operation through a PLC.

If multiple states are occurring at the same time, only the state with the highest priority is output.

■ The number of pulses for the state information output and details

Some of the details differ depending on whether the bank switching function or the muting function is used.

No. of pulses	Details: When using the bank switching function	Details: When using the muting function	Priority	
1	Normal operation (ON) bank 0	Normal operation (ON)	B	5
2	Interlock-reset-ready or reset ON-delay		B	1
3	Scanner head 1 protection zone is in detection state		A	12
4	Scanner head 2 protection zone is in detection state		A	13
5	Scanner head 3 protection zone is in detection state		A	14
6	Normal operation (ON) bank 1	Muting state	B	3
7	Normal operation (ON) bank 2	Override state	B	2
8	Normal operation (ON) bank 3	Muting input is ON*	B	4
9	Waiting for bank input		A	11
10	Bank input error or bank sequence error	Muting lamp error	A	2
11	Window alert		A	7
12	Light interference alert		A	8
13	High reflection alert		A	9
14	Other alerts		A	10
15	Window error		A	5
16	MI error		A	6
17	EDM error		A	3
18	OSSD error		A	1
19	Other errors		A	4
20	Normal operation (ON) bank 4		B	6
21	Normal operation (ON) bank 5		B	7
22	Normal operation (ON) bank 6		B	8
23	Normal operation (ON) bank 7		B	9
24	Normal operation (ON) bank 8 - 15		B	10
25	Normal operation (ON) bank 16 - 23		B	11
26	Normal operation (ON) bank 24 - 31		B	12

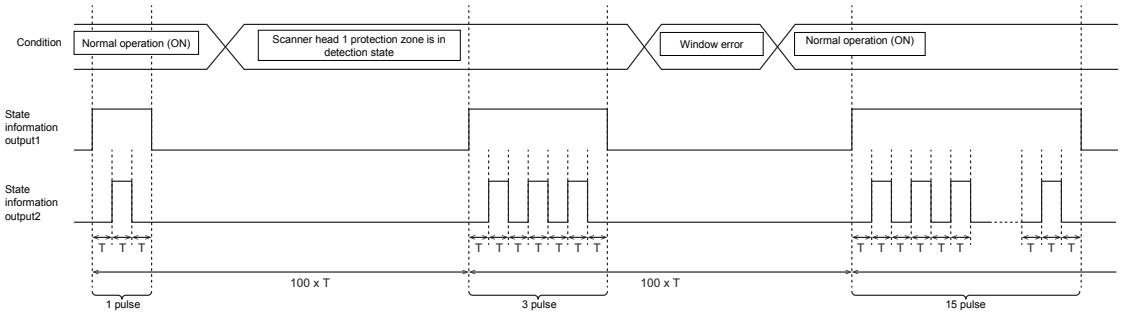
*When muting conditions are not met and the SZ-V is not in the muting state. For details of muting conditions, see “Muting function” (page 55)

■ **Priority**

Number of pulses coming out of the state information output 2 is determined by the current status of SZ-V. If SZ-V corresponds to multiple statuses, number of pulses corresponding to a status with highest priority will be output.
Status with priority A has higher priority compared to priority B. Within same priority alphabet, smaller number status has higher priority.
For statuses with priority A, if a status of priority A happens even once after the last pulse output, regardless of current status, that status will be latched and output.

■ **Timing chart**

Pulse output is generated from state information output 1 periodically (100 x T).
When state information output 1 is ON, pulse output is generated from state information output 2. Number of pulses depends on SZ-V status.

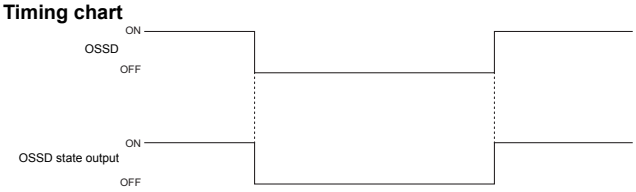


Reference The pulse width (T) time can be changed in the settings.
- 20 ms (default setting), 40 ms, 60 ms, 80 ms, 100 ms, 200 ms, 300 ms

OSSD state output

The OSSD state output operates corresponding to the operation of the OSSD. This can confirm the OSSD operation through external device, such as a PLC.
When using the multi-OSSD function, it is possible to select either the OSSD 1/2 state output corresponding to the OSSD 1/2 ON/OFF state, or the OSSD 3/4 state output corresponding to the OSSD 3/4 ON/OFF state.

Timing chart



7-2 Checking the Past Detection Status (Detection History)

The history of detecting people or objects, and the error and alert occurrence histories can all be checked. If a scanner head with a camera is used, photos and videos of the moments that objects are detected can be saved.
The history of these events can be checked in the SZ-V Configurator or the SZ-V display panel.

Detection History

Saving mode		[Single Frame/Photo]	[Multi-Frame/Video]
No. of saved items	Detection history	500	100
	Photos	30	-
	Videos	-	10
Interval between saves	Detection history	No limit	
	Photos	Approx. 1s	-
	Videos	-	Approx. 30s (Approx. 5s for scanner heads without camera)
Preservation of detection history		Cleared by power OFF	Not cleared after power OFF
How to check detection history		"Checking the Detection History" (Page 97) "Checking the Detection History (Detection History)" (page 115)	

Reference
- The following items are included in detection history.
  - Objects or people detected in the protection zone
  - Objects or people detected in the warning zone
  - Alert occurrences
- Only photos and videos of people and objects detected in the protection zone are saved in the detection history.
- Select whether to save photos or videos in the settings.

Single Frame/Photo mode

Saves a single frame of the measurement status from the Monitor View, and when using a camera model, a photo at the moment of detection. Latest 30 photos will be saved. Saved photos are deleted after restarting SZ-V.
Saved images can be checked using SZ-V, or saved to PC via SZ-V Configurator.

Reference
- During single frame mode, detection history is cleared by following procedures.
  - Turn OFF the power of SZ-V.
  - Transfer settings from SZ-V Configurator.
  - Initialize SZ-V from the SZ-V Configurator.
  - Clear detection history from SZ-V Configurator.
  - Replace the scanner head.
- When the number of saved history reaches its maximum number, the oldest history is erased to save the latest detection history.

Multi-Frame/Video mode

Saves multiple frames of the measurement status from the Monitor View, and when using a camera model, a video from 2 sevonds before to 2 seconds after the moment of detection. 10 videos will be saved. Saving order can be selected. Saved videos are not deleted after restarting SZ-V.
Saved videos can be checked using SZ-V, or saved to PC via SZ-V Configurator.

Reference
- During multi-frame mode, detection history is cleared by following procedures. Only responsible personnel can clear the detection history in the multi-frame mode.
  - Transfer settings from SZ-V Configurator.
  - Clear detection history from SZ-V Configurator.
  - Replace the scanner head.
- When the number of saved history reaches its maximum number, the oldest history is erased to save the latest detection history. However, if the SZ-V is configured to save first 10 occurrences, then old detection histories will not be erased, and new detection histories will not be saved.
- In multi-frame mode, an interval of approximately 30 seconds (approximately 5 seconds for scanner heads without camera) is required between video savings. During this period, SZ-V shows "History Saving", and continues normal operation, but cannot save new videos.
- In multi-frame mode, it is not possible to save a new video for approximately 5 seconds after start-up. Also, if the power of SZ-V is turned OFF while "History Saving" is displayed, it may not be possible to save a new video for approximately 30 seconds after the next start-up.
- In multi-frame mode, videos can be saved up to 1 million times maximum.

Error history

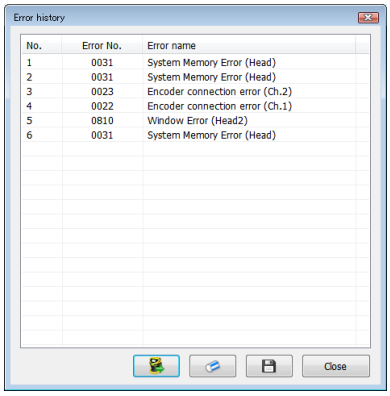
No. of saved items	100
Preservation of error history	Not cleared after power OFF
How to check error history	"Error history" (page98) "Checking the error history (Error History)" (page 117)

Reference
- Error history is not cleared by transferring settings from SZ-V Configurator or restarting the SZ-V.
- To clear error history, push "Clear Error History" button on the Error History window on SZ-V Configurator. Note that clearing error history can only be done by responsible personnel.
- Error history is cleared when SZ-V is initialized.

Checking on the SZ-V Configurator

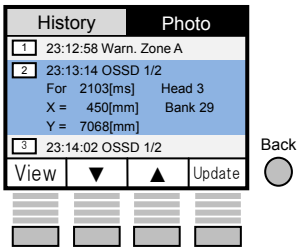
“Checking the Detection History” (page 97)

“Error history” (page 98)

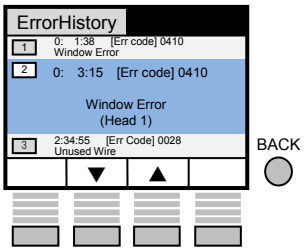


Checking on the SZ-V display

“Checking the Detection History (Detection History)” (page 115)



Checking the error history (Error History)” (page 117)



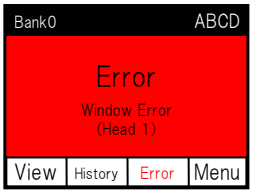
7-3 Checking Error and Alert

It is possible to check if an error or alert has occurred on the SZ-V.

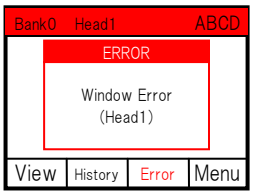
Checking on the SZ-V display

Errors and alerts can be checked in detail on the Display unit display.

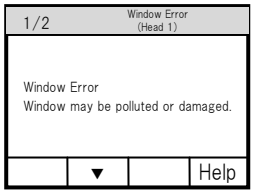
Display state



Monitor view or Camera view



It is also possible to see the detailed explanation about error or alert on the display. This explanation is available in English only.



For details on how to read the display, see “Display When an Error Occurs (Error/Alert)” (page 121).

Check the details on the website (2D code display function)

Details of the error or alert can be checked on KEYENCE website. Troubleshooting can be seen in various languages by scanning the 2D code displayed on SZ-V display using portable devices.

Checking with outputs

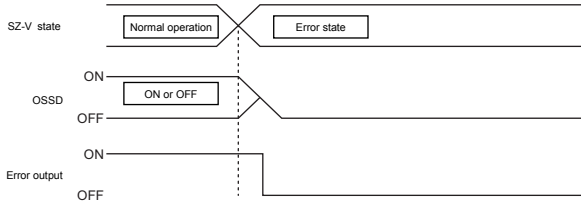
By assigning the following functions to the AUX outputs, errors and alerts can be checked through outputs.

* The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

Error output

The error output goes to the ON-state during normal operation. It goes to the OFF-state in case of an error state.

Timing chart



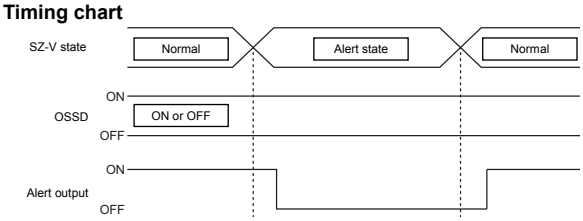
Alert output

The alert output goes to the ON-state during normal operation and when an alert is not occurring. It goes to the OFF-state during an alert. “Alert State” (page 135)

Causes of an alert state

- Light pollution on the window
- Light interference
- Highly-reflective background
- Overcurrent on AUX
- Muting lamp output failure (disconnection or overcurrent)
- Camera malfunctions, memory errors, etc.
- IP address duplication

Timing chart



Point **The alert state does not affect the OSSD state**

Error or alert output

Error or alert output goes to the ON-state during normal operation and when an alert is not occurring. The error and alert output goes to the OFF-state if the SZ-V detects an error or alert.

Encoder error output

The encoder error output goes to the ON-state during normal operation. It goes to the OFF-state if an encoder error occurs.

DANGER **Error, alert, and encoder output cannot be used as safety output for safety-related control systems. Misuse of this function as safety output could result in significant harm to the machine operators, including serious injury or death.**

Reference The following conditions must all be met to be able to use the encoder error output:

- The bank switching function is being used.
- Encoder input switching is being used for the bank switching method. “Bank Switching Function” (page 49)

7-4 Notification of Whether a Person or Object is in the Protection Zone (Detection in the Protection Zone/Warning Zone Output)

Check whether a person or object is in the protection zone or warning zone.

Checking with outputs

By assigning the following outputs to the AUX outputs, it is possible to check whether a person or object is in the protection or warning zone by outputting the state.

When multiple scanner heads are cascaded, output behavior can be selected from the following options.

- Turns the output OFF when at least one of the cascaded scanner heads detects a person or object in the zone.
- Turns the output OFF when specified cascaded scanner head detects a person or object in the zone.

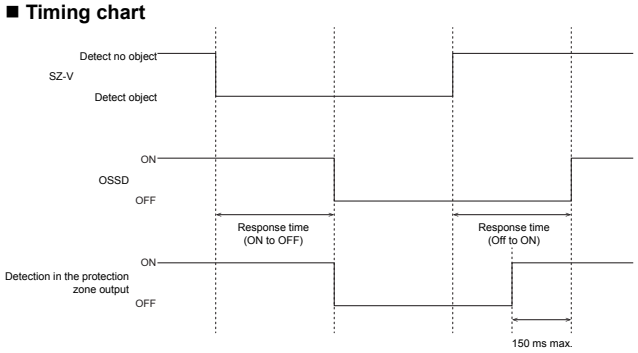
The settings are configured in the SZ-V Configurator. For details on the settings procedure, see “Configuring the settings” (page 74).

Detection in the protection zone output

Check the SZ-V detection state in the protection zone and at the reference points.
The output goes to the ON-state during normal operation, while it goes to the OFF-state in one of the following cases:

- When the SZ-V detects an object (someone or something) in the protection zone.
- When the SZ-V detects nothing at a reference point. “Reference Points Monitoring Function” (page 57)
- When the laser off input goes to the ON-state “Operation Check Function” (page 57)
- When an error is occurring on the SZ-V “Error State” (page 135)

■ Timing chart



Detection in the warning zone output

Check the SZ-V detection state in the warning zone.
The output goes to the ON-state during normal operation, while it goes to the OFF-state in one of the following cases:

- When the SZ-V detects an object (someone or something) in the warning zone.
- When the laser off input goes to the ON-state. “Operation Check Function” (page 57)
- When an error is occurring on the SZ-V “Error State” (page 135)

DANGER	**Detection output in the protection zone and Detection output in the warning zone cannot be used as safety output for safety-related control systems. Misuse of this function as safety output could result in significant harm to the machine operators, including serious injury or death.**

Reference

- When using the state information output, the scanner head that detected an object or a person in a protection or warning zone can be identified. “State information output” (page 60)
- If multiple scanner heads are used, one of the following output operations can be used:
  - If at least one scanner head meets the conditions, the output goes to the OFF-state (default setting)
  - If all scanner heads meet the conditions, the output goes to the OFF-state

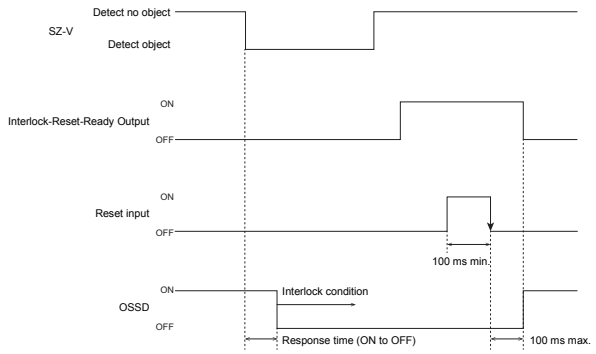
7-5 Notification of Interlock-Reset-Ready (Interlock-Reset-Ready Output)

By assigning interlock-reset-ready output to the AUX output, it is possible to confirm whether the SZ-V is ready for start/restart during an interlock condition.
The interlock-reset-ready output goes to the ON-state if the SZ-V is ready for the start/restart signal during an interlock condition. At this moment, the SZ-V can start/restart the operation through the termination of interlock condition, if the reset operation is performed.

If all of the following conditions are satisfied, the SZ-V is ready to be started/restarted:

- The SZ-V detects no object (someone or something) in the protection zone
- The SZ-V detects something at the reference point(s) (if reference points monitoring is activated) “Reference Points Monitoring Function” (page 57).
- The laser off input is in the OFF-state (if the check function is activated) “Operation Check Function” (page 57).
- The SZ-V is not in an error state “Error State” (page 135).

Timing chart

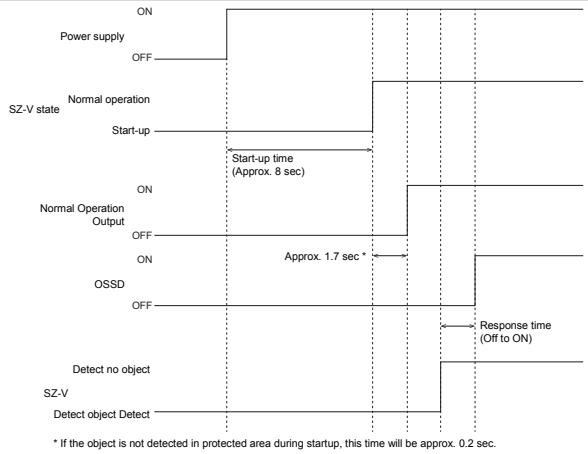


DANGER	**Interlock-reset-ready output cannot be used as safety output for safety-related control systems. Misuse of this function as safety output could result in significant harm to the machine operators, including serious injury or death.**

7-6 Checking the Timing for the Completion of Start-up (Transition to Normal Operation Output)

Confirm that the SZ-V completes start-up and starts normal operation.

Timing chart



* If the object is not detected in protected area during startup, this time will be approx. 0.2 sec.

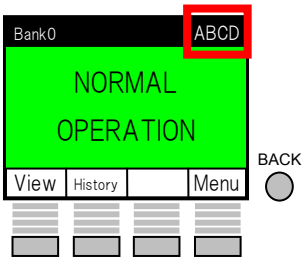
DANGER	**Transition to normal operation output cannot be used as safety output for safety-related control systems. Misuse of this function as safety output could result in significant harm to the machine operators, including serious injury or death.**

7-7 Checking Whether the Intended Settings Have Been Applied (Configuration Code (CRC))

Using a four digit code (Configuration Code (CRC)), it is possible to check whether the intended settings have been applied.
If the SZ-V settings change, the CRC changes. Therefore, by checking the displayed CRC, the intended settings can be confirmed.

Checking on the SZ-V display

During normal operation, the number is displayed in the top right of the Display unit display.



Checking on the SZ-V Configurator

The number is displayed on the Settings tab under "Information at the time of configuration."

* For details on the settings procedure, see “Configuring the settings” (page 74).

Reference

- Each time the SZ-V starts, it self-diagnoses to determine whether the settings, such as the number of scanner heads, match the configuration. If the SZ-V determines that the configuration is different from the settings, an error results.
- If the SZ-V is not configured or awaiting approval of the settings, the CRC is not displayed.

8. How to Use the SZ-V Configurator

8-1 Before using the SZ-V Configurator

System Environment

CPU	Pentium 4, 1.5GHz or higher
OS	Windows XP SP3 *1 Windows 7 SP1 Windows 8 Windows 8.1 Windows 10
Required memory size	512 MB or more
Free space on hard disk	500 MB or more
Communication interface	USB 1.1 or higher
Display	XGA (1024 x 768 pixels) or greater, High Color (16 bit) or greater
.NET Framework	.NET Framework 4.0 or 4.5 needs to be installed *2

*1 Only 32-bit systems are supported.

*2 If .NET Framework is not installed, .NET Framewrok 4.0 will be automatically installed during the installation.

Reference Recommended Windows DPI setting is “Smaller (100%)”.

Installing Safety Device Configurator

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

Point **When installing or uninstalling the software, log onto the PC as a user with Administrator privileges.**

Before installation

Check the following items before installation.

- Free space on hard disk
  The configuration software can only be installed on a hard disk. The installation requires 500 MB of free space on the hard disk. If there is insufficient free space, delete unnecessary items to free up space.
- Windows environment and installation destination
  The configuration software is a Windows application and the software is installed on Windows. Check that one of Windows XP/7/8/8.1/10 is installed on the computer and is working properly.
- USB port or Ethernet adapter
  To transmit data, such as settings data, from the PC to the SZ-V series or use the monitoring function, the PC needs to have a USB port or be able to use an Ethernet adapter. For more information about the setting method, see the PC manual.
- Help file
  The Help file for the configuration software was created in a PDF file format. The viewing software Adobe Reader from Adobe Systems Incorporated must be installed onto your computer to use the help file. The latest version can be downloaded for free from the Adobe Systems Incorporated Web site: http://www.adobe.com

Downloading the configuration software

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

Installation Procedure

Execute "setup.exe" stored in the downloaded file.
After that, start installation according to the instruction in the installation program. When installation ends successfully, the following five software applications are installed:

- Integrated software <Safety Device Configurator>.
- SZ-V configuration software <SZ-V Configurator>.
- SZ configuration software <SZ Configurator>.
- GL-R configuration software <GL-R Configurator>.
- SL-V configuration software <SL-V Configurator>.

Uninstallation Procedure

Uninstall any software by using [Add/Remove Programs] from the Windows Control Panel.

Precautions for Windows 7/8/8.1/10

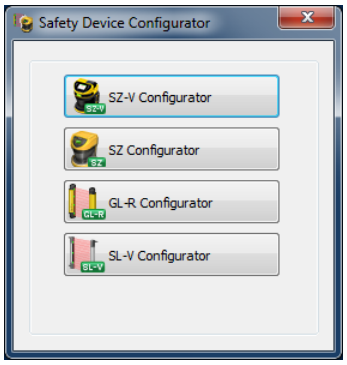
If the "User Account Control" window appears during installation or uninstallation, click [Continue].

Starting the SZ-V Configurator

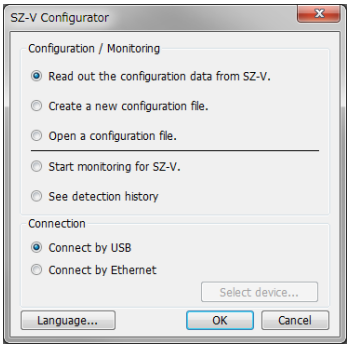
Start the SZ-V Configurator using the following method.

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

The Configurator selection screen appears. Select [SZ-V Configurator]. If the powered-on SZ-V is connected via USB, this item is skipped.



Step 2
The SZ-V Configurator starts up and the main screen and dialog box are displayed.



Step 3
Select the startup method and connection method, then click the [OK] button.

Selecting the Start-up Method

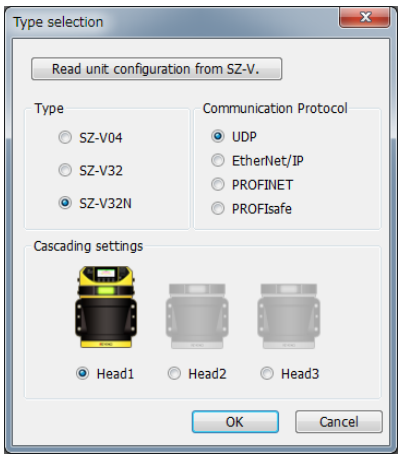
Select your desired method from the following five methods.

a) Retrieve the configuration data from the SZ-V

Before start-up, retrieve the configuration data saved on the SZ-V unit.

b) Create a new configuration file

Create a new configuration file.
The [Model selection] dialog box appears. Select the model and scanner head expansion settings, and click the [OK] button. The SZ-V Configurator starts with the default settings.



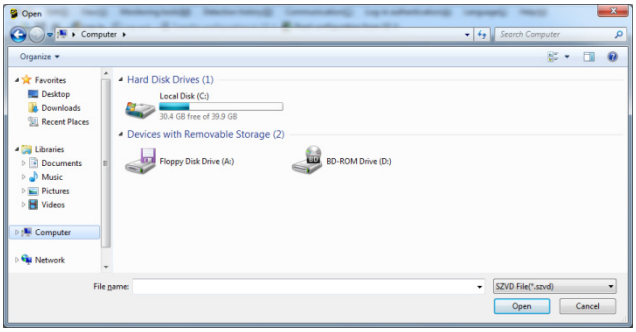
Item	Description
Model	Select the model.
Cascading settings	Select how many scanner heads to be added.
Communication Protocol (For the SZ-V32N type only)	Select a communications protocol.

For the SZ-V32N type, it is possible to configure which SZ-V unit you want to communicate with.
By clicking the [OK] button, a dialog box appears confirming if you want to select a destination connection. If you want to select that destination connection, click the [Yes] button. The destination connection selection dialog box appears.
“Connecting to different SZ-V” (page 107)

c) Open a configuration file

Open a configuration file currently saved to a computer.

The [Open] dialog box appears.
Select the appropriate SZ-V Configurator file (*.szvd) and click the [Open] button to open the configuration file.



d) Start monitoring for SZ-V

Communicate with the SZ-V unit and start monitoring operations. The SZ-V Configurator retrieves the configuration data from the SZ-V unit, and displays the data on the monitor screen. “Monitoring Operations” (page 92)

e) View the detection history

When retrieving the detection history from the SZ-V, or opening the detection history file, the detection history screen appears. “Checking the Detection History” (page 97)

Reference

- When selecting one of the following items, check that the computer and the SZ-V Series unit are correctly connected first.
  a) Retrieve the configuration data from the SZ-V
  d) Start monitoring for SZ-V
  e) Select "View the detection history" and retrieve the detection history from the SZ-V.
- Also check that power is being supplied to the SZ-V.

Selecting a connection method

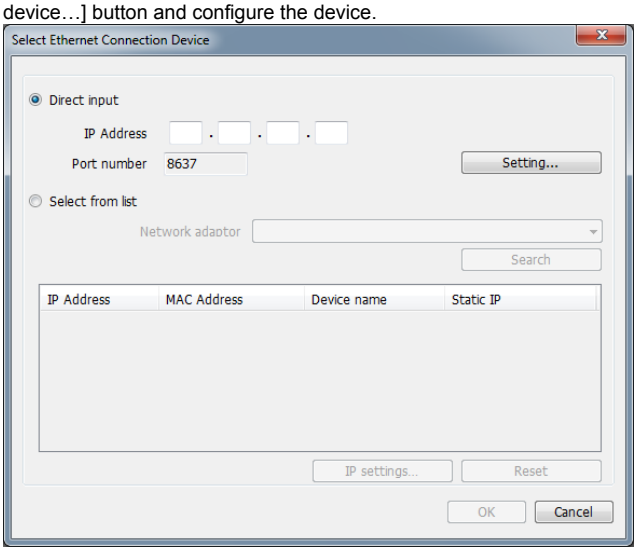
Select the desired method of connection from the following methods.

Item	Description
USB (default)	Read and write configuration information with a USB cable.
Ethernet	Read and write configuration information with an Ethernet cable. (For the SZ-V32N type only)

For details on the connection method, see “Connecting the SZ-V to a computer” (page 69).

Selecting an Ethernet connection device (for the SZ-V32N type only)

If Ethernet is selected for the connection method, it is necessary to specify which SZ-V to connect to over the network. Press the [Select device…] button and configure the device.

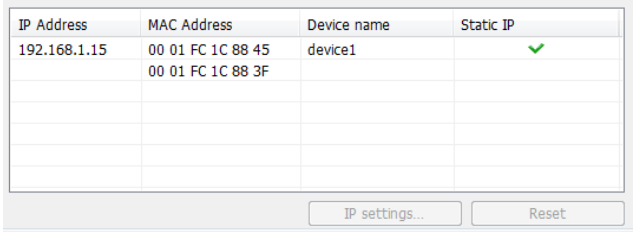


Direct Input
By directly inputting the IP address and TCP port number, it is possible to set which SZ-V to communicate with.

Select from list
Searches for any SZ-V units on the network and displays the results. Select which SZ-V to communicate with from the displayed list.

Step 1
Select the network adapter and press the [Search] button.

Step 2
From the displayed SZ-V units, select which SZ-V to communicate with and press the [OK] button.



Reference

- If the IP address of the displayed SZ-V unit has not been configured, start communicating with that SZ-V by assigning it a temporary IP address.
- To assign a temporary IP address, click the [IP settings] button and set an IP address, subnet mask, and default gateway.
- A temporary IP address cannot be assigned to an SZ-V unit that has a configured IP address.
- By pressing the [Reset] button, the IP address can be restored to a not configured state. It is not possible to restore the IP address of a SZ-V configured with a Static IP.

Exiting SZ-V Configurator

When exiting the SZ-V Configurator, select [Exit] from the [File] menu. When changing the settings, the confirmation dialog box appears.

Reference

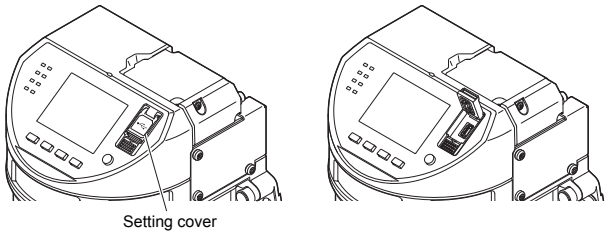
- When changing the settings, the configuration file must be saved before exiting the SZ-V Configurator. If the SZ-V Configurator is exited without saving, the changes are lost.
- On the confirmation dialog box, clicking the [No] button exits the program without saving.

Connecting the SZ-V to a computer

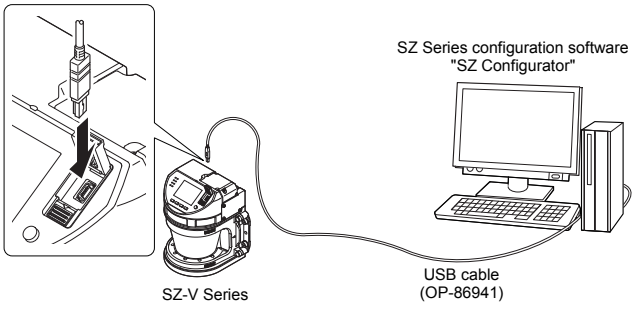
To connect the SZ-V to a computer, use a USB cable or an Ethernet cable.
Only the SZ-V32N type can be connected with an Ethernet cable.

Connecting with a USB cable

1. Open the setting cover on the Display unit.



2. Use a USB cable (OP-51580 or OP-86941) to connect the Display unit to the computer.

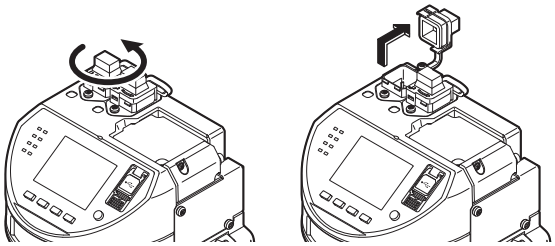


NOTICE

- **If the setting cover is open, the enclosure rating IP65 cannot be satisfied. Make sure that dust does not enter the inside.**
- **Communication is not possible when an SZ-V with positive grounding is connected to a PC with negative grounding through a USB cable.**

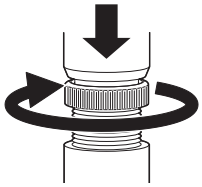
Connecting with an Ethernet cable (for the SZ-V32N type only)

1. Open the Ethernet cable cover on the Display unit.



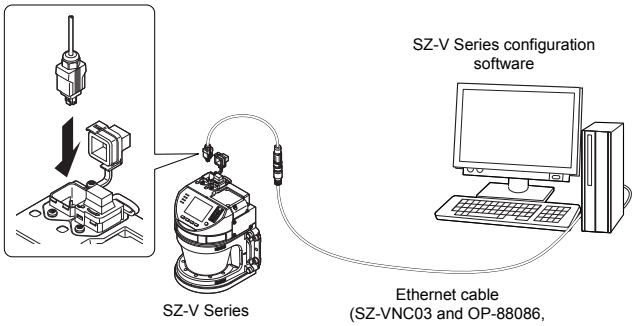
2. Connect Ethernet main unit connection cable (SZ-VNC03) with Ethernet extension cable (such as OP-88086).
   a) Joint the three recesses on the Ethernet main unit connection cable connector and three bosses on the Ethernet extension cable connector to connect the cables.

   b) Turn the screw of the connector clockwise. When connecting the cable, insert it vertically and tighten the screw while pushing it.



OP-88086/88087/88088/88089/88090/88091/88092
Recommended tightening torque: 0.8 to 1.0N· m
Tightening amount: 5 to 10°

3. Connect Ethernet main unit connection cable to display unit, to connect SZ-V to the computer.

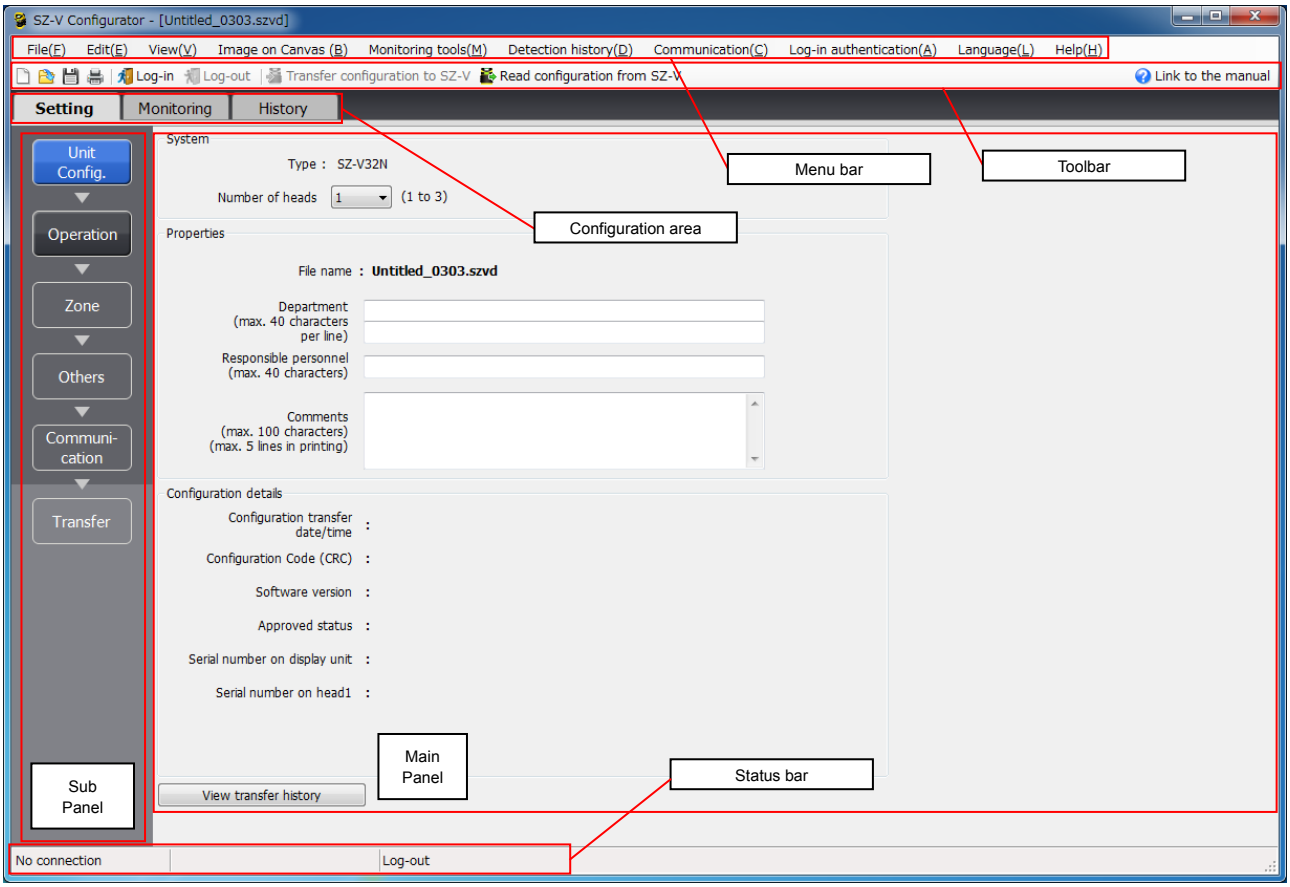


NOTICE

- **When connecting to a network, please consult with someone who has knowledge of the network.**
- **Utilize networking in an environment where the security against threats is high.**

8-2 Area and Function Names on the Screen

This section describes the names and functions of each part on the SZ-V Configurator screen.



Menu bar

Displays the menus which execute each function.
For more information about the menus, see “Operation Menu” (page 101).

Toolbar

Buttons for frequently used functions are located here.

Item	Description
	Creates a new configuration file.
	Opens a saved configuration file (*.szvd).
	Saves the configuration file being edited over the previous version of the file.
	Prints the information in the configuration file being edited.
	Enter a password to log in to the SZ-V Unit.
	Logs out of the SZ-V Unit.
	Transfers the configuration file to the SZ-V.
	Reads configuration data from the SZ-V.
	Displays the PDF file of the SZ-V Series User's Manual.

Configuration area

It is possible to switch to the Setting tab, Monitoring tab, and History tab using these tabs.

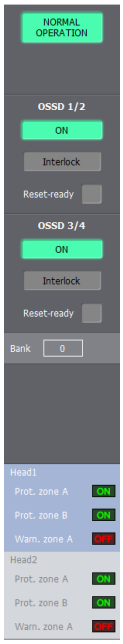
Item	Description
Setting	Sets each function. “Configuring the settings” (page 74) Select the configuration item in the subpanel and set the corresponding items in the main panel. • Unit Config.: Set configuration and management information. • Operation: Set the functions to be used. • Zone: Set the zones for detection. • Others: Sets AUX outputs and misc. • Communication: Setup communication. • Transfer: Write the settings to the SZ-V.
Monitoring	Start monitoring the SZ-V. “Monitoring Operations” (page 92)
History	Check the SZ-V detection history. “Checking the Detection History” (page 97)

Subpanel

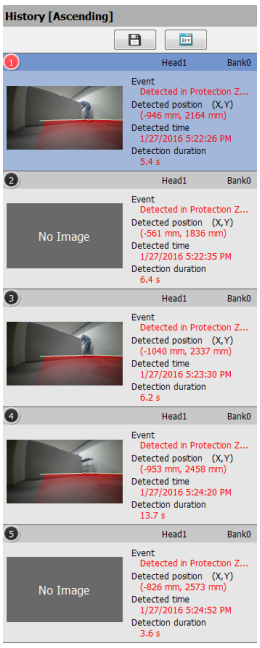
Display the navigation and SZ-V status.
The content displayed on the Setting tab, Monitoring tab, and History tab differs.

Setting tab

Monitoring tab



History tab

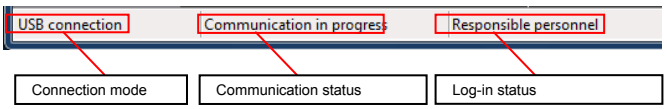


Main panel

Displays setting items and monitoring information.
The content displayed on the Setting tab, Monitoring tab, and History tab differs.

Status bar

Displays the connection mode, communication status, and log-in information.



1. Connection mode
   Displays how the SZ-V is connected to the computer.
   If a connection is not established with the SZ-V Configurator, it is shown as “No connection”.
   - USB connection, Ethernet connection, No connection

2. Communication status
   Displays the communication status between the SZ-V and computer.
   - Communicating, blank

3. Log-in status
   Displays what authorization levels are the user is currently logged in with.
   - Responsible Personnel, Maintenance Personnel, Log-out

8-3 Authorization Level and Settings

Three types of authorization levels are available in the SZ-V Configurator. User capabilities differ depending on the authorization level setting.

Authorization level names	Overview	Initial password
Responsible personnel	Can perform all operations	1111
Maintenance personnel	In addition to machine operator authorization level, the following operations are possible: • Transfer the settings approved by the responsible personnel • Window calibration • Clear system configuration information	None
Machine operator (User yet to log in)	Only the following operations are possible • Retrieve settings • Monitor operations • Check detection history	Cannot set

By default, valid authorization level setting is either responsible personnel or machine operator only. Maintenance personnel authorization level is disabled by default. Only the responsible personnel can change the validity of maintenance personnel authorization level, or change the password of maintenance personnel.

Important **The configuration for safety-related functions and the others cannot be performed without the password. You must strictly keep the password.**

Reference
- Maintenance personnel can transfer only settings that have been approved by the responsible personnel.
- If the maintenance personnel modifies settings, those settings cannot be transferred, even if the settings have been previously approved by the responsible personnel.
- If the responsible personnel saves the approved setting into a file, maintenance personnel can open the saved file and transfer the setting. However if maintenance personnel modifies the settings, the setting cannot be transferred.

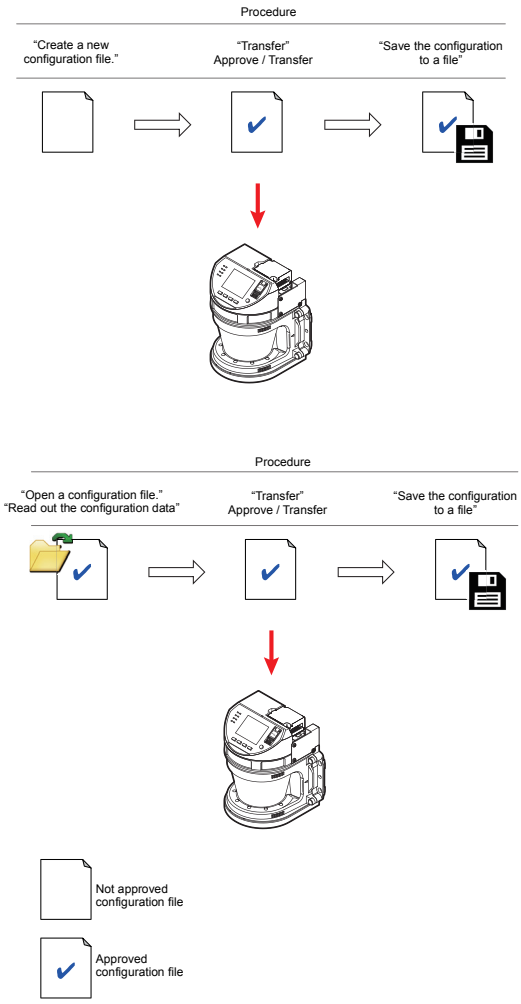
Possible operations according to authorization level

Operation	Responsible personnel	Maintenance personnel	Machine operator
Read configuration from SZ-V	○	○	○
Monitor SZ-V operation	○	○	○
See detection history	○	○	○
Transfer a setting approved by the responsible personnel	○	○	
Window calibration	○	○	
Clear system configuration information	○	○	
Approve the setting	○		
Transfer a newly created setting to SZ-V	○		
Initialization	○		

8-4 Overview of How to Configure Settings

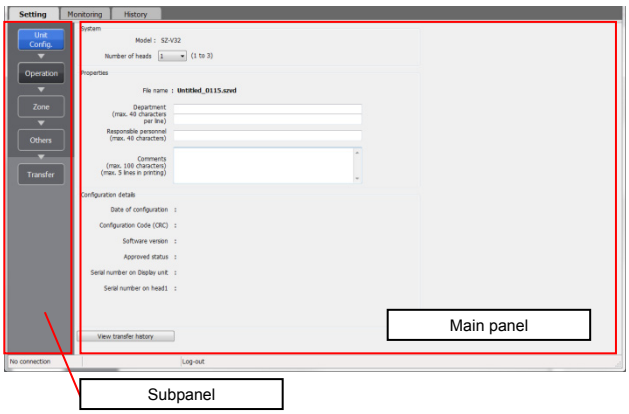
The SZ-V settings can be transferred with the following procedure:

1. Edit the settings in the SZ-V Configurator.
2. Select “transfer” to send the settings to the SZ-V.
3. Check that the transferred settings are as intended and approve them.
4. The SZ-V starts operating with the new settings.



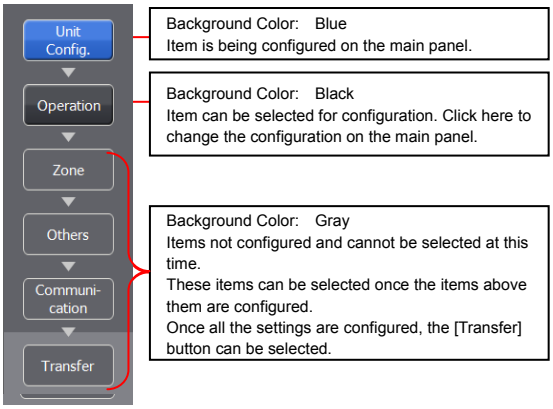
NOTICE	**The following settings are not transferred.** • **“View” (page 102)** • **“Image on Canvas” (page 103)** • **“Language” (page 108)**

How to read the Configuration tab



Subpanel

Items can be selected by clicking the item name. The background color of the subpanel indicates the selection status.
Configure the settings in order from top to bottom.



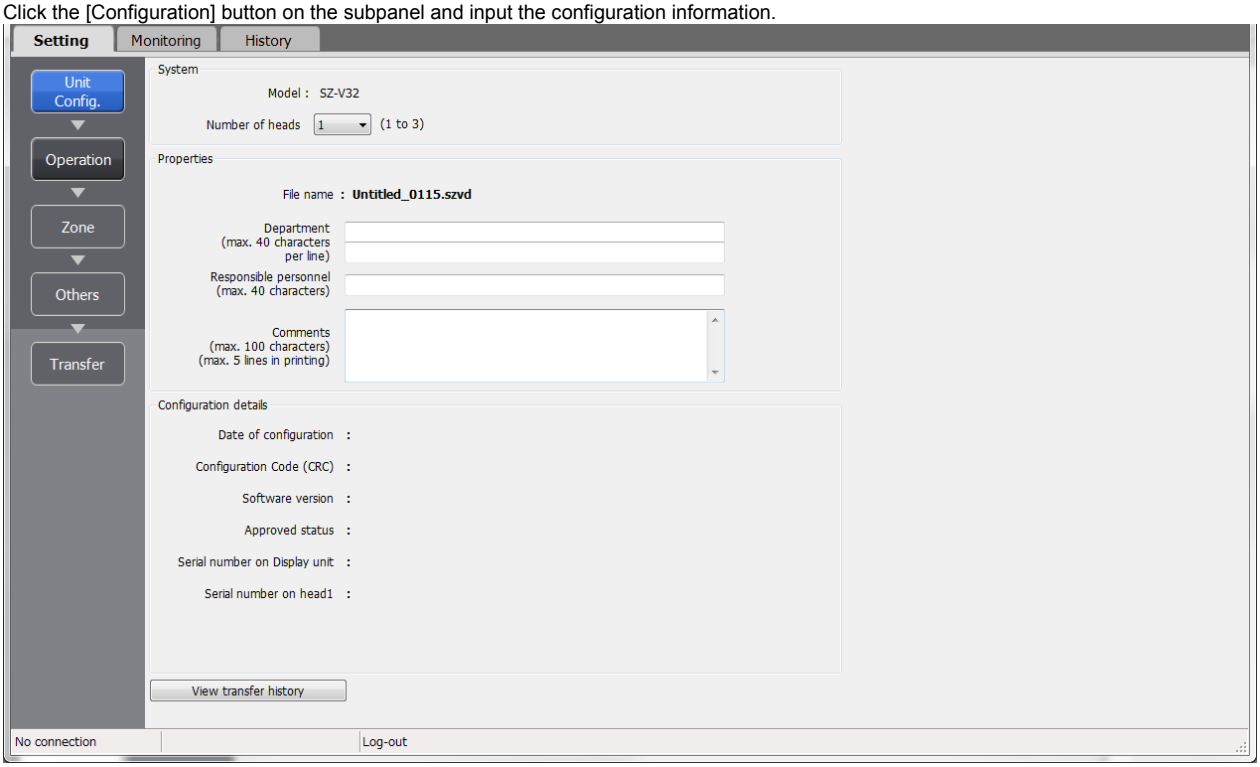
Main panel

Displays detailed setting items.
For details, see “Setting Procedure” (page 73).

8-5 Setting Procedure

1. Determine the configuration

Click the [Configuration] button on the subpanel and input the configuration information.



Item		Description
System	Model	Displays the set SZ-V model.
	Number of heads	Select the number of scanner heads the SZ-V connects to.
Properties	File name	Displays the configuration file's name. "untitled_MMDD.szvd" is displayed as the name for new, unsaved files. MMDD represents the date information. Example: January 1st 2016: untitled_0101.szvd
	Department	Enter title or department information. Up to 80 characters can be entered (40 characters per line).
	Responsible personnel	Enter the name of the person in charge of configuration. Up to 40 characters can be entered.
	Comments	Enter any comments here. Up to 100 characters*1 can be entered.
Configuration Details *3	Date of configuration	This shows the date and time that the configuration was transferred from the SZ-V Configurator to the SZ-V*2.
	Configuration Code (CRC)	Displays a four digit code to identify the settings information*2.
	Software version	This shows the version information for the SZ-V Configurator software that was used to create the settings file*2.
	Approved status *2	Displays whether these settings have been approved by the responsible personnel. Both the responsible personnel and maintenance personnel can transfer approved settings to the SZ-V.
	Serial number on Display unit	Displays the serial numbers of the Display unit and scanner heads*2.
	Serial number on head 1	
	Serial number on head 2	
	Serial number on head 3	
	[View transfer history] button	The history of the past 20 transfers can be viewed. The transfer history includes the following information: ・ Date and time of transfer ・ File name ・ Configuration Code (CRC) ・ The serial number of the Display unit that transferred the file The log in authorization levels of the person who transferred the file

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

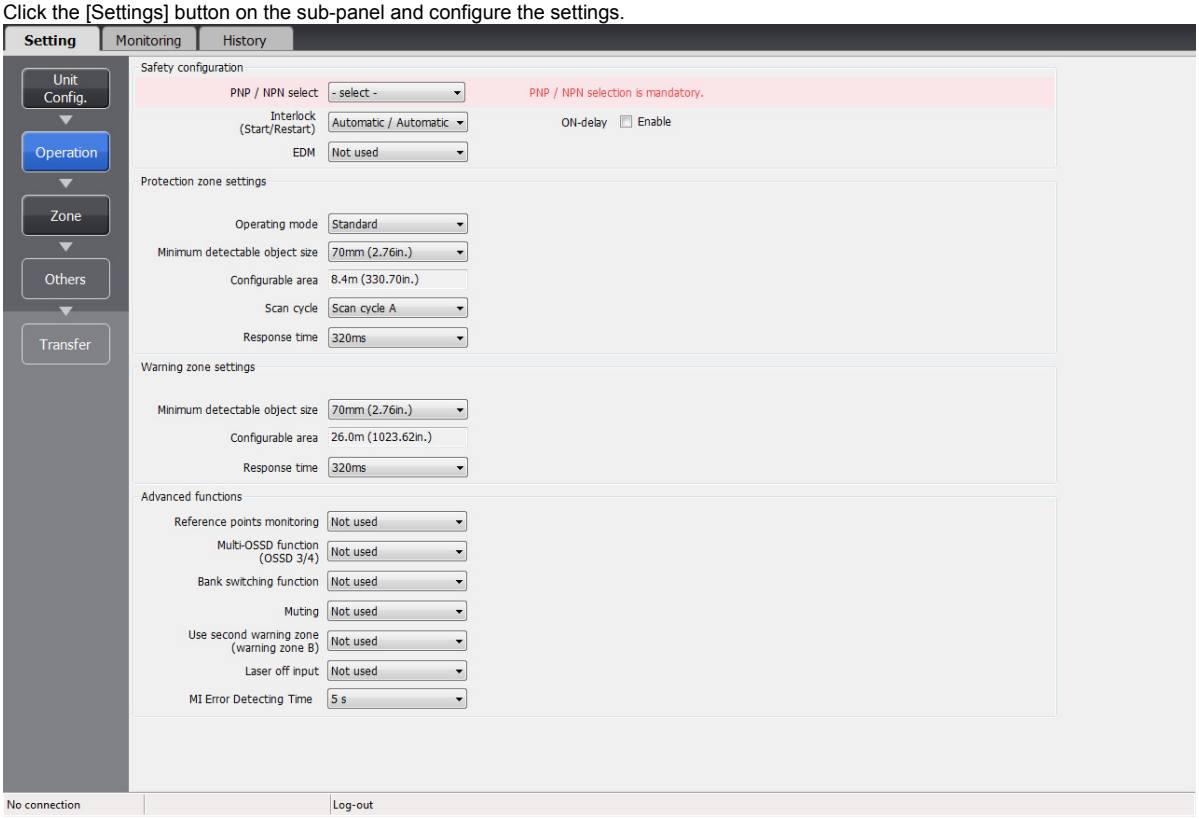
*2 In the following cases, these items will be left blank.

- The settings file is newly created and has never been transferred to the SZ-V.
- The content of the settings file retrieved from the SZ-V was modified.

*3 Displayed only after settings are retrieved from SZ-V.

2. Configuring the settings

Click the [Settings] button on the sub-panel and configure the settings.



Basic settings related to safety

Item	Description	Related items
PNP/NPN select	Select whether to set the SZ-V input and output logic to PNP or NPN. ・ Not configured (default) ・ PNP ・ NPN	“Select PNP or NPN” (page 46)
Interlock (Start/Restart)	Set the desired reset behavior when starting and restarting. ・ Automatic / Automatic (default) ・ Manual / Automatic ・ Manual / Manual	“Interlock function” (Page 47)
ON-delay	Set the delay when starting and restarting. Place a check mark ☑ in the [Enable] check box to turn on the delay timer. Setting range: 2 to 60 (seconds) Default: 2	
EDM	Set the status of the external device monitoring function. ・ Not used (default) ・ Apply	“EDM Function” (Page 48)
EDM time	If the EDM function is used, set the tolerance time needed for the external device to respond within. ・ 0.15 s ・ 0.3 s (default) ・ 0.6 s ・ 3 s	

Protection zone settings

Item	Description	Related items
Operation mode	Set the operation mode. ・ High speed mode ・ Standard mode (default)	“Operation modes” (page 44)
Minimum detectable object size	Configure the minimum detectable object size.	“Minimum detectable object” (page 45)
Configurable area	This shows the maximum protection distance. This cannot be changed. The maximum configurable distance varies depending on the operation mode and minimum detectable object size setting.	
Scan cycle	Configure the scan cycle.	“Response Time and Scan Cycle” (page 45)
Response time	Set the SZ-V response time for the protection zone.	

Minimum detectable object size (mm)	Standard Mode	High Speed Mode
φ20 mm	1.6 m	1.1 m
φ30 mm	2.9 m	2.0 m
φ40 mm	4.3 m	2.9 m
φ50 mm	5.6 m	3.8 m
φ70 mm	8.4 m	5.7 m
φ150 mm	8.4 m	5.7 m

▶ Important **Make sure to select the PNP/NPN Select. If the PNP/NPN Select is not selected, the settings cannot be transferred to the SZ-V. This is not necessary when PROFIsafe communication is used with the SZ-V32N.**

Warning zone settings

Item	Description	Related items
Minimum detectable object size	Configure the minimum detectable object size.	"Minimum detectable object" (page 45)
Configurable area	This shows the maximum warning distance. This cannot be set. The maximum configurable distance varies depending on the operation mode and minimum detectable object size settings. Minimum detectable object size (mm) / Standard Mode / High Speed Mode φ20 mm / 21 m / 15 m φ30 mm / 23 m / 18 m φ40 mm / 24 m / 20 m φ50 mm / 25 m / 21 m φ70 mm / 26 m / 23 m φ150 mm / 26 m / 23 m	
Response time	Set the SZ-V response time for the warning zone. As the scan cycle is the same as the scan cycle for the protection zone, it cannot be set here.	"Response Time and Scan Cycle" (page 45)

Advanced Settings

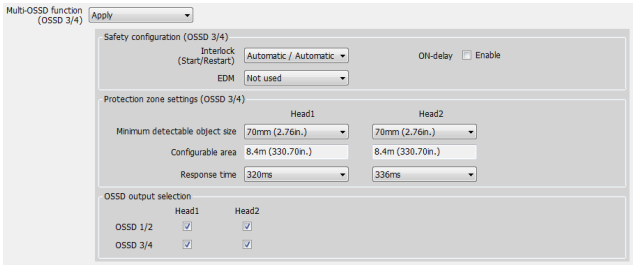
Item	Description
Reference points monitoring	Set the reference points monitoring function. ・ Not used (default) ・ Apply "Reference Points Monitoring Function" (Page 57)
Multi-OSSD function (OSSD3/4)	Set the multi-OSSD function. ・ Not used (default) ・ Apply "Multi-OSSD Function" (Page 54)
Bank switching function (Bank function when using PROFIsafe)	Set the bank switching function. ・ Not used (default) ・ Apply "Bank Switching Function" (Page 49)
Muting	Set the muting function. ・ Not used (default) ・ Apply "Muting function" (Page 55)
Use second warning zone (warning zone B)	Set whether to use two warning zones per bank. ・ Not used (default) ・ Apply "Warning zone" (Page 17)
Laser off input	Set the laser off input. When using the laser off input, use an external input to set the SZ-V to laser shutdown. ・ Not used (default) ・ Apply "Operation Check Function" (Page 57)
MI error detection time	Set the time until an MI error occurs. ・ 5 s (default) ・ 2 h

Reference
- The multi-OSSD function can only be set on the SZ-V04.
- The muting function can only be set on the SZ-V04 and SZ-V32N.

■ Reference point monitoring

There are no detailed setting items.

■ Multi-OSSD function



Safety Configuration (OSSD 3/4)

Item	Description	Related items
Interlock (Start/Restart)	Configure the reset behavior when starting and restarting. ・ Automatic / Automatic (default) ・ Manual / Automatic ・ Manual / Manual	"Interlock function" (Page 47)
ON-delay	Set the delay when starting and restarting. Place a check mark ☑ in the [Enable] check box to set the delay time. Setting range: 2 to 60 (seconds) Default: 2	
EDM	Utilize the external device monitoring function. ・ Not used (default) ・ Apply	"EDM Function" (Page 48)

Protection zone settings (OSSD3/4)

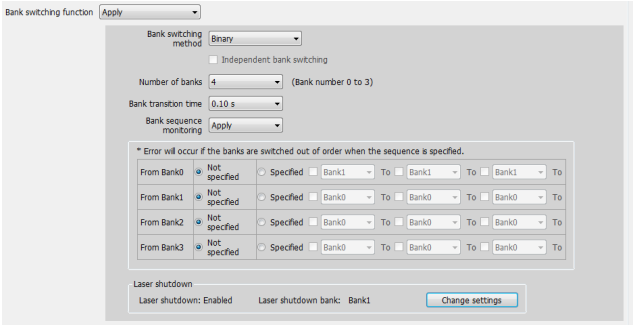
Item	Description	Related items
Minimum detectable object size	Configure the minimum detectable object size.	"Minimum detectable object" (page 45)
Configurable area	This shows the maximum protection distance. This cannot be set. The maximum configurable distance varies depending on the operation mode and minimum detectable object size setting. Minimum detectable object size (mm) / Standard Mode / High-speed Mode φ20 mm / 1.6 m / 1.1 m φ30 mm / 2.9 m / 2.0 m φ40 mm / 4.3 m / 2.9 m φ50 mm / 5.6 m / 3.8 m φ70 mm / 8.4 m / 5.7 m φ150 mm / 8.4 m / 5.7 m	
Response time	Set the SZ-V response time for the protection zone.	"Response Time and Scan Cycle" (page 45)

OSSD output selection

Item	Description
OSSD 1/2	Set which scanner heads have protection zones that relate to OSSD 1/2. If you check ☑ the check box for each scanner head, you can control if the protection zone relates to OSSD 1/2. Default: ON
OSSD 3/4	Set which scanner heads have protection zones that relate to OSSD 3/4. If you check ☑ the check box for each scanner head, you can control if the protection zone relates to OSSD 3/4. Default: ON

Reference
- OSSD output selection can be set only when two or more scanner heads are selected in the configuration.
- The OSSD output selection can be set to OFF for both OSSD 1/2 and OSSD 3/4 for a scanner head.
- In the OSSD output selection, users cannot set OSSD 1/2 or OSSD 3/4 to OFF for all scanner heads.

■ Bank switching function

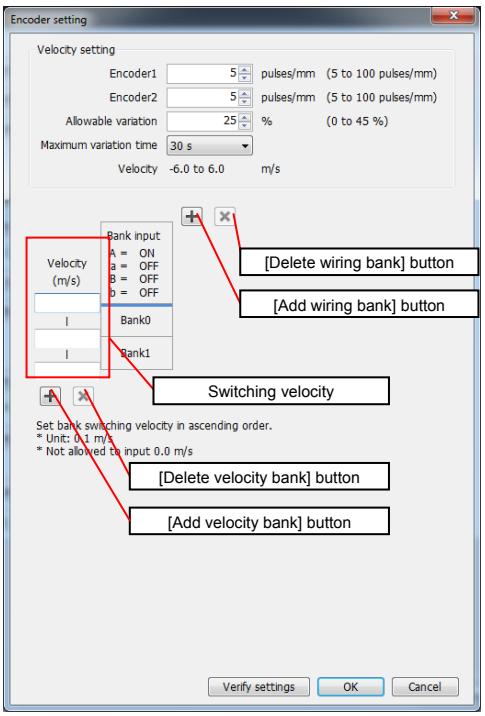


Item	Description
Bank switching method	Select the bank input method. • Binary input (default) • Single input • Encoder input
Independent bank switching	Enable the independent bank switching function. Place a check mark ☑ in the check box to enable the independent bank switching function. Default: OFF To enable independent bank switching, following settings must be set. Interlock: Auto/Auto Multi-OSSD function: Apply Bank switching method: Single Use second warning zone: Apply Laser off input: Not used
Number of banks	Set the number of banks to be used. The setting range differs depending on the Display unit, bank input method, and if the independent bank switching function is used. “Bank Switching Function” (page 49) Default: 2
Bank transition time	If bank switching is not completed within the specified transition time, a bank input error will occur. Setting range: 0.02/0.05/0.1/0.25/0.5/1/2.5/5 (seconds) Default: 0.1 (seconds)
Bank sequence monitoring	Configurable when using three or more banks. Bank sequence monitoring is enabled by choosing “Apply”. Default: Not used The bank sequence is set separately for each bank. Not specified: This permits switching to any bank (default). Specified: Monitor the bank switching sequence. This permits switching only to the banks specified (maximum 3). If switched to an unspecified bank, a bank sequence error will occur. Setting range: Bank 0 to Number of banks Default: Bank 0 (”1” for “From Bank 0”)
Laser shutdown	The operation check function will operate when the bank specified in the assigned bank number is activated. To enable the operation check function, press the [Change settings] button, place a check mark ☑ in the [Enable] check box, and then select [Laser shutdown bank]. Default: Disabled
Laser shutdown bank	When the operation check function is enabled, switching to the specified bank number will cause the operation check function to activate.

Reference
- Encoder inputs can be selected for the bank switching method for only the SZ-V32 type and SZ-V32N type.
- The independent bank switching function is only available on the SZ-V04 type.
- The same bank number cannot be set for the bank to be switched to in the bank sequence monitor function.
  Example: "3" cannot be set when you set "To bank" for "From bank3".

Encoder settings

When the bank input method is set to encoder input, the [Encoder settings] button is displayed. Click the [Encoder settings] button and configure the encoder-related settings.



Velocity settings

Item	Description
Encoder 1	Specify the number of pulses per 1mm of AGV travel for Encoder 1. Setting range: 5 to 100 (pulses/mm) Default: 5
Encoder 2	Specify the number of pulses per 1mm of AGV travel for Encoder 2. Setting range: 5 to 100 (pulses/mm) Default: 5
Allowable variation	Set the maximum value that is allowed as an error for Encoder 1 and Encoder 2. If an error that exceeds the maximum value continues for longer than the time set in "Maximum variation time" the SZ-V goes to an error state. Setting range: 0 to 45% Default: 25%
Maximum variation time	Specify the time until an allowable error is detected. 10 s, 30 s (default), and 1 min
Switching velocity	Specify the velocity at which the velocity banks switch. The velocity must be set in ascending order. Unit of input: 0.1 (m/s) Invalid input: 0.0 (m/s) The minimum and maximum switching velocities are determined by the formula below. Max velocity (m/s) = 100 (kHz) / No. of pulses per 1mm of AGV travel (pulse/mm) for the encoder
[Add velocity bank] button	The threshold of the velocity at which velocity banks switch can be increased. Up to eight velocity banks can be set.
[Delete velocity bank] button	Delete the velocity bank added last.
[Add wiring bank] button	Add wiring banks depending on the combination of bank input wires. Up to four banks can be set.
[Delete wiring bank] button	Delete the wiring bank added last.

Reference
If the minimum value of switching velocity is 0.1 [m/s] or higher, SZ-V goes to “Bank Velocity Error” when encoder is stopped. To prevent SZ-V from going to error state while encoder is stopped, please set the minimum value of switching velocity to -0.1 [m/s] or smaller.

■ Muting

・ Muting configuration

Item	Description
Time period between muting inputs	Set the time period between muting inputs that is recognized for the start of muting. Muting is initiated if the SZ-V detects the muting inputs (muting input 1 and 2) within the specified time period according to the "Sequence of muting inputs". ・ 0.04s to 3s (default) ・ 0.04s to 5s ・ 0.04s to 10s ・ Not specified
Sequence of muting inputs	Set the sequence of muting input that is needed to initiate the muting condition. ・ 1 → 2 fixed (default) ・ 2 → 1 fixed ・ Not specified
Maximum muting period of time	Specify how long muting will last. ・ 1 min ・ 5 min (default) ・ 10 min ・ Not specified
Muting lamp error	Set how the OSSD performs in the case of muting lamp failure. ・ ERROR ・ Alert (default)

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. Moreover, based on this result, enact additional safeguards if necessary.**

Important

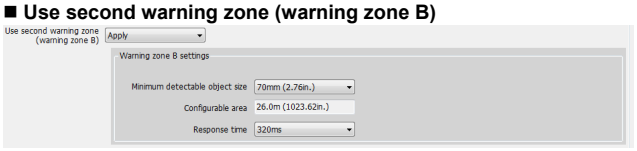
Consider the potential danger due to the muting sensor unexpectedly failing. Also, note the following when “Not specified” is selected for both the maximum muting period and time between muting inputs.

- **If the time between muting inputs exceeds 3 seconds, the muting state will be terminated approximately 5 minutes later. (If the time between muting inputs is within 3 seconds, the muting state continues and is unlimited as per the settings.)**

・ Override configuration

Item	Description
Maximum override period of time	This specifies how long the override will last. ・ 1 min (default) ・ 5 min ・ 10 min

■ Use second warning zone (warning zone B)



Item	Description	Related items
Minimum detectable object size	Configure the minimum detectable object size.	“Minimum detectable object” (page 45)
Configurable area	This shows the maximum warning distance. This cannot be set. The maximum configurable distance varies depending on the operation mode and minimum detectable object size setting.	
Response time	Set the response time. As the scan cycle is the same as the scan cycle for the protection zone, it cannot be set here.	“Response Time and Scan Cycle” (page 45)

Minimum detectable object size (mm)	Standard Mode	High-speed Mode
φ20 mm	21 m	15 m
φ30 mm	23 m	18 m
φ40 mm	24 m	20 m
φ50 mm	25 m	21 m
φ70 mm	26 m	23 m
φ150 mm	26 m	23 m

■ Laser off input

There are no detailed setting items.

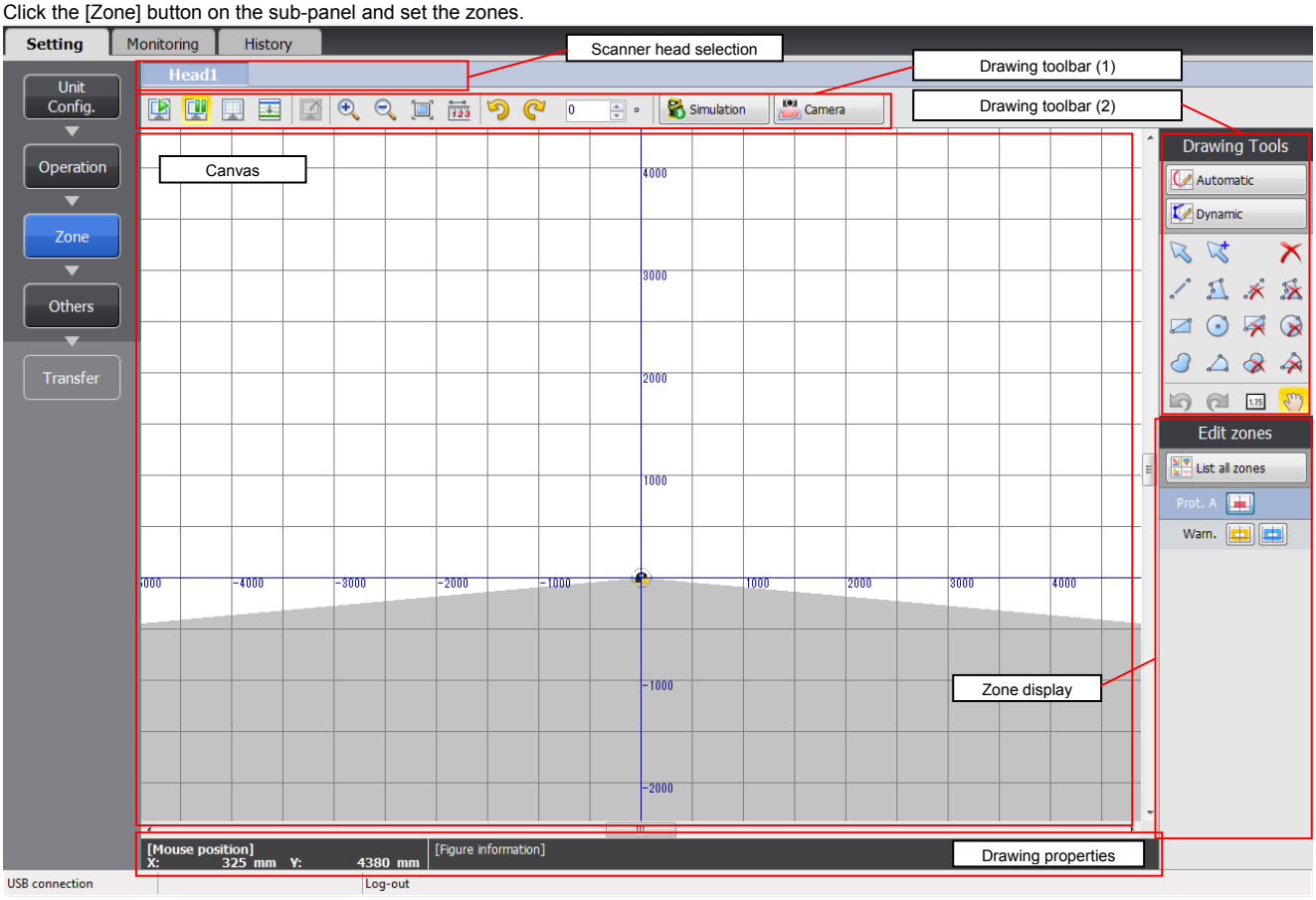
■ MI error detection time

Item	Description
MI error detection time	This specifies MI error detection time. ・ 5s (Default) ・ 2h

For detail, refer to “MI Error” (page 19).

3. Set the zone

Click the [Zone] button on the sub-panel and set the zones.



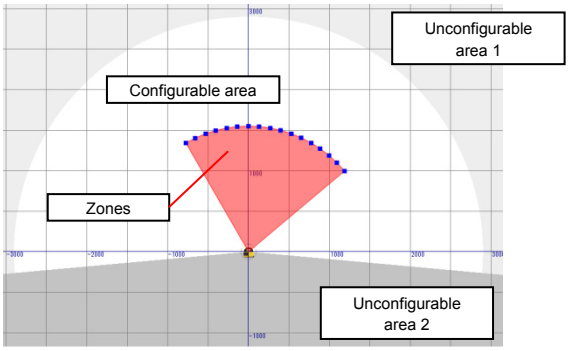
Item	Description
Scanner head selection panel	Displays the selected scanner head.
Canvas	Set the zone that the selected SZ-V scanner head detects. “Canvas” (page 79) The "Drawing toolbar" is used for zone configuration.
Zone display panel	Select the zone to be configured with this panel and also switch whether the zone in question is displayed or not. * This button is disabled when the independent bank switching function is used.
Drawing toolbar (1) (2)	Draw the zone on the canvas with these drawing tools. “Drawing toolbar (1)” (page 80) “Drawing toolbar (2)” (page 80)
Drawing properties	This shows information related to the drawing. ・ [Mouse position] This shows the current coordinates of the mouse pointer. ・ [Figure information] This shows information such as the size and angles of figures on the canvas.

Reference See the following section for detailed information on each function.

- “Protection zone” (page17)
- “Warning zone” (page 17)
- “Reference Points Monitoring Function” (page 57)
- “Multi-OSSD Function” (page 54)
- “Bank Switching Function” (page 49)
- “Muting function” (page 55)

Canvas

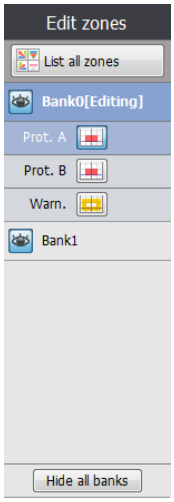
The SZ-V scanner head is represented in the center of the canvas. A grid is shown on the canvas for reference.



Item	Description
Configurable area	The color of the canvas is white for the configurable area. The configurable area varies depending on the configuration of the safety functions.
Unconfigurable area 1	The canvas background color is light gray for areas that cannot be configured.
Unconfigurable area 2	The canvas background color is dark gray for areas that are not visible to the SZ-V scanner head laser (blind areas). These zones cannot be configured.
Zone with the limited detection capability	The zone within the circle with a radius of 93.5mm from the center of the SZ-V scanner head (protection zone origin) is a zone with limited detection capability. "Zone with the limited detection capability" (page 19)
Zones	Zones consist of points on the optical axis (user points) and detection zone origin points connected by line segments. The filled in area indicates the zone.

Zone display panel

The contents vary depending on the model and the selected content.



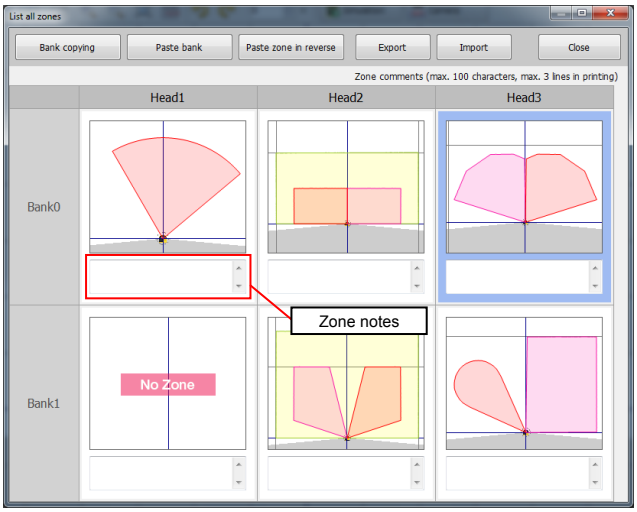
Item	Description
[List all zones]	Displays zones in a list. "List all zones" (page 79)
Bank	This is shown if banks have been set. [Editing] is displayed on the selected bank. If the button is pressed, that bank's protection zones, warning zones, muting zones, and reference points will be hidden. When pressed again, they will reappear. *1
Zones	The following configurable items will be displayed: • Protection zone A • Protection zone B • Reference points • Muting zones • Warning zone A*2 • Warning zone B
Show all/hide all banks	Switch all banks to be shown or hidden. Even if all banks are hidden, the zones of the bank that is being edited are shown.

*1 Zone being currently edited cannot be hidden.

*2 Warning Zone A is displayed as the warning zone if Warning Zone B is not set.

■ List all zones

Shows zone settings per bank.

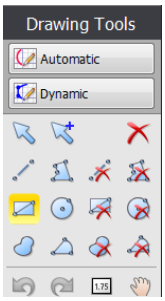


Item	Description
(Bank number)	Indicates each bank's zone.
[Bank copying] button*	Copy all regions of the selected bank.
[Paste bank] button*	Paste the copied zones of the selected bank.
[Paste zone in reverse] button*	Paste the copied zones of the selected bank in reverse.
[Export] button*	Save all regions of the selected bank in a bank file.
[Import] button*	Retrieve and paste the zones saved in the bank file onto the selected bank.
[Close] button	Return to the Zone screen.
Zone notes	Enter any comments here. Recommended to enter some information about when this zone is selected. Up to 100 characters can be entered.

* When using the independent bank switching function, this button is disabled.

Drawing toolbar (1)

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



Item	Description
[Automatic] button	Automatically draws a zone based on the detection state of the SZ-V scanner head. “Automatic drawing function” (page 87) “Automatic trimming function” (page 88)
[Dynamic] button	By detecting the specialized sheet, users can automatically draw zones. “Dynamic drawing function” (page 89)
[Point selection]	Select a user created point or reference point for the zone currently being edited. Drag to select multiple points.
[Add points]	Add user created points or reference points to the border of the zone currently being edited.
[Delete all]	Clear everything in the zone.
[Set a line segment]	Add a line connecting two points, as well as the triangular area defined by the points on that line and the origin.
[Add polygon]	Add a polygon defined by multiple user points, as well as the area defined by these points and the origin.
[Delete a line segment]	Delete from the area currently being edited an area defined by the two points on the selected line and the origin.
[Delete polygon]	Delete a polygon defined by multiple user points and the area created by these points and the origin.
[Set a rectangle]	Add a rectangle with two specified points at opposite vertices, as well as the area defined by these points and the origin.
[Set a circle]	Add a circle with a radius defined by specified points, as well as the area defined by these points and the origin.
[Delete a rectangle]	Delete a rectangle with the two selected points on opposing vertices and the area created by these points and the origin.
[Delete a circle]	Delete a circle with a radius defined by specified points and the area created by these points and the origin.
[Freehand drawing]	Add a freehand shape, as well as the area defined by that shape and the origin.
[Set a sector]	Add 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.
[Freehand deletion]	Delete a freehand shape, as well as the area defined by that shape and the origin.
[Delete a sector]	Delete 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.
[Undo]	Undo the previous operation.
[Redo]	Redo the last operation that was undone.
[Number input]	Add zones by entering coordinates in numbers for line segments, rectangles, polygons, circles, and sector zones.
[Palm]	Change the XY direction of the display position. The mouse icon changes into ✥ while dragging.

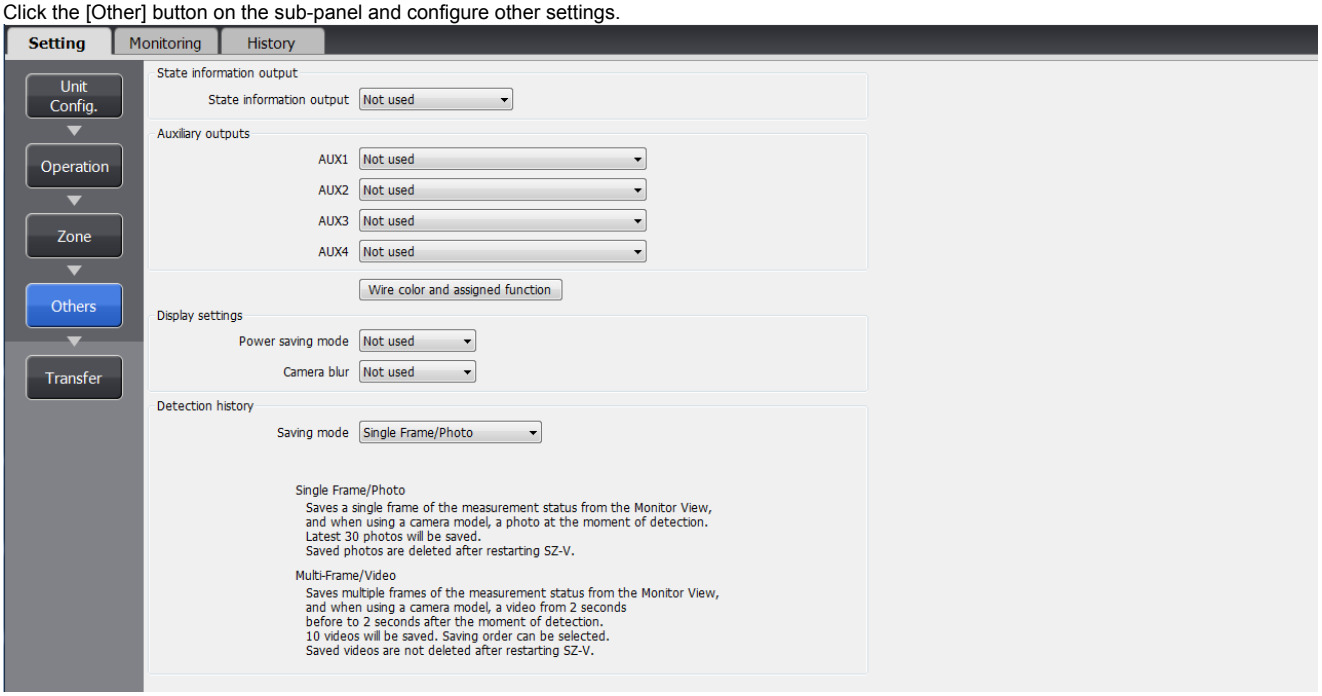
Drawing toolbar (2)

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

Item	Description
[Start real-time ranging]	Displays the ranging state of the current SZ-V scanner head in real time. “Real-time ranging” (page 90)
[Pause real-time ranging]	Temporarily stops the real time ranging display. “Real-time ranging” (page 90)
[Finish real-time ranging]	Clears the real-time ranging information on the canvas. “Real-time ranging” (page 90)
[Bottom hold]	Holds real time ranging display at the bottom. Displays the results of a bottom-hold with a green line. This is available only when the real time ranging display is being executed. “Real-time ranging” (page 90)
[Clear bottom hold]	Clears the bottom hold display.
[Zoom In]	Zooms in on the canvas.
[Zoom Out]	Zooms out of the canvas.
[Full display]	Adjust the screen scale in order to show the entire zone of the real-time ranging that is being executed on the canvas.
[Ruler]	This indicates the distance between two specified points.
[Left rotation]	Rotates the SZ-V scanner head direction 45° to the left on the canvas. “Rotating the canvas” (page 90)
[Right rotation]	Rotates the SZ-V scanner head direction 45° to the right on the canvas. “Rotating the canvas” (page 90)
[Rotation angle]	Rotates the SZ-V scanner head direction on the canvas. Press the up and down buttons on the input box to track and rotate the SZ-V scanner head on the canvas. “Rotating the canvas” (page 90)
[Simulation mode] button	Start Simulation mode. “Simulation mode” (page 90)
[Camera] button	Displays the sensor camera image. “Checking the camera” (page 91)

4. Configure other settings

Click the [Other] button on the sub-panel and configure other settings.



Reference See the following sections for detailed information on each function.

- “State information output” (page 60)
- “Error output” (page 64)
- “Alert output” (page 64)
- “Error or alert output” (page 64)
- “Muted or override condition output” (page 56)
- “Muting lamp output” (page 56)
- “OSSD state output” (page 61)
- “Detection in the protection zone output” (page 65)
- “Detection in the warning zone output” (page 65)
- “Interlock-Reset-Ready Output” (page 66)
- “Encoder error output” (page 64)
- “Transition to Normal Operation Output” (page 66)

State information output

Item	Description
State information output	Set state information output. • Not used (default) • Apply
Pulse width	Set the pulse width for the state information output. • 20 ms (default) • 40 ms • 60 ms • 80 ms • 100 ms • 200 ms • 300 ms

Reference When using the state information output, the AUX 1 output and the AUX 2 output will be automatically assigned to state information output.

Auxiliary outputs

Item	Description
AUX 1 to AUX6*1	Set AUX outputs. • Not used (default) • Error output • Alert output • Error or alert output • Muted or override condition output*2 • Muting lamp output *2 *3 • OSSD state output • Detection in the protection zone output*4 • Detection in the warning zone output*4 • Interlock-reset-ready output*5 • Encoder error output*6 • Transition to normal operation output

*1 The number of AUX outputs that can be used differs depending on the Display unit model and the other functions that are used. “AUX Output” (Page 46).

*2 Select this item only when specifying "Apply" for the muting function.

*3 This output can only be assigned to AUX 6 (AUX 4 for the SZ-V32N type).

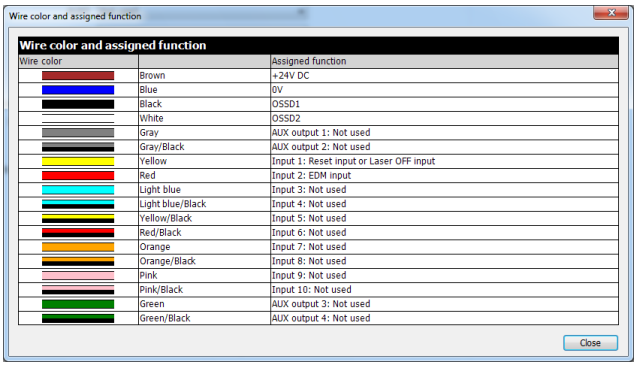
*4 When adding scanner heads, select all scanner heads or a specific scanner head.

*5 Do not select this item when the interlock function is set to "Automatic/Automatic".

*6 Select this item only when the bank switching function is set to "Apply" and the bank switching method is set to "Encoder input".

■ Wire color and assigned function

The [Wire color and assigned function] button allows users to check which wire color is assigned to which function with the current settings.



Display settings

Item	Description
Power saving mode	Set power saving mode. "Reducing Power Consumption" (page 58) ・ Not used (default) ・ Apply
Camera blur	Set the camera blur function. "Camera Blur Function" (page 58) ・ Not used (default) ・ Apply

Detection history

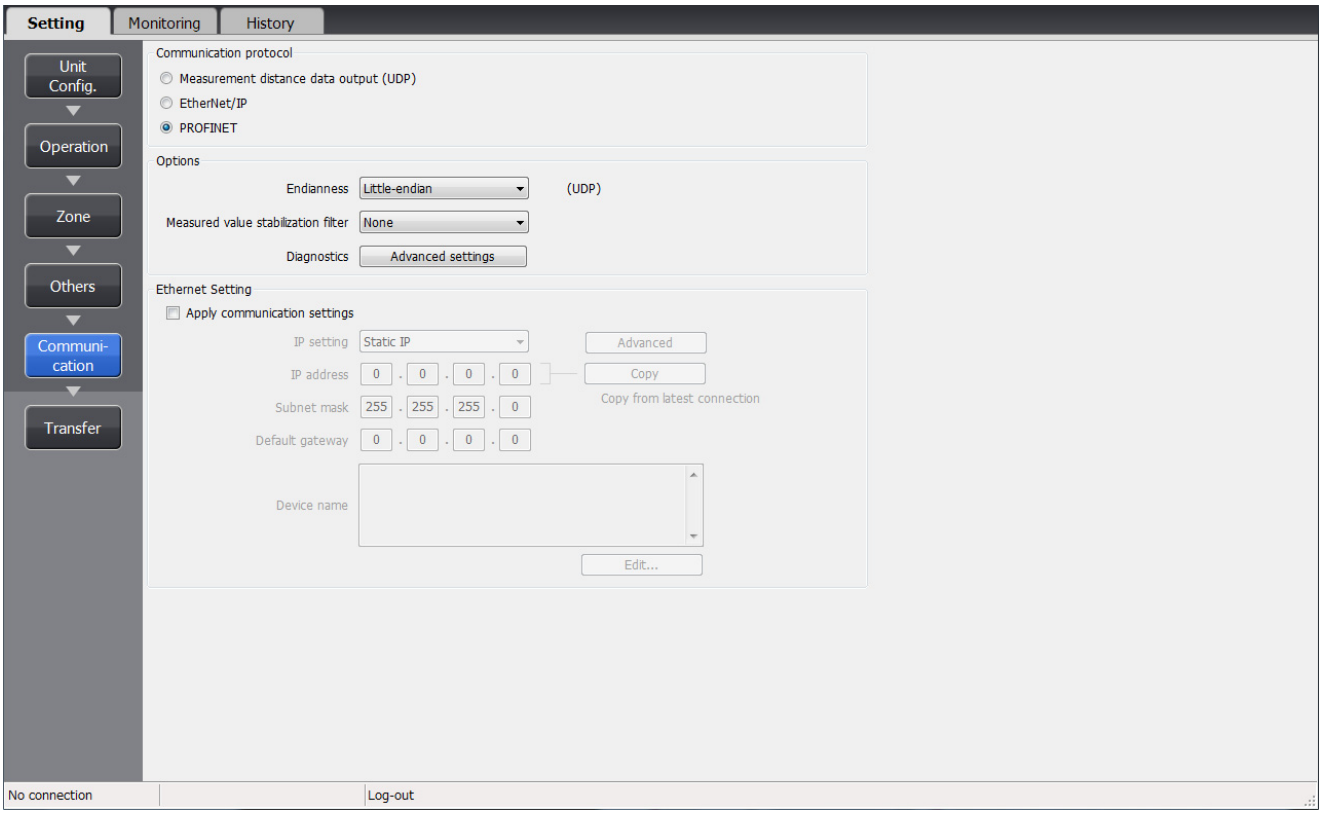
Item	Description
Saving mode	Set the format to save images for the detection history. ・ Single Frame/Photo (default) ・ Multi-Frame/Video
Save First / Last 10 occurrences	Set the format to save the detection history. Select a format only when the image save format is set to [Multi-Frame/Video]. ・ Save last 10 ・ Save first 10 (default)

Reference When the image save format is [Single Frame/Photo], the save format is automatically set as [Save last 30].

Reference
- The communication settings can only be set for the SZ-V32N type. For other models, "Communication settings" is not displayed.
- For details about communication methods, see the separate "SZ-V Communications Manual".

Click the [Communication settings] button on the sub-panel and configure the communication settings.

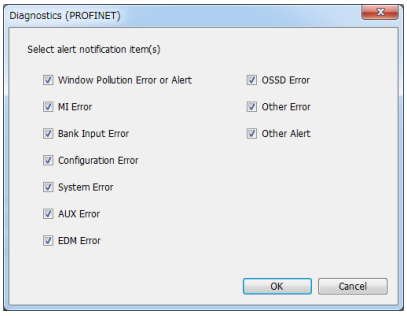
■ **When UDP, EtherNet/IP or PROFINET is selected as the communication protocol**



Communication protocol

Select a communications protocol.
- Measurement distance data output (UDP) (default)
- EtherNet/IP
- PROFINET

Options

Item	Description
Endianness	Set the data endianness. • Big-endian • Little-endian (default)
Measured value stabilization filter	Set whether to filter the distance data obtained from the communication. When using a filter, the stability of the obtained data increases, but the response time decreases. • None (default) • Apply
Diagnostics (Only when PROFINET is selected)	The notifying error and alarm items can be set using the PROFINET Diagnostics function. 

Common Ethernet settings

Checking ☑ the change settings check box allows users to change the Ethernet settings. The modified settings are transferred to the SZ-V.

Item	Description
IP setting	Set the method to assign the IP address. • BOOTP/DHCP • Static IP (default)
Device name*	Set the device name. Click the [Edit] button to edit the device name.

* The device name has the following restrictions.
  - Maximum of 240 characters.
  - Labels can be up to 63 characters in length.
  - Characters “a-z”, “0-9”, and “-” can be used for labels.
  - “-” cannot be used at the beginning or end of labels.
  - “-” cannot be used at the beginning of end of the device name.
  - “port-x” (x is number) cannot be used.
  - “n.n.n.n” (n is number) cannot be used.

If the IP settings are set to "Static IP", configure the settings below.

Item	Description
IP address	Set the IP address.
Subnet mask	Set the subnet mask.
Default gateway	Set the default gateway.
[Copy] button*	Automatically obtain the IP address, subnet mask, and default gateway information from the connected SZ-V.

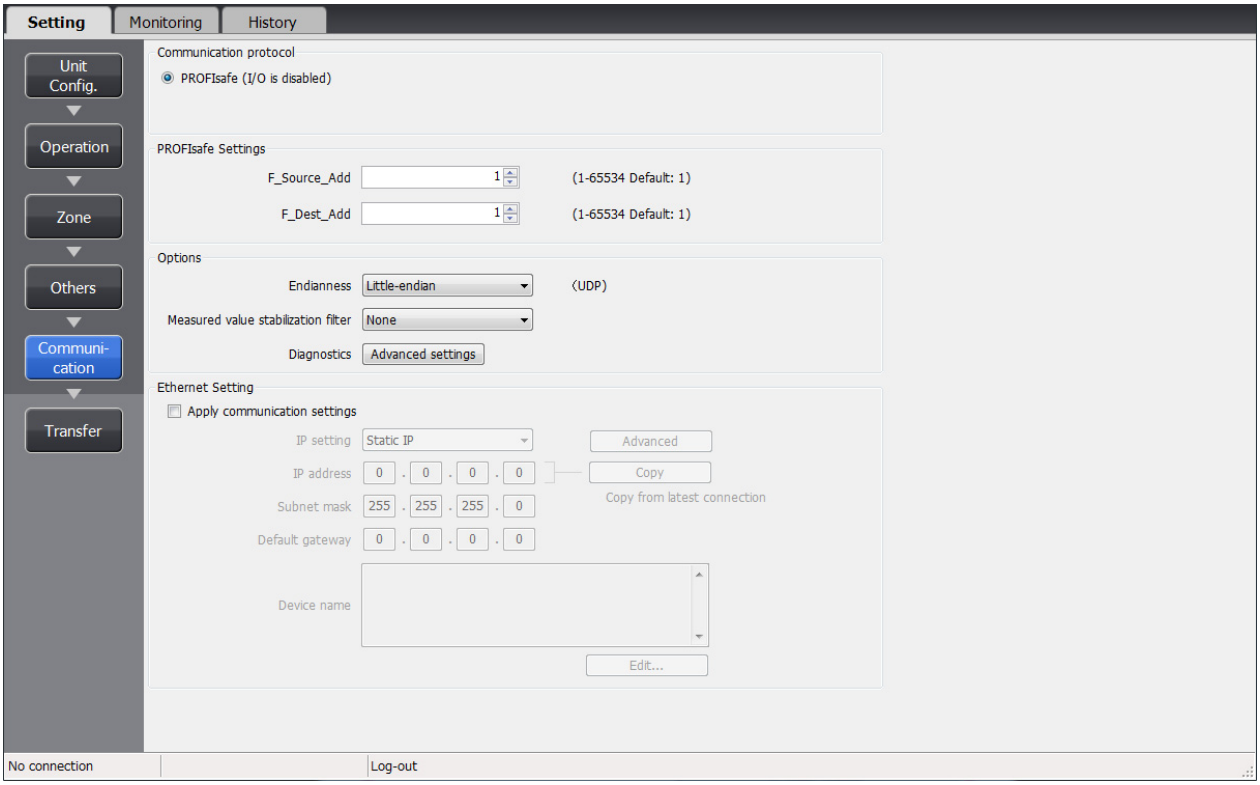
* This button cannot be used when a device is not selected.

■ **Advanced settings**

When the [Advanced settings] dialog box appears, the setting below can be configured

Item	Description
TCP port number	Set the port number to use for TCP communications. • Setting range: 0 to 65535 • Default: 8637
UDP Command Port No.	Set the port number to use for UDP communications. • Setting range: 0 to 65535 • Default: 8800
Keep-alive time	Set the keep-alive time for TCP communications. • Setting range: 10 to 600 s • Default: 90 s
Timeout period	Set the timeout time for communications. • Setting range: 10 to 60 s • Default: 10 s

■ **When PROFIsafe is selected as the communication protocol**



Communication Protocol

The settings of communications protocol are displayed.

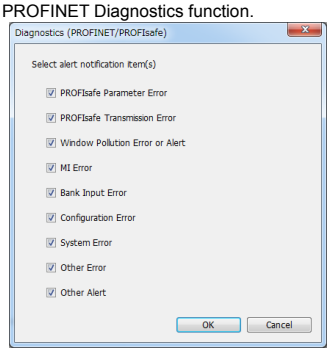
- PROFIsafe (default)

PROFIsafe settings

Item	Description
F_Source_Add	Set the source address. • Setting range: 1 to 65534 • Default: 1
F_Dest_Add	Set the destination address. • Setting range: 1 to 65534 • Default: 1

Detail settings

Item	Description
Endianness	Set the data endianness. • Big-endian • Little-endian (default)
Ranging filter	Set whether to filter the distance data obtained from communications. If you use a filter, the stability of the obtained data increases, but the response time decreases. • Not use (default) • Use
Diagnostics	The notifying error and alarm items can be set with the PROFINET Diagnostics function.



Common Ethernet settings

If you check ☑ the change settings check box, you can change the Ethernet settings. The modified settings are transferred to the SZ-V.

Item	Description
IP settings	Set the method to assign the IP address. • BOOTP/DHCP (default) • Fixed IP
Device name*	You can set the device name. If you click the [Edit] button, you can edit the device name.

* The device name has the following restrictions.
  - Maximum of 240 characters.
  - Labels can be up to 63 characters in length.
  - Characters “a-z”, “0-9”, and “-” can be used for labels.
  - “-” cannot be used at the beginning or end of labels.
  - “-” cannot be used at the beginning of end of the device name.
  - “port-x” (x is number) cannot be used.
  - “n.n.n.n” (n is number) cannot be used.

If you set the IP settings to "Fixed IP," you can configure the settings below.

Item	Description
IP address	Set the IP address.
Subnet mask	Set the subnet mask.
Default gateway	Set the default gateway.
[Copy bank] button*	Automatically obtain the IP address, subnet mask, and default gateway information from the connected SZ-V.

* This button cannot be used when a device is not selected.

■ **Advanced settings**

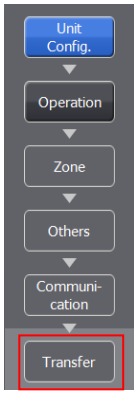
The [Advanced settings] dialog box appears and you can set the items below.

Item	Description
TCP port number	Set the port number to use for TCP communications. • Setting range: 0 to 65535 • Default: 8637
UDP command port number	Set the port number to use for UDP communications. • Setting range: 0 to 65535 • Default: 8800
Keep-alive time	Set the keep-alive time for TCP communications. • Setting range: 10 to 600 seconds • Default: 90 seconds
Timeout time	Set the timeout time for communications. • Setting range: 10 to 60 seconds • Default: 10 seconds

Once configuration is completed, the configuration data can be transferred to the SZ-V unit.
Before transferring the configuration data, make sure that the computer and the SZ-V unit are properly connected.

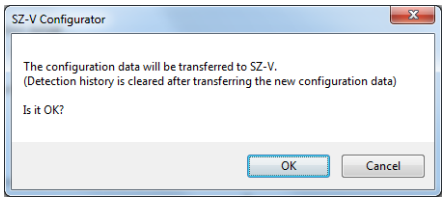
Procedure for transfer

1. Click the [Transfer] button on the sub-panel.



- The [Transfer] button cannot be clicked if the configuration is not complete.

2. Click the [OK] button in the transfer settings dialog box.

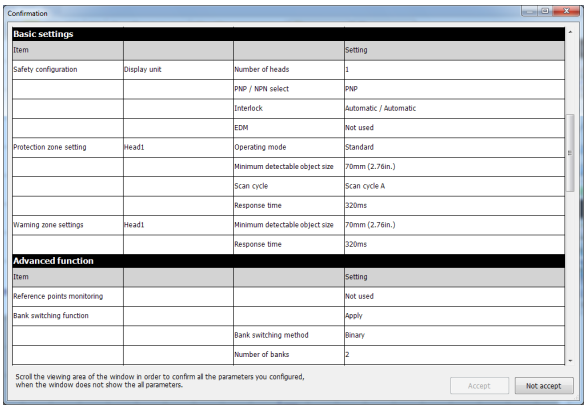


In the following cases, the settings cannot be transferred.
- The input and output polarity is not selected. (Except when PROFIsafe communication is used with the SZ-V32N.)
- There is an empty protection zone.
- The zone that was created is configured beyond the specifications.
- The set model and the connected SZ-V do not match.
- The number of set scanner heads and the number of connected SZ-V scanner heads do not match.
- If encoder input was selected for the bank switching method and the encoder settings are not configured.
- The connected SZ-V does not support the version of the SZ-V Configurator which is being used.
- When PROFINET or PROFIsafe is used with the SZ-V32N, the “Apply Communication Settings” check box is checked, and the device name is “Not configured".
- SZ-V is not connected with the computer.

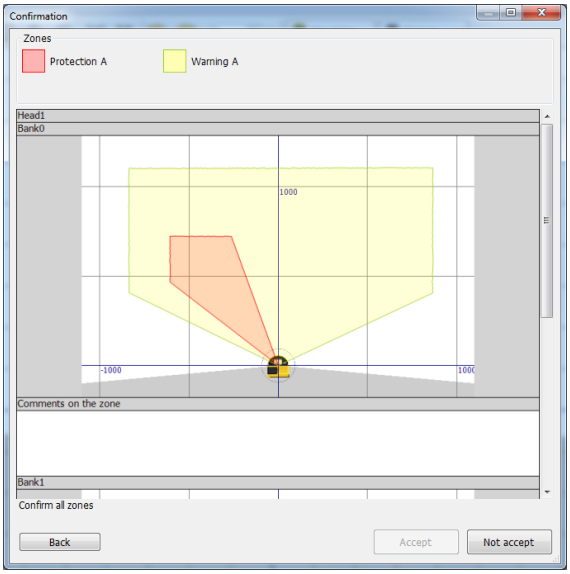
NOTICE	**Pressing [OK] while logged in erases the current SZ-V settings. If cancelled during the following procedure, the SZ-V enters waiting for configuration state and the current settings cannot be restored.**

Reference When logged in as maintenance personnel, settings other than those pre-approved by the responsible personnel cannot be transferred.

3. If not logged into the SZ-V unit, the [Log-in] dialog box will appear. Enter the correct password to log in. “Log-in” (page 107).
4. The configuration data will be written to the SZ-V unit. After the configuration data is written, the configuration data is retrieved from the SZ-V unit for confirmation. During this time, do not disconnect the computer from the SZ-V.
5. Click [OK] in the confirmation dialog to show the [Confirmation] dialog for the configuration data. Confirm the configuration and then click [Accept] if nothing is 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.

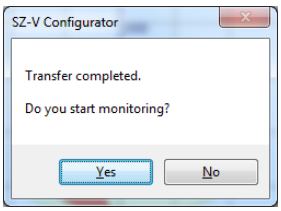


6. The [Confirmation] dialog box appears. Confirm the zone and then click [Accept] if you find nothing different from your intention.
If you have expanded the scanner heads, or are using the multi-OSSD or bank switching functions, the [Next head] button will appear next to the zone name, and the [Accept] button will be grayed out.
The [Accept] button will become available once all the zones have been confirmed.



Important
- **Clicking the [Not accept] button at step 5 or step 6 will cancel the transfer. If this happens, all configuration data on the SZ-V unit will be erased. The SZ-V enters the waiting for configuration state and “Waiting for Configuration” is displayed.**
- **However, the common Ethernet settings are transferred, and the SZ-V starts operating with the new settings. (If the “Apply Communication Settings” check box is checked.)**

7. The [Confirm] dialog box appears. Click the [Yes] button or the [No] button.

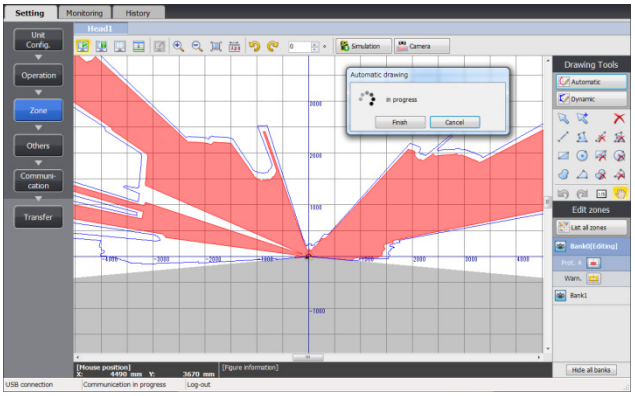


8-6 Useful Functions for Setting Zones

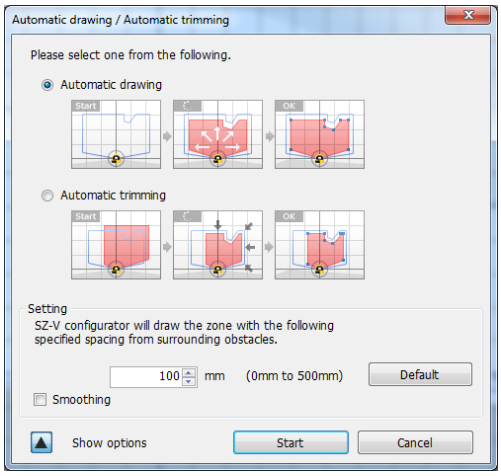
These are functions that can be used on the zone settings screen. By using these functions, it is possible to more quickly and easily set zones.

Automatic drawing function

The purpose of the automatic drawing function is to draw the zone automatically based on the surroundings of the SZ-V, such as a protective guarding.



Automatic drawing and automatic trimming settings



Item	Description
(Function selection)	Select whether to execute automatic drawing or automatic trimming.
Setting	Based on the actual ranging information from the SZ-V unit, the SZ-V Configurator automatically draws the zone, taking into account the specified space from the surrounding obstacles. Use the up and down buttons of the input box, or input the value directly. 0 to 500 (mm) Default: 100 mm
[Default] button	Reset the [Space] value to its default value.
Smoothing	Checking this check box and executing automatic drawing, reduces the number of user points so as to make the drawing easier to see and adjust. Default: OFF
[Start] button	Start automatic drawing.
[Cancel] button	Cancels automatic drawing and closes the dialog box.

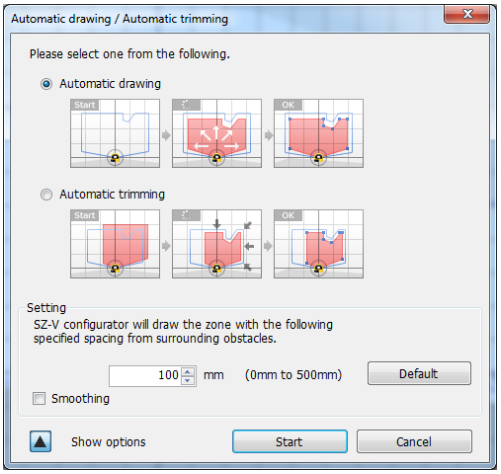
DANGER	**The zone drawn with automatic drawing or automatic trimming is just an informative zone, which is automatically drawn by the SZ-V Configurator based on the surrounding situation of the SZ-V, such as a protective guarding. Therefore, you must confirm whether the zone drawn with automatic drawing or automatic trimming is just as you intended, if you want to configure the actual protection zone according to the zone drawn with automatic drawing or automatic trimming. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.**

Reference

- Check that the computer and the SZ-V Series unit are correctly connected first before executing automatic drawing and automatic trimming.
- Automatic drawing and automatic trimming cannot be used in muting zone settings and reference point settings.

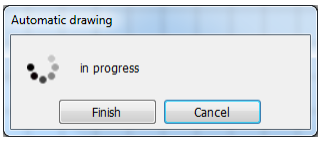
Automatic drawing procedure

1. Click the [Automatic] button on Drawing toolbar (1).
2. The Automatic drawing/automatic trimming window appears. Select [Automatic drawing]. This procedure configures automatic drawing.



3. Click the [Start] button to start automatic drawing.

   The [Automatic drawing] dialog box appears.



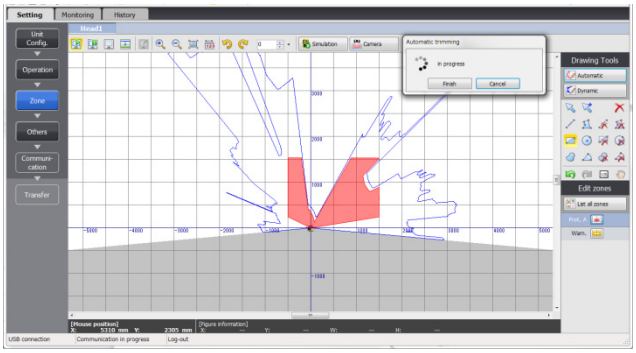
4. Click the [Finish] button to fix the zone.
5. Click the [OK] button to complete automatic drawing.

Point

During automatic drawing, zone is drawn as a bottom hold of the detected distance. Unnecessary zone can be eliminated by actually moving objects or equipment.

Automatic trimming function

The purpose of the automatic trimming function is to draw the zone automatically based on the surrounding situation of the SZ-V in the same manner as automatic drawing. Unlike automatic drawing, it does this by trimming a zone that has already been set by the user. This function only affects zones that have already been drawn.

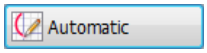


Automatic trimming settings

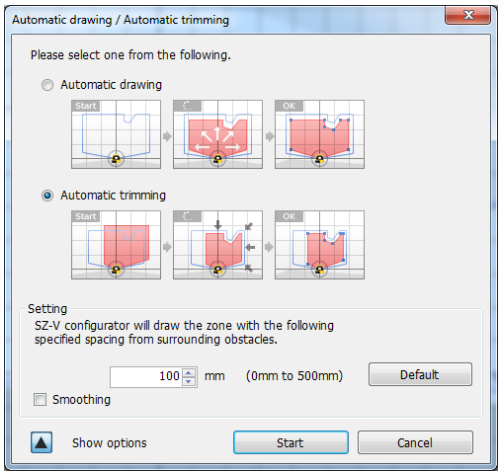
See “Automatic drawing function” page 87.

Automatic trimming procedure

1. Click the [Automatic drawing] button on Drawing toolbar (1).

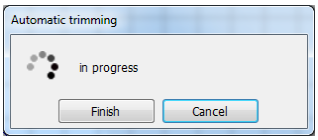


2. The Automatic drawing/automatic trimming window appears. Select [Automatic trimming]. This procedure configures automatic trimming.



3. Click the [Start] button to start automatic trimming.

   The [Executing automatic trimming] dialog box appears.

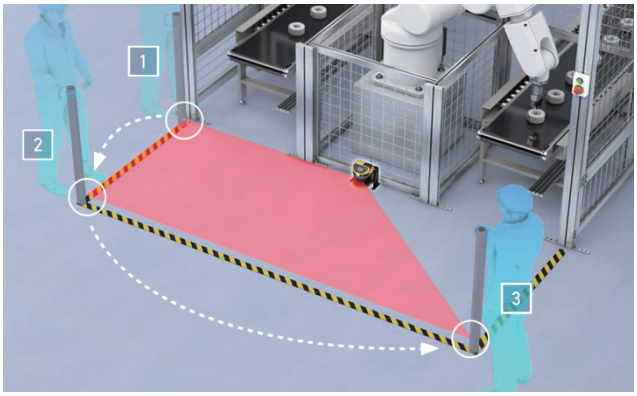


4. Click the [Finish] button to fix the zone.
5. Click the [OK] button to complete automatic trimming.

Reference The automatic trimming function cannot be executed if a zone was not set in advance.

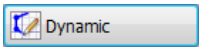
Dynamic drawing function

The dynamic drawing function detects a particular workpiece (bundled dynamic drawing sheet(s)) on the SZ-V, and sets zones based on these detected positions.

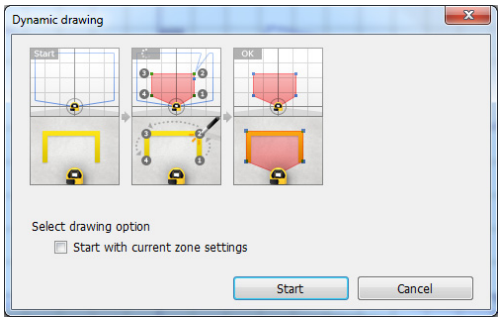


Dynamic drawing procedure

1. Click the [Dynamic] button on Drawing toolbar (1).

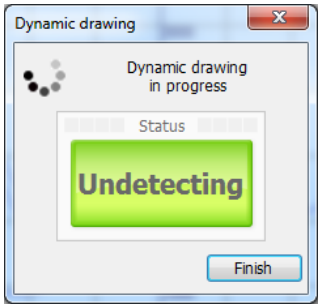


2. The dynamic drawing window appears. Select the execution option.



3. Click the [Start] button to start dynamic drawing.

   The [Dynamic drawing] dialog box appears.



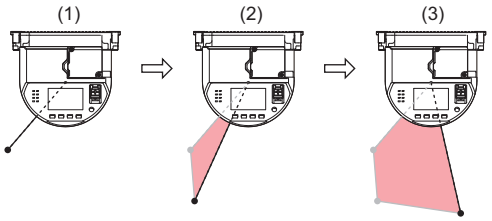
4. The dynamic drawing sheet is detected in the SZ-V detectable zone.

   The detected points are added to the zone as dynamic drawing points. The added dynamic drawing points are connected and the zone is set.

During dynamic drawing, scanner head indicator flashes as follows.

Light color	Status	Details
Green	Flashing slowly	The zone being edited is in an object non-detection state
Orange	Flashing slowly	The dynamic drawing sheet is in a detection state
Red	Flashing slowly	The zone being edited is in an object detection state

Point **When dynamic drawing points are added, zones can be efficiently drawn by adding points to the corner of the zone being set.**



5. Click the [Finish] button to fix the zone.
6. Click the [OK] button to complete dynamic drawing.

DANGER **You must confirm whether the zone drawn with the dynamic drawing is just as you intended, if you want to configure the actual protection zone according to the zone drawn with dynamic drawing. Failure to follow this warning may result in a significant harm to the machine operators, including serious injury or death.**

Reference
- You cannot execute dynamic drawing from a position 500 mm from the SZ-V.
- Check that the computer and the SZ-V Series unit are correctly connected first before executing dynamic drawing.
- Dynamic drawing cannot be used in muting zone settings and reference point settings.
- When detecting the dynamic drawing sheet, place it so that is faces the front of the SZ-V.
- When starting dynamic drawing, if there is a highly-reflective object or background, that optical axis cannot be used to detect the dynamic drawing sheet.

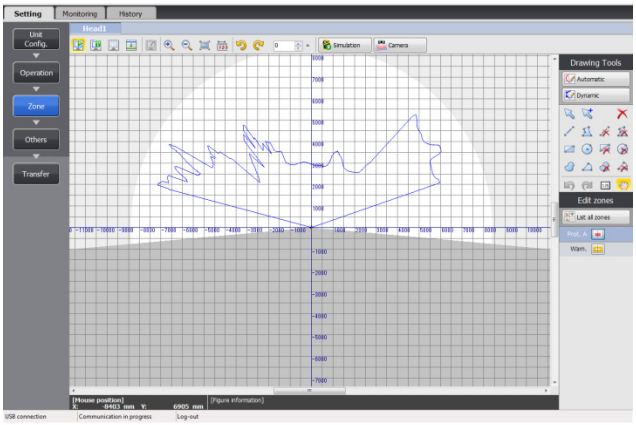
Real-time ranging

Displays the detected environmental boundaries of the SZ-V Series laser in real time on the canvas.

Real-time ranging procedure

1. Click the [Start real-time ranging] button on Drawing toolbar (2).

2. Real-time ranging starts.



3. Click the [Pause real-time ranging] button to stop real-time ranging.

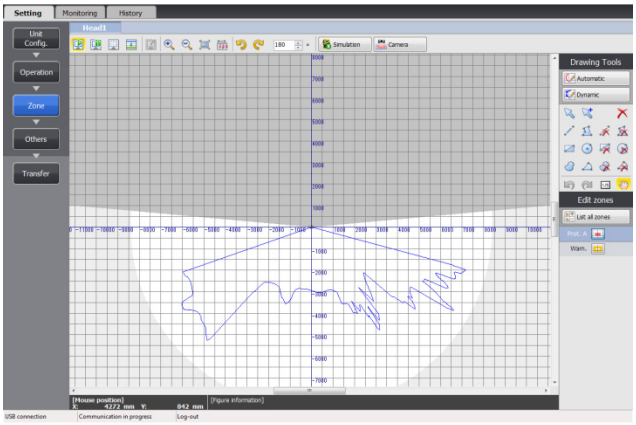
Reference Check that the computer and the SZ-V Series unit are correctly connected first before executing real-time ranging.

Rotating the canvas

Rotate the canvas to change the direction the SZ-V is facing on the SZ-V Configurator. By aligning with the direction the SZ-V scanner head is facing, zone settings and monitoring become easier to perform.

Procedure to rotate the canvas

By clicking the [Rotate left] button or [Rotate right] button, the canvas rotates in increments of 45°. It is also possible to align with a desired angle by entering a [Rotation angle] directly. Press the up and down buttons on the [Rotation angle] input box to track and rotate the SZ-V scanner head on the canvas.



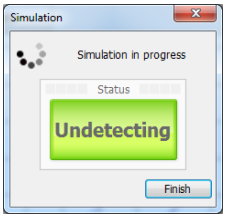
Simulation mode

Simulation mode is a function that can check operation in a new zone without transferring settings to the SZ-V unit. This function is useful when minor adjustments to the zone may be necessary.

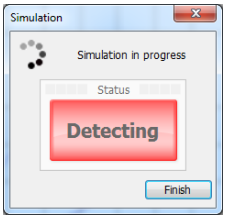
Simulation mode procedure

1. Click the [Simulation] button on Drawing toolbar (2).
2. Simulation mode starts.

   The [Simulation] dialog box appears.



3. If an object is detected in the newly configured zone, the [Detection state] of the [Simulation] dialog box becomes [Detecting].



During simulation mode, scanner head indicator flashes as follows.

Light color	Status	Details
Green	Flashing slowly	The simulation zone is in a non-detection state
Red	Flashing slowly	The simulation zone is in a detection state

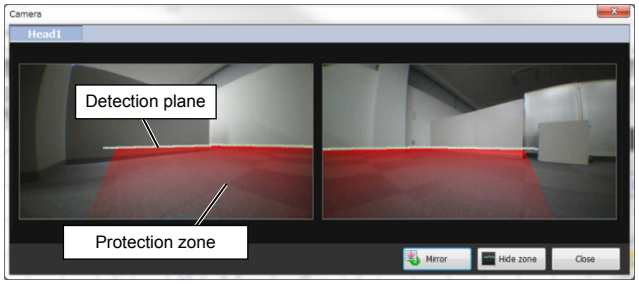
Reference
- Check that the computer and the SZ-V Series unit are correctly connected first before executing simulation mode.
- While in simulation mode, the SZ-V unit indicator alternately flashes red and green.
- The SZ-V continues normal operation with the settings last transferred even in simulation mode. The new settings are not applied until the settings are actually transferred.
- Simulation mode cannot be used in the muting zone settings and reference point settings.
- Simulation mode can be performed to one scanner head at once. If multiple scanner heads are cascaded, only the selected scanner head goes into simulation mode.

Checking the camera

Check the zone and detection plane on camera images without transferring the settings.

Procedure to check the camera

1. Click the [Camera] button on Drawing toolbar (2).
2. The currently selected scanner head* camera image is displayed.



Item	Description
Detection plane	Shows the detection point where detection laser is detecting an object. If detection is done in the protection zone, point is shown in red color. If detection is done out of the protection zone, point is shown in green color.
[Mirror] button	Displays the camera image in reverse.
[Show/Hide zone] button	Overlays the zone onto the screen. Press this button again to hide it.
[Close] button	Close the camera confirmation screen.

*If a scanner head that does not have a camera is selected, a message appears stating "Cannot display image as there is no camera" and the camera image is not displayed.

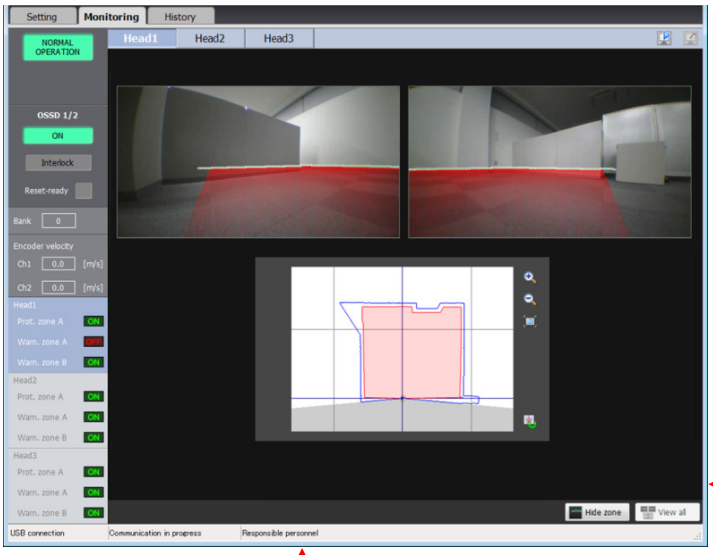
Reference
- Check that the computer and the SZ-V Series unit are correctly connected first before checking the camera.
- Only the camera images for protection zones and warning zones can be view. It is not possible to check the muting zone.

8-7 Monitoring Operations

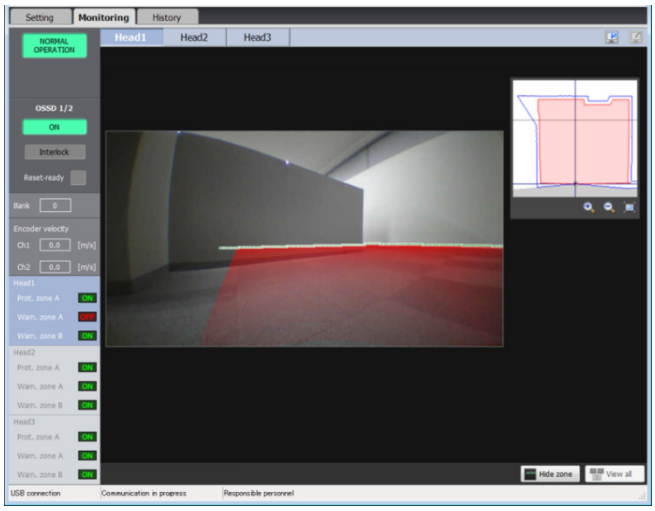
How to read the monitoring tab

Select the Monitoring tab to monitor the detection state of the SZ-V unit in real time.

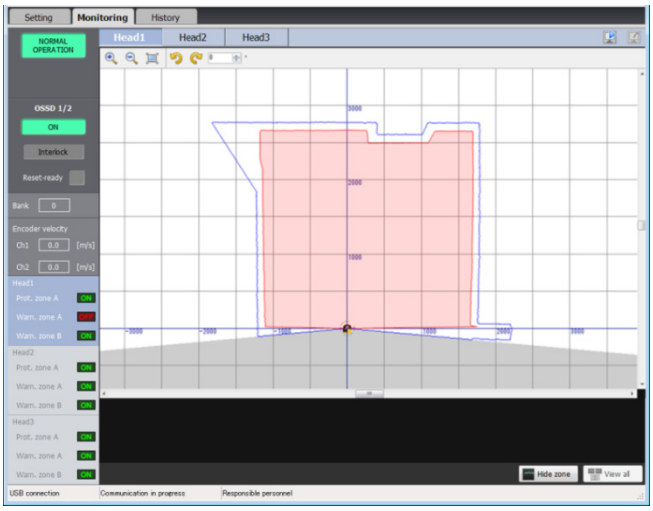
Full screen display (initial screen*)



Camera view (left/right)



Monitor view *



*If all the connected scanner heads do not have a camera, the monitor view is displayed. The monitor view will be the only available display.

Reference

- Before selecting the Monitoring tab, make sure that the computer and the SZ-V Series are properly connected.
- Monitoring is not possible if the configuration data on the SZ-V Configurator is different from the configuration data on the SZ-V Series. Read the configuration data from the SZ-V unit or transfer the configuration data from the SZ-V Configurator, and then start monitoring.
- Monitoring is not possible when the SZ-V enters the waiting for configuration state and Waiting for Configuration is displayed. Transfer the configuration data from the SZ-V Configurator and start monitoring.

Scanner head selection panel

Select which scanner head to use for monitoring.
- Item: Head 1 to 3

Background hold button

This button is for the background hold function.
This function holds the minimum distance measured by the SZ-V on the SZ-V Configurator for each bank. Since 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.

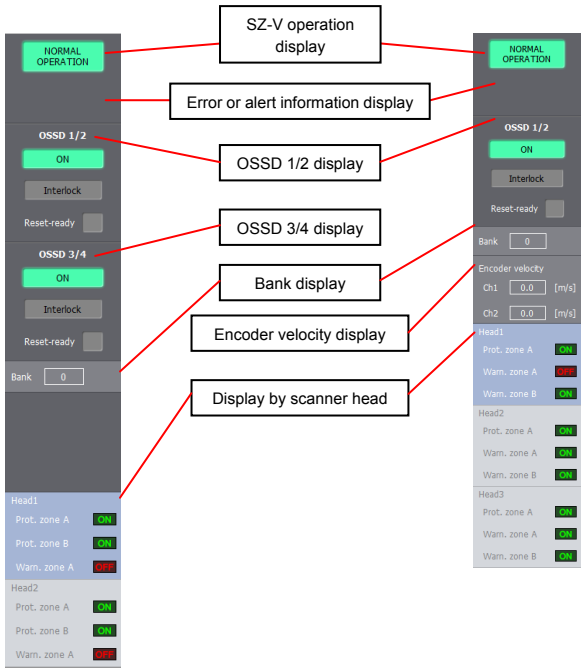
 Start/stop background hold	If this icon is clicked, the minimum distance detected by the SZ-V will be displayed on the gray line. With this gray line as a border, the hold will be displayed with the far distance side as gray, and the close distance side as white. If changing the bank, the hold display 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.
 Clear background hold	Reset the hold display conditions. The area set as gray will return to white.

Reference Background hold also can be executed after using a timer. “Background hold setting” (page 103).

Subpanel

Displays the operating state of the SZ-V.

SZ-V04 type **SZ-V32 type or SZ-V32N type**

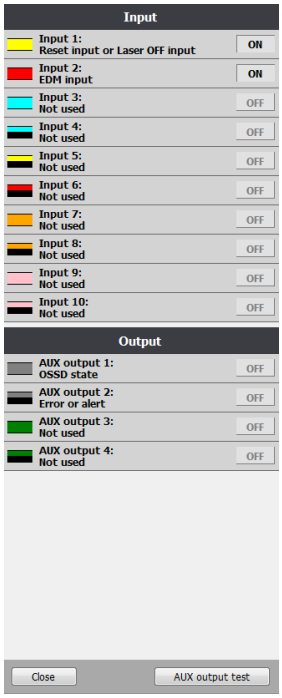


Item	Description
SZ-V operation display	Displays the operating state of the SZ-V. • Normal operation • AUX output test • Laser shutdown • Laser off input state • Error State • Waiting for bank input • Override • Muting • Reference point not detected • History saving
Error or alert information display	Displays the content of errors and alerts. Nothing is displayed when there is no error or alert.
OSSD 1/2 display OSSD 3/4 display	This shows the state of the OSSD.  This indicates the state of the OSSD output. Lights yellow during interlock. Lights yellow-green during interlock-reset-ready.
Bank display	Displays the selected bank number when using banks.
Encoder velocity display	Displays velocity detected by each encoder when using the bank switching function • Ch1: Detected velocity of Encoder Input 1 • Ch2: Detected velocity for Encoder Input 2
Display by scanner head	Indicates the detection state of each scanner head. • Protection zone • Warning zone

I/O monitoring panel

This shows the state of inputs and outputs.

■ **When PROFIsafe is not used**

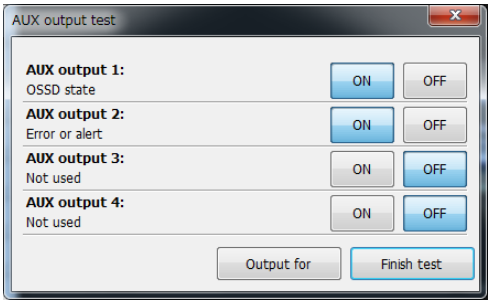


Item	Description
Input	This shows the wire color, function, and ON/OFF state of the input. The contents of this varies depending on the function, configuration, and input state.
Output	This shows the wire color, function, and ON/OFF state of the output. The contents on this varies depending on the function, configuration, and input state.
[Close] button	Hides the I/O monitoring panel.
[AUX output test] button	Turns OSSD OFF and tests the AUX outputs.

■ **AUX output test**

This function turns the desired AUX outputs ON or OFF. Operate this function from the [AUX output test] dialog box.

Important **OSSD turns OFF during the AUX output test.**



Item	Description
State information output 1/2	Output the pulse to indicate the specified state. Set this item only when using [State information output]. “State information output” (page 60)
[ON] button [OFF] button	Turn a specified AUX output [ON] or [OFF]. The outputs will not be generated until the [Test output] button is clicked.
[Test output] button	Outputs in accordance with the output state and each AUX outputs setting.
[Finish test] button	Finishes the AUX output test. Click the [Finish test] button to restore the state of all AUX outputs. The OSSD also goes back to normal operation.

Reference OSSD keeps OFF state during AUX output test.

■ **When PROFIsafe is used**

Input data (from SZ-V)		
Byte Offset	HEX	BIN
Input 0	0x00	0000 0000
Input 1	0x00	0000 0000
Input 2	0x00	0000 0000
Input 3	0x00	0000 0000
Input 4	0x00	0000 0000
Input 5	0x00	0000 0000
Input 6	0x00	0000 0000
Input 7	0x00	0000 0000
Input 8	0x00	0000 0000
Input 9	0x00	0000 0000
Input 10	0x00	0000 0000
Input 11	0x00	0000 0000

Output data (to SZ-V)		
Byte Offset	HEX	BIN
Output 0	0x00	0000 0000
Output 1	0x00	0000 0000
Output 2	0x00	0000 0000
Output 3	0x00	0000 0000
Output 4	0x00	0000 0000
Output 5	0x00	0000 0000
Output 6	0x00	0000 0000
Output 7	0x00	0000 0000
Output 8	0x00	0000 0000
Output 9	0x00	0000 0000
Output 10	0x00	0000 0000
Output 11	0x00	0000 0000

Close Details

Item	Description
Input data (from SZ-V)	The state of the data sent from the SZ-V to the Safety PLC.
Output data (to SZ-V)	The state of the data received from the SZ-V to the Safety PLC.
[Close] button	Hides the I/O monitoring panel.
[Detail] button	Details of the Input data and the Output data are displayed.

Bank monitoring panel

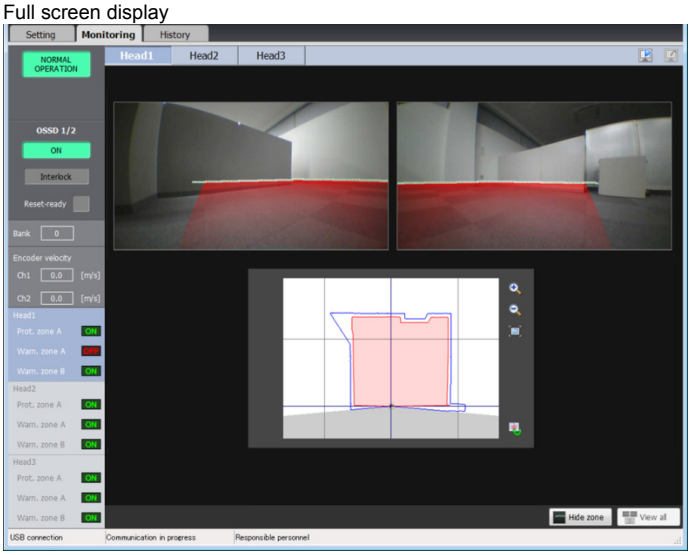
When both PROFIsafe and All Banks are used, the ON/OFF state of each bank will be displayed.
To display the bank monitoring panel, select [Monitoring tools]→[Bank monitoring panel] from the menu bar.

	Prot. zone A	Prot. zone B
Bank0	OFF	ON
Bank1	ON	OFF
Bank2	ON	OFF
Bank3	OFF	ON
Bank4	OFF	ON
Bank5	OFF	OFF
Bank6	ON	ON
Bank7	ON	OFF
Bank8	ON	OFF
Bank9	ON	ON
Bank10	OFF	OFF
Bank11	OFF	ON
Bank12	ON	OFF
Bank13	ON	ON
Bank14	ON	OFF
Bank15	ON	ON

Close

How to read and operate the full screen display

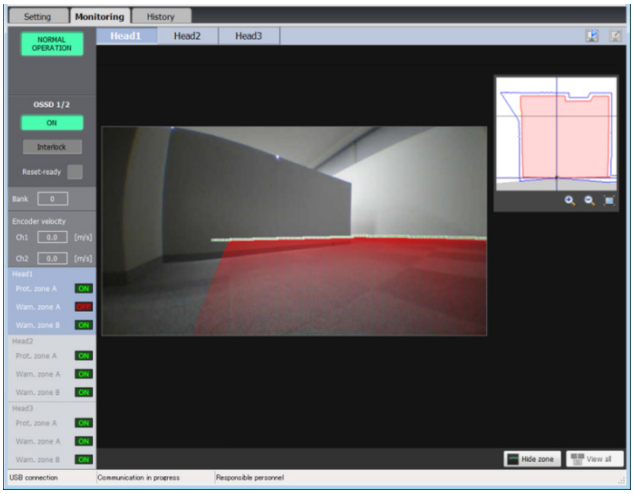
Full screen display



Item	Description
Left camera display panel	Displays the left camera image of the selected scanner head. If clicked, the camera image from the left camera is displayed.
Right camera display panel	Displays the right camera image of the selected scanner head. If clicked, the camera image from the left camera is displayed.
Monitor view panel	Displays the detection status of the selected scanner head. If clicked, the monitor view is displayed.
(Zoom In) button	Zoom in on the monitor view.
(Zoom Out) button	Zoom out of the monitor view.
(Full Display) button	Adjusts the screen scale in order to show the entire zone that is drawn on the canvas.
(Reverse) button	Displays the camera images and the monitor view in reverse.
Hide zone (Show/hide zone) button	Overlays the protection zone onto the camera view. Press the button again to hide it.

How to read and operate the camera view

Camera view

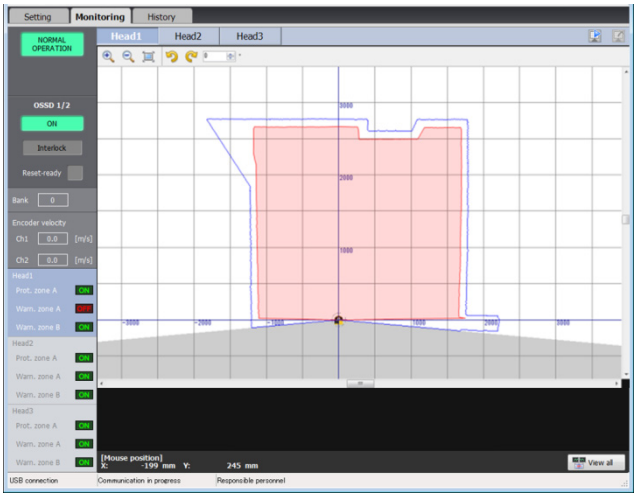


Item	Description
Monitor view panel	Displays the detection status of the selected scanner head.
(Zoom In) button	Zoom in on the monitor view.
(Zoom Out) button	Zoom out of the monitor view.
(Full Display) button	Adjusts the screen scale in order to show the entire zone that is drawn on the canvas.
Camera display panel	Displays the camera image of the selected camera.
Hide zone (Show/hide zone) button	Overlays the protection zone onto the camera view. Press the button again to hide it.
View all (View all) button	Displays the full screen.

*How to read and operate both the left and right camera screens is the same.

How to read and operate the monitor view

Monitor view



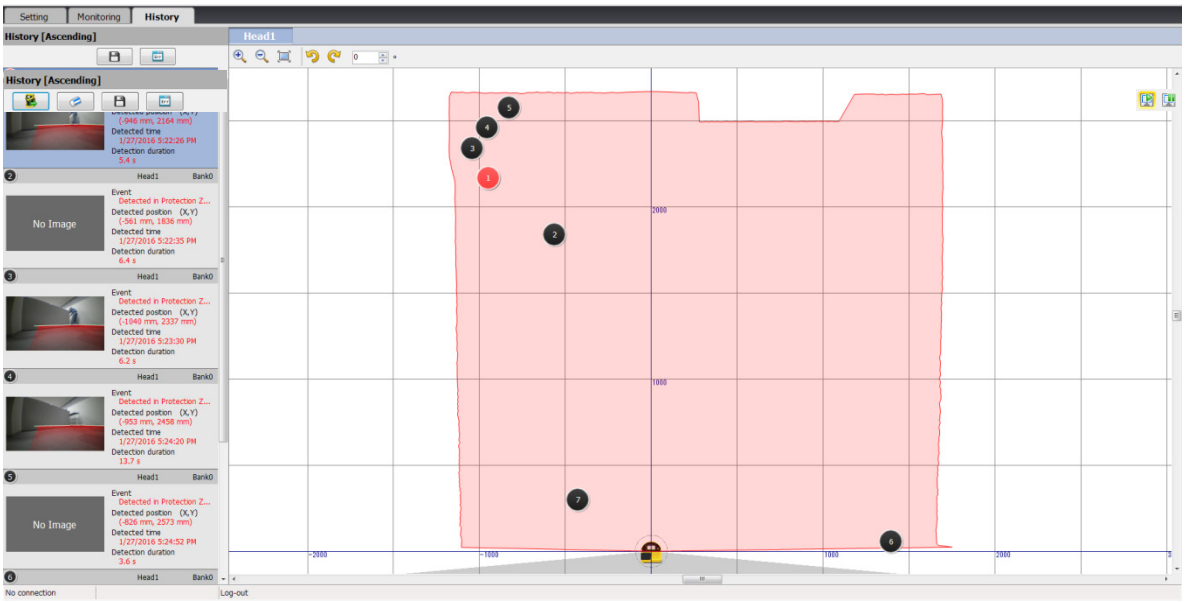
Item	Description
Monitor view panel	Displays the detection status and zone of current bank of the selected scanner head.
Display panel	Operates the display.
(Zoom In) button	Zoom in on the monitor view.
(Zoom Out) button	Zoom out of the monitor view.
(Full Display) button	Adjusts the screen scale in order to show the entire zone that is drawn on the canvas.
(Left rotation) button	Rotates the SZ-V scanner head direction 45° to the left on the canvas. “Rotating the canvas” (page 90)
(Right rotation) button	Rotates the SZ-V scanner head direction 45° to the right on the canvas. “Rotating the canvas” (page 90)
[Rotation angle]	Rotates the SZ-V scanner head direction on the monitor view panel. Press the up and down buttons on the input box to track and rotate the SZ-V scanner head on the canvas. “Rotating the canvas” (page 90)
Drawing properties display	This shows information related to drawing.
Mouse position	This shows the current coordinates for the mouse pointer.
View all (Full Display) button	Displays the full screen.

Reference If all the connected scanner heads do not have a camera, the [Full display] button is not displayed.

8-8 Checking the Detection History

On this screen, it is possible to check the history of detections of people and objects in the protection zone, and occurrences of alerts and errors.

How to read the History tab



Reference Before selecting the History tab, make sure that the computer and the SZ-V Series are properly connected.

Monitor view

Item	Description
Detected position	Displays the detected position on the monitor view. Displays up to 20 items in display order on the subpanel. The selected history is displayed highlighted in red on the subpanel.

Reference If the selected history is the 21st point or later, only the selected point is displayed in red on the monitor view panel.

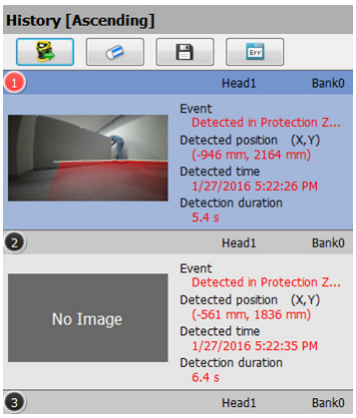
Display panel

Item	Description
(Zoom In) button	Zoom in on the monitor view.
(Zoom Out) button	Zoom out of the monitor view.
(Full Display) button	Adjusts the screen scale in order to show the entire zone that is drawn on the monitor view.
(Left rotation) button	Rotates the SZ-V scanner head direction 45° to the left on the canvas. “Rotating the canvas” (page 90)
(Right rotation) button	Rotates the SZ-V scanner head direction 45° to the right on the canvas. “Rotating the canvas” (page 90)
[Rotation angle]	Rotates the SZ-V scanner head direction on the monitor view panel. Press the up and down buttons on the input box to track and rotate the SZ-V scanner head on the canvas. “Rotating the canvas” (page 90)

Subpanel

Displays the detection history in order from the newest item.

However, if [First 10] is selected for the [Save format] in the detection history settings, the oldest item is displayed first. "Detection history" (page 82)

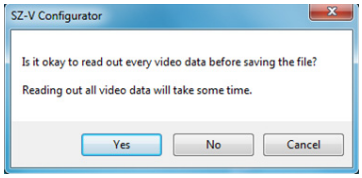


Item	Description
[Selected display]	Displays the selected history in blue. If a history item is selected, the detected position corresponding to the selected history item is displayed on the main panel highlighted in red.
[Thumbnail image]	Displays the image when the OSSD went OFF. If the thumbnail image is double clicked, the [Image/video dialog box] is displayed. "Checking detection images and video in the protection zone" (page 99) • If the scanner head does not have a camera, monitor view when the OSSD went OFF is displayed. • If the history item does not have a thumbnail image, "No image" is displayed.
Event	The reason for the event (OSSD OFF) is displayed.
Detection position	The coordinates of the position that the event (OSSD OFF) occurred are displayed.
Detected time	The time that the OSSD went from ON to OFF is displayed. (Time of occurrence*)
Detected duration	Period of time that the OSSD was OFF is displayed.

Item	Description
(Refresh) button	The detection history is retrieved from the SZ-V and displayed.
(Clear detection history) button	Deletes the detection history. If [Video] for [Save format] is selected, history can only be deleted when logged in as the responsible personnel.
(Save detection history to a file) button	The [Save detection history] dialog box appears and the history can be saved to a file. "Saving detection history" (page 98)
(Error history) button	The [Error history] dialog box appears and displays the error history in a list. "Error history" (page 98)
Change page button	Select to display the detection history per 100 items.

Reference Check that the computer and the SZ-V Series unit are correctly connected first before clearing or refreshing the detection history.

■ Saving detection history

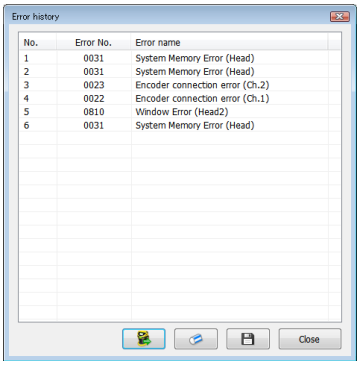


Saving format of history

- Detection history file (.szvh): OFF information and the image when it went to OFF are saved for all detection history items.
- CSV file (.csv): For all detection history items, OFF information is saved as text data.

■ Error history

Displays the error history in order. The history is displayed in order from the newest items.



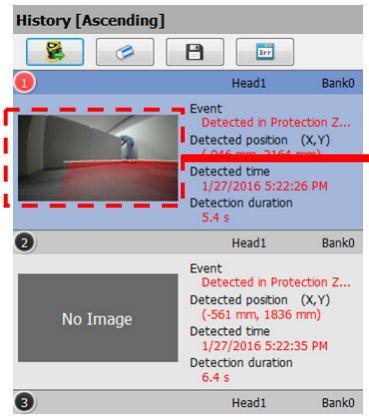
Up to 100 error history items are saved; items after the 101st item are not saved. Even if the SZ-V power is turned OFF, the error history is no cleared.

Item	Description
(Refresh) button	Error history is retrieved from the SZ-V unit.
(Clear error history) button	Clear the error history recorded on the SZ-V unit. Clearing the error history is only possible when logged in as the responsible personnel.
(Save error history to a file) button	Saves the error history to a CSV file.
[Close] button	Close the [Error history] dialog box.

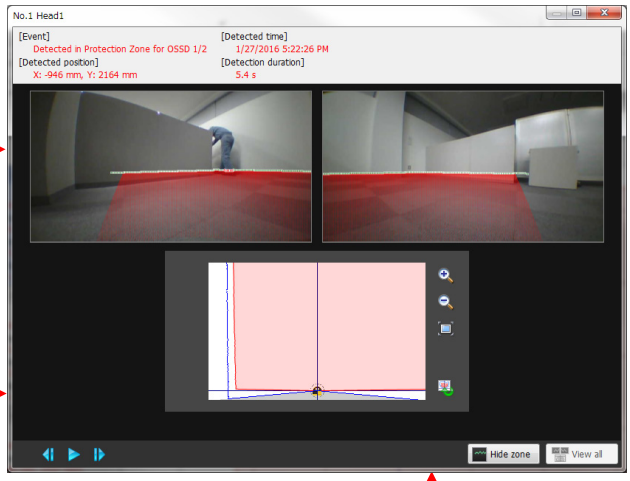
Checking detection images and video in the protection zone

When an object is detected in the protection zone, record the monitor view and camera images and play them back later as photos or videos. Whether the images are saved as photos or videos depends on the settings. "Detection history" (page 82)

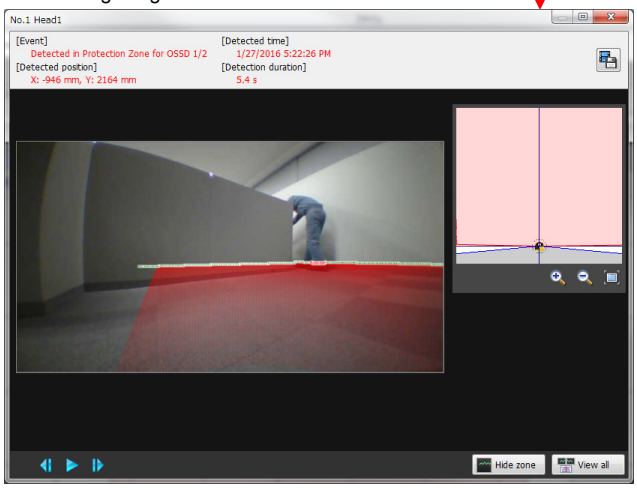
Subpanel



Checking images/videos Full screen display



Checking images/videos Camera view



Checking images/videos Monitor view

Reference

- Camera images can only be saved when using a scanner head that has a camera.
- Photos or videos cannot be played back when the image is being saved on the SZ-V unit. The message "Cannot read out video data since history saving is ongoing. " appears.
- If all the connected scanner heads do not have a camera, a monitor view is displayed. This is the only screen that can be displayed.

History display panel

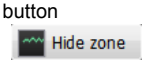
Item	Description
[Event]	Depending on the type, the details that are displayed differs. When using the SZ-V04 or when PROFIsafe communication is used with the SZ-V32N ・ OSSD 1/2 OFF ・ OSSD 3/4 OFF When using the SZ-V32 type or when PROFIsafe communication is not used with the SZ-V32N type. ・ OSSD OFF
[Detection position]	The coordinates of the position that the event (OSSD OFF) occurred are displayed.
[Detected time]	The time that the event occurred is displayed. (Time of occurrence*)
[Detected duration]	Period of time that the event persisted is displayed. If the detected duration is not fixed yet, "----" is shown.
[Save history] button	Save the history information The icon changes depending on whether the [Save format] is set to multi-frame mode or single frame mode.  Save as video  Save as photo In the case of multi-frame mode, videos can be saved only after playing them. When videos cannot be saved, the icon above is grayed out.

*History items that occurred before the power was turned ON cannot be displayed. Instead, the running time will be displayed.

History main panel

Shows the state when an object or person was detected in the protection zone as a camera image or on a monitor view.
Click the camera image to display the camera screen.
Click the monitor view image to display the monitor view.

History operation panel

Item	Description
[Play]/[Pause] buttons 	[Play] button Play the video. This button functions as the pause button when videos are playing. [Pause] button Pauses the video. This button functions as the play button when videos are paused.
[Frame advance] button	Plays the video frame-by-frame.
[Frame rewind] button	Rewinds the video frame-by-frame.
[Show / Hide zone] button 	Shows or hides the zone on the camera view.
[View all] button 	Displays in full screen.

Reference Due to camera blind areas, it may not be possible to check images of all detected objects.

8-9 Monitoring Using Communications

On the SZ-V32N, information such as error status and measuring distance data can be obtained using Ethernet communications.
The SZ-V32N supports the following protocols:
・ UDP
・ EtherNet/IP™
・ PROFINET
・ PROFIsafe

For details about monitoring using communications, see "SZ-V32N Type Communications Manual."

DANGER	**All the data received from the communication of UDP, EtherNet/IP or PROFINET 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.**

8-10 Operation Menu

File

Item	Description
New	Create new settings. This operates in the same manner as when selecting [Create a new configuration file] when the SZ-V Configurator starts. "b) Create a new configuration file" (page 68)
Open	Open a configuration file saved on the computer. This operates in the same manner as when selecting [Open a configuration file] when the SZ-V Configurator starts. "c) Open a configuration file" (page 68)
Close	This closes the configuration file currently being edited. If editing a configuration file, a save confirmation dialog appears.
Save	This saves the configuration file currently being edited.
Save as	Save the file currently being set with a different name. The [Save As] dialog box appears. Enter a name for the file and then save the file.
Print	The [Print] dialog box appears. Configure print settings. When clicked, information related to settings are printed. When "Image on Canvas" (Page103) has been set, the printing method can be selected based on the background image. ・ Full display aligned with background image ・ Full display aligned with region ・ Hide background image Following information is included in the printed document. ・ File Name ・ Information on "Configuration", such as Title/Department, Name of the person responsible and comment, date of configuration, software version, Model and serial number. ・ Configuration parameters ・ For the image of a printed document, please see "Image of a printed document" (Page 109).
Recent files	This shows the five files most recently opened in the SZ-V Configurator.
Exit	This exits the SZ-V Configurator. If currently editing a file, a save confirmation dialog box appears.

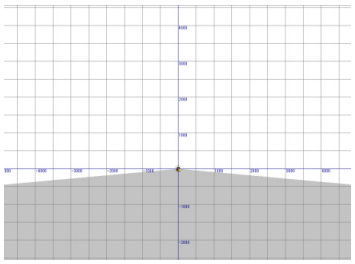
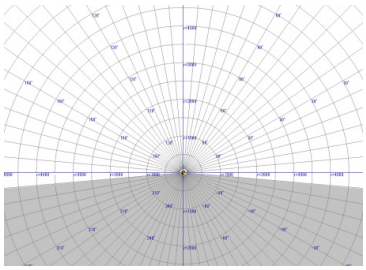
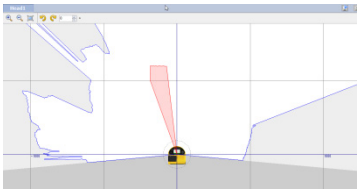
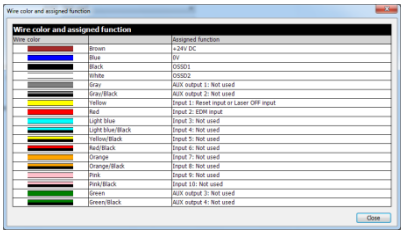
*Detection or error history cannot be printed.

Edit

Item	Description
Undo	Undo the previous operation.
Redo	Redo the last operation that was undone.
Copy zone	This copies the zone currently being edited to the clipboard.
Paste zone	This pastes a zone copied with [Copy zone] to the selected location.
Paste zone in reverse	This pastes a zone copied with [Copy zone] to the selected location in reverse.

Reference [Edit] can only be used while configuring [Zone Settings].
"Set the zone" (page 78)

View

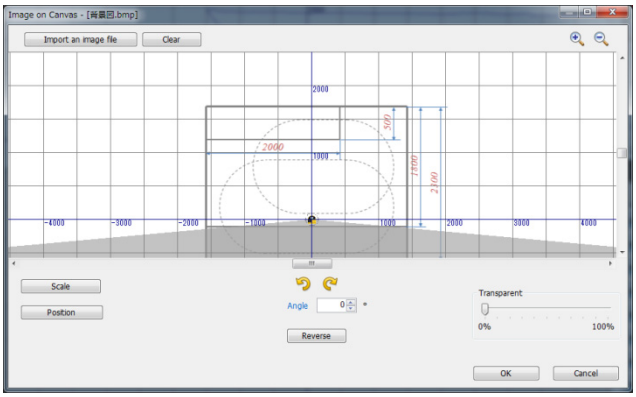
Item	Description
Configuration tab	The [Setting] tab will become active.
Monitoring tab	The [Monitoring] tab will become active.
Detection history tab	The [History] tab will become active.
Zoom	This is a setting for the display of the monitoring panel and of the canvas. Zoom in: Magnifies the currently displayed content. Zoom out: Reduces the currently displayed content.
Grid	Sets the display of the grid. **Visible** • Check box checked ☑ The grid is displayed. • Unchecked The grid is not displayed. **Grid interval** The "Grid interval" dialog box appears allowing for adjustment of the grid interval.*1 • Setting range: 100 to 2000 (mm) *2 • Default: 500 (mm) **Cartesian coordinates** • Check box checked ☑ The grid is displayed as Cartesian coordinates.  **Polar coordinates** • Check box checked ☑ The grid is displayed as polar coordinates. 
Display unit	Set the display units. • mm (default) • in. • feet/in.
Real-time ranging	Displays the ranging state of the current SZ-V scanner head in real time on the canvas. “Real-time ranging” (page 90) **Start** Starts real-time ranging. **Pause** Temporarily stops the real time ranging display. **Clear** Clears the real-time ranging information. **Bottom-hold** Holds the displayed real-time ranging display at the bottom. Displays the result of bottom-hold with a green line.
Highly reflective background	Switch whether a highly-reflective background is shown or hidden.
All points	Displays user points and setting points for the remaining beams.
Shade detected area	The SZ-V displays the outside of the detected zone filled. 
Camera blur	Set the camera blur function. “Camera Blur Function” (page 58) This setting is used when the check box is checked ☑.
Wire color and assigned function	The [Wire color and assigned function] dialog box appears. 

*1 The “Undo” function cannot be used to restore the grid interval.
*2 For inches, 3.94 to 78.74 (inch)

Image on Canvas

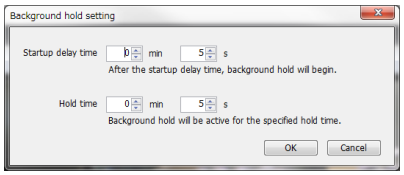
Item	Description
Visible	Switch the display/hide the configured background image.
Settings	The [Image on Canvas] dialog appears and the settings can be configured. The configured background image is displayed on the canvas.

■ **Background drawing dialog**



Item	Description
[Import drawing file] button*	Specifies the drawing file displayed on the background. The file types that can be displayed are BMP file (*.bmp), JPEG file (*.jpg, *.jpeg), TIFF file (*.tif, *.tiff) and PNG file (*.png).
[Clear] button	[Import drawing file] button*
(Zoom In) button	Zoom in and display.
(Zoom Out) button	Zoom out and display.
[Scale] button	Change the magnification of the background image. Select two points which form the reference within the image, and input the distance between the two points. The magnification of the background image is changed.
[Location] button	Move the background image.
(Left rotation) button	Rotate the background image 45° counterclockwise.
(Right rotation) button	Rotate the background image 45° clockwise.
[Rotation angle]	The background image can be rotated at any angle. Press the up and down buttons on the input box to track and rotate the background image.
[Reverse] button	Reverse the background image.
[Transparent] slide bar	The opacity of the background image can be set.

Monitoring tools

Item	Description
I/O monitoring	Displays the I/O monitoring panel. “I/O monitoring panel” (page 94)
Bank monitor	Displays the bank monitoring panel. “Bank monitoring panel” (page 95)
Background hold setting	 It is possible to perform background hold function after designated period of time. Startup delay time: After the startup delay time, background hold will begin. Hold time: Background hold will be active for the specified hold time. To start background hold, press start background hold button. “Background hold button” (Page 93)

Reference Use the [Monitoring tools] only during monitoring (when the [Monitor] tab is selected in the function selection panel).

Detection history tools

Item	Description
Read detection history from SZ-V	The detection history is retrieved from the SZ-V and displayed.
Clear detection history	Deletes the detection history. If [Multi-Frame/Video] is set for [Save format], deleting the history can only occur when logged in.
Open from file	Open a detection history file saved on the computer.
Save detection history to file	Opens the [Save detection history] dialog box. Save the detection history on the computer. “Saving detection history” (page 98)
Save detection history to CSV file	Opens the [Save detection history] dialog box. Save the detection history on the computer in CSV format. “Saving detection history” (page 98)
Show error history	Displays the [Error history] dialog box. “Error history” (page 98)

Reference Use the [Save detection history to file], [Save detection history to CSV file], and [Show error history] only when checking detection history (when the [Detection History] tab is selected on the function selection panel).

Communications

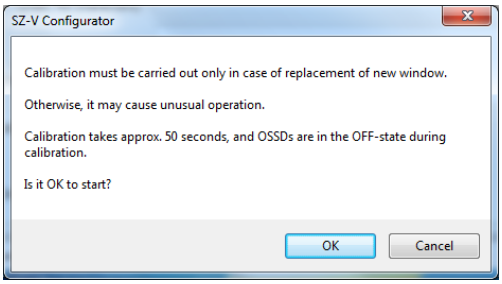
Item	Description
Read configuration from SZ-V	Retrieve configuration data from the connected SZ-V unit.
Transfer configuration to SZ-V	The SZ-V Configurator transfers configuration data from the computer to the SZ-V unit.
Verification	Check the configuration currently being edited against the configuration data on the SZ-V unit. The results are shown in the [Verification] window when matching is completed.
Window calibration	Execute calibration when changing the window. “Window calibration” (page 105)
Initialization	Return the SZ-V to its default settings. "Initialization” (page 105)
Clear system configuration	Delete the system memory connection history. “Clear system configuration” (page 106)
Identification & Maintenance (Only when PROFINET or PROFIsafe is selected with the SZ-V32N type)	The [Identification & Maintenance] dialog box appears. The identification information for the device can be read and written. “Identification & Maintenance” (page 106)
Connect to different SZ-V (For the SZ-V32N type only)	Displays the [Model selection] dialog box. Select the destination device. “Connecting to different SZ-V” (page 107)

Reference Check that the computer and the SZ-V Series unit are correctly connected first before using the Communications menu.

Window calibration

When replacing the window, it is necessary to calibrate the unit afterwards.

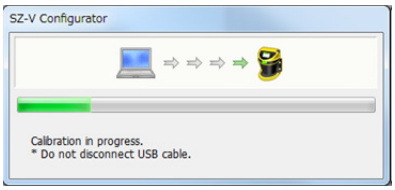
1. The dialog box to check execution of window calibration appears. Click the [OK] button.



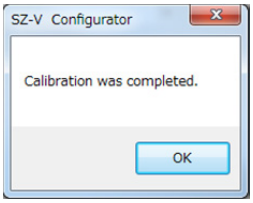
Reference When multiple scanner heads are cascaded, head selection dialog is shown.

2. If not logged into the SZ-V unit, the [Log-in] dialog box will appear. Select [Responsible Personnel] or [Maintenance Personnel] and enter the password to log in. “Log-in” (page 107)

3. The confirmation dialog box appears and window calibration is executed.



4. If window calibration completes normally, a confirmation dialog box appears. Click the [OK] button.

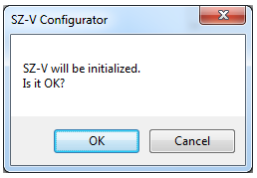


Reference Only the responsible personnel and maintenance personnel can execute window calibration.

Initialization

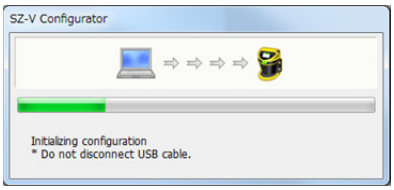
Restore the unit's settings to their factory default settings.

1. The initialization confirmation dialog box appears. Click the [OK] button.

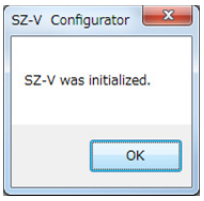


2. If not logged into the SZ-V unit, the [Log-in] dialog box will appear. Select [Responsible Personnel] and enter the password to log in. “Log-in” (page 107)

3. The following dialog box appears and initialization starts.



4. If initialization completes normally, a confirmation dialog box appears. Click the [OK] button.

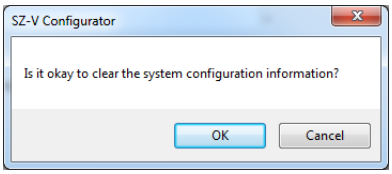


Reference Only the responsible personnel can reset the SZ-V.

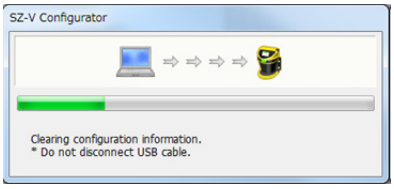
Clear system configuration

This procedure deletes the system memory and system configuration information for the Display unit and scanner head(s).

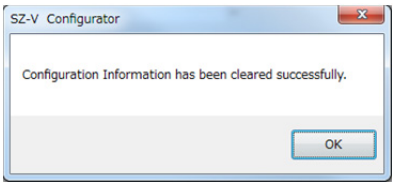
1. A dialog box to confirm that you want to clear system configuration information appears.
   Click the [OK] button.



2. If not logged into the SZ-V unit, the [Log-in] dialog box will appear. Select [Responsible Personnel] or [Maintenance Personnel] and enter the password to log in. “Log-in” (page 107)
3. The following dialog box appears and deletion of system configuration information starts.



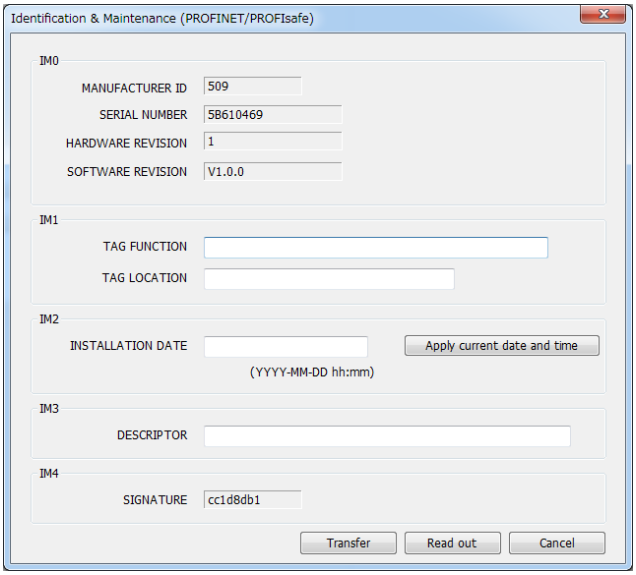
4. If the system configuration information is deleted normally, a confirmation dialog box appears. Click the [OK] button.



Reference Only the responsible personnel and maintenance personnel can clear system configuration information.

Identification & Maintenance

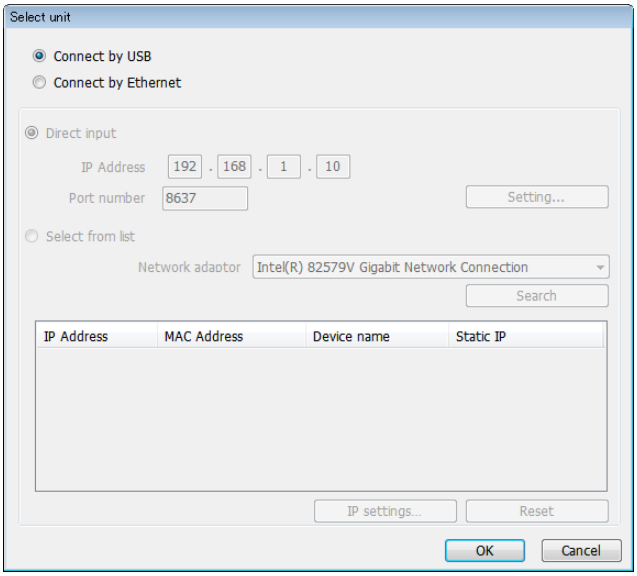
Identification & Maintenance displays the device information stored in SZ-V. When the SZ-V32N type is used, the device information can be read and written when PROFINET or PROFIsafe has been selected in Communication Protocol. The device information can be read and written from the [Identification & Maintenance] dialog shown below.



Item	Property	Description
IM0	R	Displays the hardware and firmware.
IM1	R/W	Enter the tag information.
IM2	R/W	The installation date information is written. Press the [Enter current date and time] button to input the current time.
IM3	R/W	Enter a comment.
IM4	R	Displays the signature information for the settings.
[Transfer] button	-	Transfers the device configuration information to SZ-V.
[Read out] button	-	Reads the device configuration information from the SZ-V.
[Cancel] button	-	The dialogs closes.

Reference Even if the configuration data such as zone setting is transferred to the SZ-V, the device information will not be transferred automatically. To transfer the device information from SZ-V Configurator, press the above [Transfer] button.

Connecting to different SZ-V



Item	Description
(Selecting a connection method)	Select the method to connect the SZ-V to the computer. ・ Connect by USB ・ Connect by Ethernet

When selecting Ethernet connection, it is necessary to set the Ethernet connection device.
For the setting method, see “Selecting an Ethernet connection device (for the SZ-V32N type only)” (page 68).

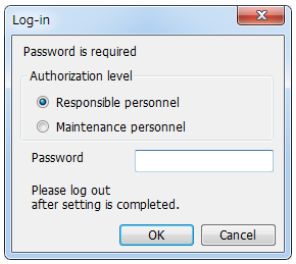
Log-in authentication

Item	Description
Log-in	The [Log in] dialog box appears. Log in to the SZ-V. This cannot be selected if already logged in to the SZ-V.
Log-out	This will log out of the SZ-V. This cannot be selected if already logged out of the SZ-V.
Password change	The [Password change] dialog box appears. This allows changing of the password for the SZ-V*1. This is only available when logged in to the SZ-V.
Lost Password	The [When you forget the password] dialog box appears. This can be used to reset the password for the SZ-V*1.
Enable/Disable maintenance personnel authorization level	Maintenance personnel authorization level can be enabled or disabled, or its password can be changed. Only responsible personnel can use this function.

*1 The default “Responsible Personnel” password is "1111".
There is no set default maintenance personnel password.
Log in as the responsible personnel to reset the password of maintenance personnel.
For the details about authorization level, see “Authorization Level and Settings” (page 71).

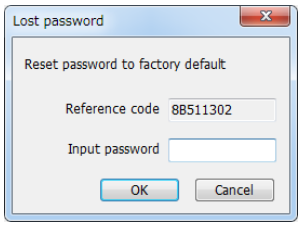
Reference Before selecting log in authentication, make sure that the computer and the SZ-V Series are properly connected.

Log-in



Item	Description
Authorization level	Displays what authorization level to log in with. ・ Responsible personnel ・ Maintenance personnel
Password	Enter the password.

Lost password



Item	Description
Reference code	The code is necessary to reset the password. Contact your nearest KEYENCE office with this code to receive a password initialization code.
Input password	Enter the password initialization code.

When the correct password initialization code is entered, the password is reset to the default setting.

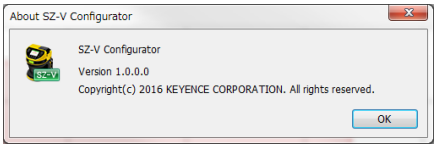
Language

The language used in the SZ-V Configurator can be changed.

Item	Description
Japanese	Change the language to Japanese.
English	Change the language to English.
Chinese	Change the language to Chinese.
Italian	Change the language to Italian.
German	Change the language to German.
French	Change the language to French.
Portuguese	Change the language to Portuguese.
Spanish	Change the language to Spanish.

Reference The SZ-V Configurator starts in the language selected here at the next restart.

Help

Item	Description
User's Manual	View the SZ-V User's Manual (this manual) as a PDF file.
Communication Manual	View the SZ-V32N Communication Manual. This menu is shown only when SZ-V32N Type is selected.
About SZ-V Configurator	This displays the version information for the SZ-V Configurator. 

8-11 Image of a printed document

Property			
Item			Setting
File name			Untitled_0219.szvd
Title / Department			
Responsible personnel			
Comments			

Information			
Item			Setting
Configuration transfer date/time			
Configuration Code (CRC)			
Software version			
Type			SZ-V32
Serial number	Display unit		
	Head1		
	Head2		
	Head3		

Basic settings			
Item			Setting
Safety configuration	Display unit	Number of heads	3
		PNP / NPN select	- select -
		Interlock	Automatic / Automatic
		EDM	Not used
Protection zone setting	Head1	Operating mode	Standard
		Minimum detectable object size	70mm (2.76in.)
		Scan cycle	Scan cycle A
		Response time	320ms
	Head2	Operating mode	Standard
		Minimum detectable object size	70mm (2.76in.)
		Scan cycle	Scan cycle B
		Response time	336ms
	Head3	Operating mode	Standard
		Minimum detectable object size	70mm (2.76in.)
		Scan cycle	Scan cycle C
		Response time	352ms
Warning zone settings	Head1	Minimum detectable object size	70mm (2.76in.)
		Response time	320ms
	Head2	Minimum detectable object size	70mm (2.76in.)
		Response time	336ms
	Head3	Minimum detectable object size	70mm (2.76in.)
		Response time	352ms

Advanced function			
Item			Setting
Reference points monitoring			Not used
Bank switching function			Not used
Warning zone B settings			Not used
Laser OFF input			Not used
MI Error Detecting Time			5 s

Wire color and assigned function			
Wire color			Assigned function
	Brown		+24V DC
	Blue		0V
	Black		OSSD1
	White		OSSD2
	Gray		AUX output 1: Not used
	Gray/Black		AUX output 2: Not used
	Yellow		Input 1: Reset input or Laser OFF input
	Red		Input 2: EDM input
	Light blue		Input 3: Not used
	Light blue/Black		Input 4: Not used
	Yellow/Black		Input 5: Not used
	Red/Black		Input 6: Not used
	Orange		Input 7: Not used
	Orange/Black		Input 8: Not used
	Pink		Input 9: Not used
	Pink/Black		Input 10: Not used
	Green		AUX output 3: Not used
	Green/Black		AUX output 4: Not used

Others			
Item			Setting
AUX	Display unit	State information output	Not used
		AUX1	Not used
		AUX2	Not used
		AUX3	Not used
		AUX4	Not used
Others	Display unit	Power saving mode	Not used
		Camera blur	Not used
Detection history setting	Display unit	Saving mode	Single Frame/Photo

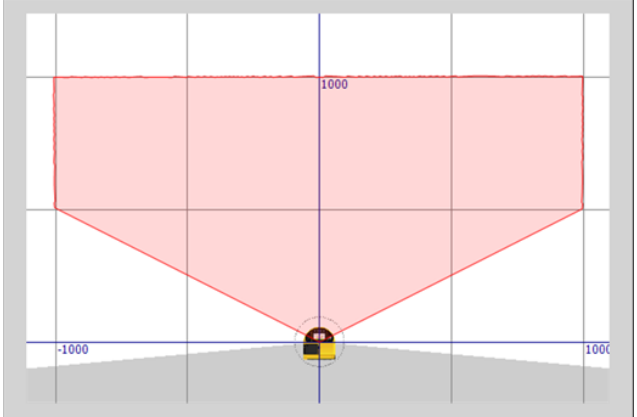
Communication setting			
Item			Setting
Communication setting		Communication protocol	PROFINET
		Endianness	Little-endian
		Measured value stabilization filter	None
	Diagnostics	Window Pollution Error or Alert	ON
		MI Error	ON
		Configuration Error	ON
		System Error	ON
		AUX Error	ON
		EDM Error	ON
		OSSD Error	ON
		Other Error	ON
		Other Alert	ON
Ethernet common setting		IP setting	Static IP
		IP address	192.168.0.1
		Subnet mask	255.255.255.0
		Default gateway	0.0.0.0
		Device name	test
	Advanced setting	TCP port number	8637
		UDP command port number	8800
		Keep-alive time	90 s
		Time-out period	10 s

Explanatory note

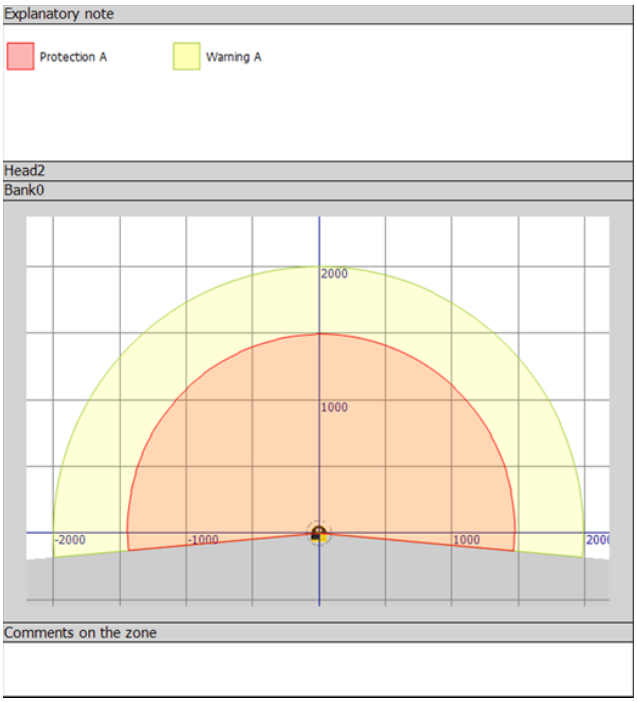
Protection A Warning A

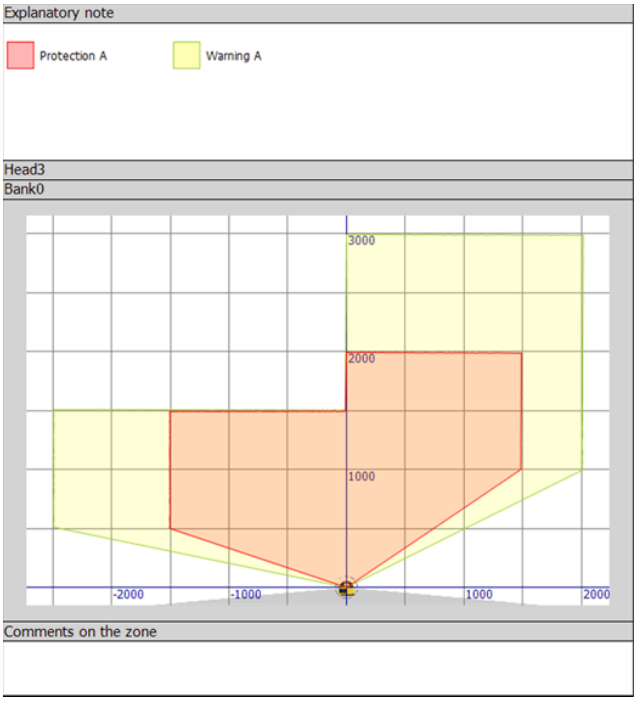
Head1

Bank0



Comments on the zone

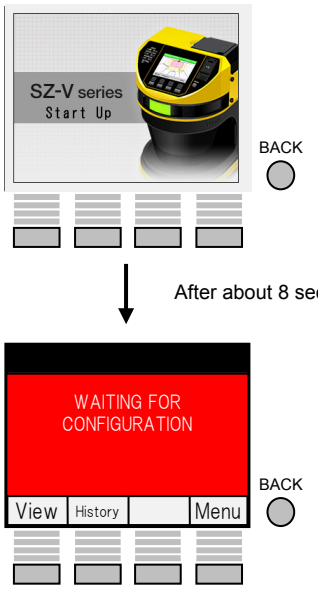

Explanatory note
Protection A
Warning A
Head2
Bank0
2000
1000
-2000
-1000
1000
Comments on the zone


Explanatory note
Protection A
Warning A
Head3
Bank0
3000
2000
1000
-2000
-1000
1000
2000
Comments on the zone

9. Operating the SZ-V

9-1 Turning On Power for the First Time

When the SZ-V starts for the first time, the following screens are displayed:



When “Waiting for configuration” appears, configure the settings from the SZ-V Configurator. “Setting Procedure” (page 73)

Important

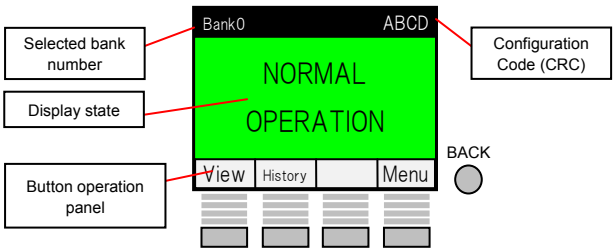
- **The SZ-V cannot perform normal operations with the factory default settings. Password input and configuration are required to start normal operation. To set the SZ-V functions, use the SZ-V configuration software. Function cannot be set directly on the SZ-V.**
- **Until the settings have been configured, OSSD will remain in the OFF State.**

9-2 How to Read the SZ-V Display

How to Read the Display

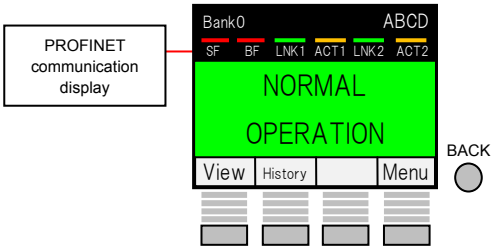
The display can be switched between three types of displays.
For details on how to switch the display, see "Switching the Display (View)" (page 114).

How to read the state on the display



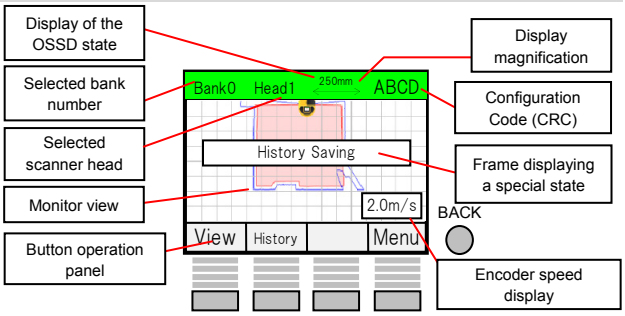
Name	Description
Selected bank number	Displays the selected bank number when using the bank switching function. ・ When using independent bank switching, the bank number is displayed as two digits (for example, Bank0-0).
Configuration Code (CRC)	Displays the Configuration Code (CRC) of the current settings. “Configuration Code (CRC)” (page 66)
Display state	Displays the status of the SZ-V. For details on the display, see "Information on the Display” (page 136). Background color is green: OSSD is ON Background color is red: OSSD is OFF
Button operation panel	Indicates the behavior when buttons 1 to 4 are pressed. For the meaning of each button operation, see the following: ・ “Switching the Display (View)” (page 114) “ ・ Operating the Menu (Menu)” (page 115) ・ “Displaying the Detection History” (page 97) ・ “Display When an Error Occurs (Error/Alert)“ (page 121)

■ When using PROFINET/PROFIsafe



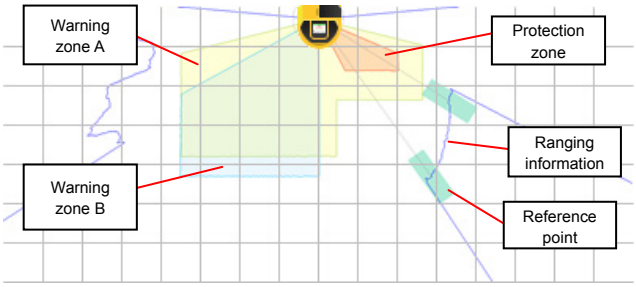
Name	Color/Status	Description
SF	Red (ON)	An error has occurred in the SZ-V.
	OFF	Normal operation.
BF	Red (ON)	An error has occurred with the Ethernet communication.
	Red (Flashing)	Receiving a FLASH signal.
	OFF	Normal operation.
LNK1 (2)	Green (ON)	Ethernet cable is connected to port 1 (2).
	OFF	Ethernet cable is not connected to port 1 (2).
ACT1 (2)	Orange (Flashing)	Communicating on port 1 (2).
	Off	Not communicating on port 1 (2).

How to read the monitor view on the display



Name	Description
Selected bank number	Displays the selected bank number when using the bank switching function. ・ When using independent bank switching, the bank number is displayed as two digits (for example, Bank01).
Selected scanner head number	Displays the number of the currently selected scanner head.
Display magnification	Displays the current magnification of the display. There are five levels of display magnification.
Configuration Code (CRC)	Displays the Configuration Code (CRC) of the current settings. “Configuration Code (CRC)” (page 66)
Display of the OSSD state	Background color is green: OSSD is ON Background color is red: OSSD is OFF
Frame displaying a special state	Message for a special state, such as interlock-reset-ready, flashes on the display. The frame is only displayed for a special state. “Information on the Display” (page 136)
Monitor view	Draws the detection zone of the selected scanner head. When using the bank switching function, the selected bank zone is drawn.
Encoder velocity display	When the bank switching method is switching through encoder input, this is displayed as the encoder velocity (unit: m/s).
Button operation panel	Indicates the behavior when buttons 1 to 4 are pressed. For the meaning of each button operation, see the following: ・ “Switching the Display (View)” (page 114) ・ “ ・ Operating the Menu (Menu)” (page 115) ・ “Displaying the Detection History” (page 97) ・ “Displaying the Detection History” (page 120) ・ “Display When an Error Occurs (Error/Alert)” (page 121)

■ Monitor view

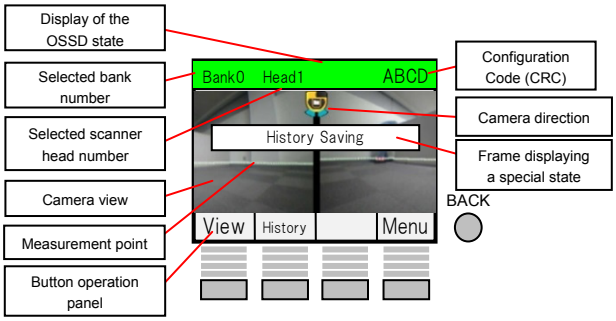


Name	Description
Protection zone A/B	Displays the set protection zone*.
Warning zone A	This is shown if Warning Zone A is set.
Warning zone B	This is shown if Warning Zone B is set.
Ranging information	This shows the ranging result of the SZ-V Series in real time. (Displayed in blue)
Reference point	Displays a set reference point.

*In the muting state, the protection zone excluding the muting zone is displayed.

Reference Even if it looks like an object is not detected on the monitor view, a person or an object may actually be detected.

How to read the camera view



Name	Description
Selected bank number	Displays the selected bank number when using the bank switching function. ・ When using independent bank switching, the bank number is displayed as two digits (for example, Bank01).
Selected scanner head number	Displays the number of the currently selected scanner head.
Configuration Code (CRC)	Displays the Configuration Code (CRC) of the current settings. “Configuration Code (CRC)” (page 66)
Display of the OSSD state	Background color is green: OSSD is ON Background color is red: OSSD is OFF
Frame displaying a special state	Message for a special state, such as interlock-reset-ready, flashes on the display. The frame is only displayed for a special state. “Information on the Display” (page 136)
Camera view	Displays the camera image of the selected scanner head.
Measurement point	Overlays the position of the measurement laser on the camera image. Measurement point is red: An object is detected in the protection zone. Measurement point is green: An object is detected outside of the protection zone.
Camera direction	Displays the direction of the camera with an icon. Default setting: Center display camera, mirror display ON
Button operation panel	Indicates the behavior when buttons 1 to 4 are pressed. ・ “Switching the Display (View)” (page 114) “ ・ Operating the Menu (Menu)” (page 115) ・ “Displaying the Detection History” (page 120) ・ “Display When an Error Occurs (Error/Alert)” (page 121)

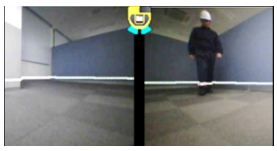
Reference The color of the measurement point changes based on whether an object is detected in the protection zone, regardless of the muting or override states.

■ Camera direction

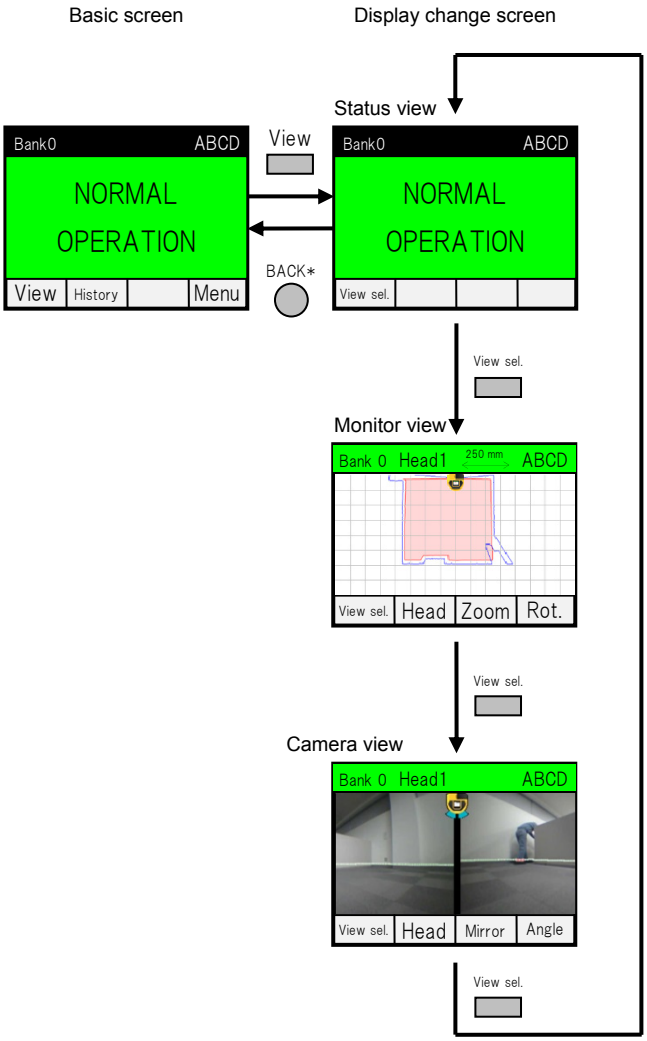
Indicates whether the displayed camera and mirror display are on or off.

Icon	Display Camera	Mirror display	Description
	Left camera	Off	Displays the left camera image.
	Right camera	Off	Displays the right camera image.
	Center	Off	Displays both the left and right camera images.
	Left camera	On	Displays the left camera image in reverse.
	Right camera	On	Displays the right camera image in reverse.
	Center	On	Displays both the left and right camera images in reverse.

Mirror display

Mirror display OFF	Mirror display ON
	
Does not display the camera image in reverse. This is best suited for when the Display unit and scanner head are facing the same direction.	Displays the camera image in reverse. This is best suited for when the Display unit and scanner head are facing the opposite direction.

9-3 Switching the Display (View)



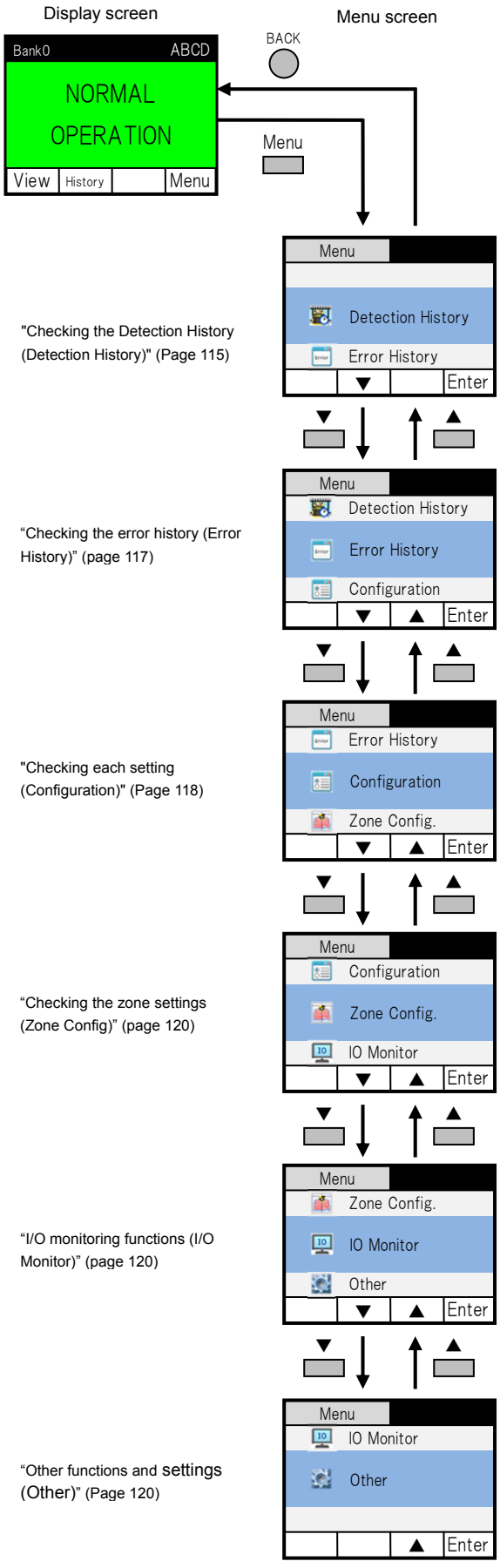
* Also goes back to basic screen when there was no operation for more than 10 seconds.

Item	Operation details
[View.] button	Transition from the basic screen to the display change screen.
[View sel.] button	Switch between display state, monitor view, and camera view.
[Head] button	Switch the displayed scanner head. Displayed only when scanner heads have been expanded. Scanner head 1→ 2 → 3 → 1
[Zoom] button	Zoom in on the display. There are 5 levels of zoom.
[Rot.] button	Switches the display direction in increments of 90°.
[Mirror] button	Switch the mirror display on and off. Default setting: Off
[Angle] button	Switch the camera view direction. Center → left camera → right camera → center Default setting: Center

"How to read the monitor view on the display" (page 112)
"How to read the camera view" (page 113)

Reference
- The display state is displayed as the default setting. After starting the SZ-V for the second time, the last item displayed during the last start-up is displayed.
- The camera view can only be selected when using a scanner head type with a camera.

9-4 Operating the Menu (Menu)

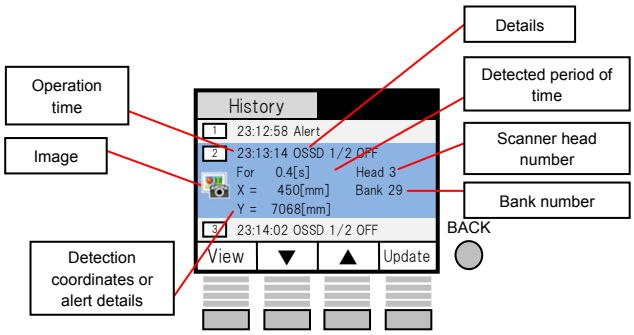


Select items with the ▼ or ▲ buttons and use the Enter button to select them.

Checking the Detection History (Detection History)

Displays the detection history in order. The history is displayed in order from the newest item.

However, if [First 10] is selected for the [Save format] in the detection history settings, the oldest item is displayed first. “Detection history” (page 82)



Item	Description
Operation time	Indicates the time an event occurred. The displayed time is the time from when the SZ-V power was turned on until the event occurred.
Details	Displays the details of the detected event.

Detection in the protection zone	
OSSD 1/2 OFF	OSSD 1/2 is OFF
OSSD 3/4 OFF	OSSD 3/4 is OFF
Ref. Point (1/2)	The reference points are not detected in Protection Zone A
Ref. Point (3/4)	The reference points are not detected in Protection Zone B
Detection in the warning zone	
Warn. Zone A	Detection in Warning Zone A.
Warn. Zone B	Detection in Warning Zone B.
Alert	
Alert	An alert is occurring.

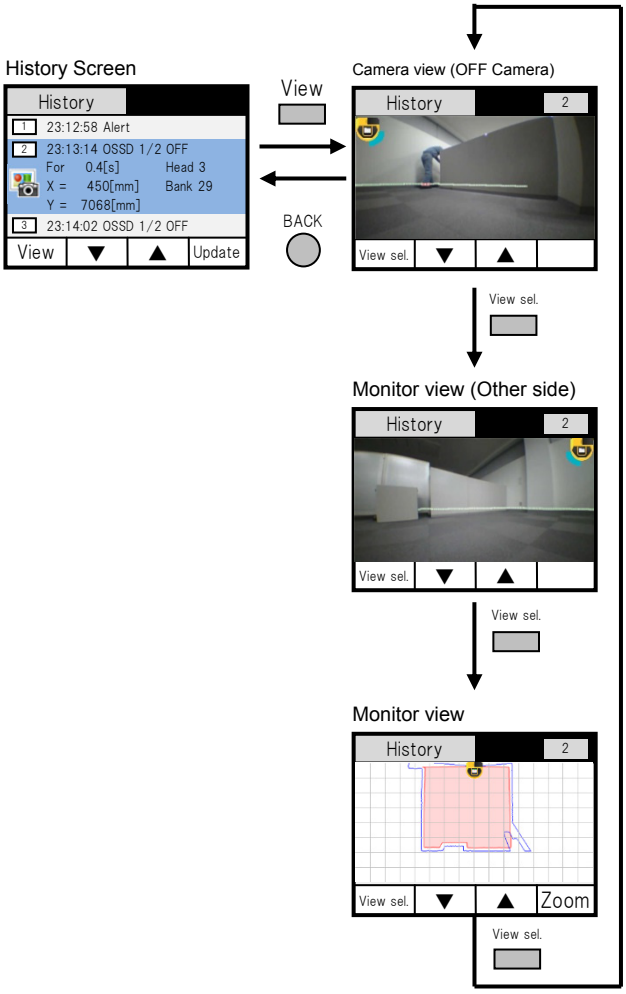
Detected time	Displays the duration (seconds) of the event.
Scanner head number	Displays the scanner head that detected the event. Nothing is displayed if an event is not related to the scanner head.
Detection coordinates	Displays the position coordinates if a person or object is detected in the protection zone or warning zone.
Alert details	Displays the details of the alert. “Alert State” (page 135)
Bank number	Displays the selected bank when an event occurs when using the bank switching function.
Image	Displays an icon when a video or photo is being saved. A video of two seconds before and after the moment the event occurred A photo of the moment the event occurred is being saved. “Checking detection images and video in the protection zone on the SZ-V” (page 116)
[View] button	Check the details of a saved video or photo. “Checking detection images and video in the protection zone on the SZ-V” (page 116)
[▼] button	Displays the next detection history item down.
[▲] button	Displays the next detection history item up.
[Update] button	Refreshes the detection history. Refresh and display events that occurred while the detection history is displayed.

Reference Check up to 100 detection history items on the SZ-V. To see a detection history item older than the 100th item, you can check it on the SZ-V Configurator. “Checking the Detection History” (page 97)

Checking detection images and video in the protection zone on the SZ-V

Easily check detection images or videos of when a detection occurs in the protection zone.
Only photos and videos of events when detection occurs in the protection zone are saved. Photos and videos when detections or alerts occur in the warning zone are not saved.

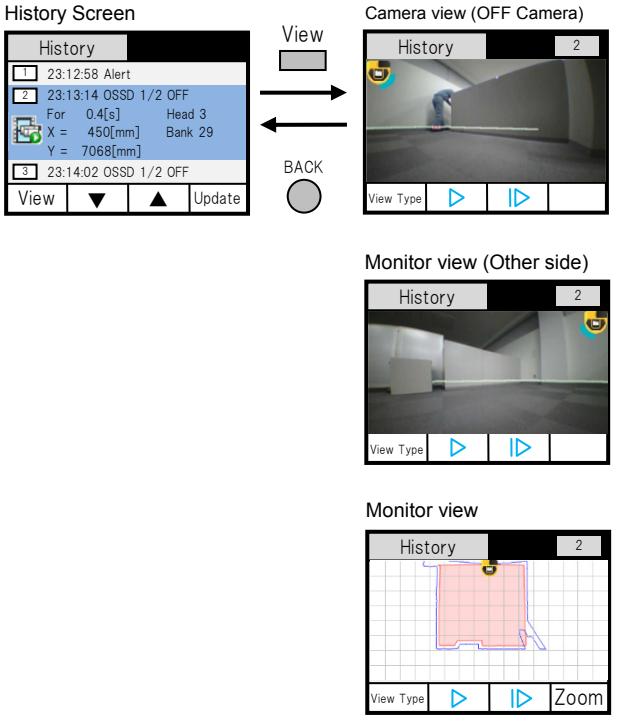
■ For Single frame mode/Photos



Item	Description
[▼] button	Display previous image.
[▲] button	Display next image.
[Zoom] button	Zoom (enlarge) the screen. (The zoom are 5 steps)

Reference Display camera images can only be displayed when using a scanner head that has a camera.

■ For Multi-frame mode/Videos

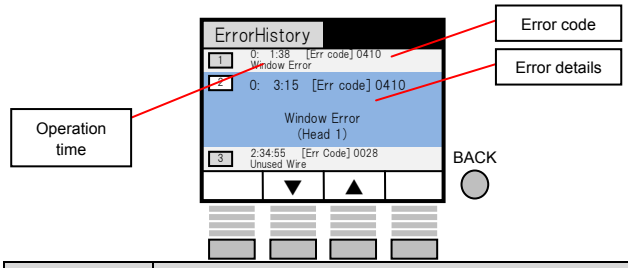


Item	Description
[View Type] button	Change the display. If the [View Type] button is pressed, the menu changes as follows and a display can be selected. [ ] [ ] [Line] [ ] button Switch to the right camera view. [ ] button Switch to the left camera view. [Line] button Switch to the monitor view.
[▷] button	Play the video.
[▷|] button	Play the video frame-by-frame.
[Zoom] button	Zoom in on the display. There are 5 levels of zoom.

Reference
- Camera images can only be displayed when using a scanner head that has a camera. If the bank is switched during the video, the protection zones, warning zones, and reference points are also switched and displayed.

Checking the error history (Error History)

Displays the error history. The history is displayed in order from the newest item.

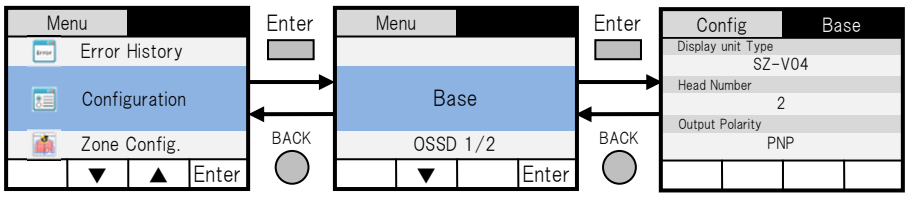


Item	Description
Operation time	Indicates the time an event occurred. The displayed time is the time from when the SZ-V power was turned on until the event occurred.
Error code	Displays the code that indicates the error.
Error details	Displays the details of the error.

Checking each setting (Configuration)

Check each setting from the display.
Settings cannot be checked when SZ-V is under waiting for configuration status. In that case, the display will show “Waiting for Configuration”.

Reference
- With the exception of some items, such as the display brightness, settings cannot be changed on the SZ-V. To change the settings, use the SZ-V Configurator. “Configuring the settings” (page 74)
- The bank sequence monitoring settings cannot be viewed from the SZ-V. Check them in the SZ-V Configurator.



Select items with the ▼ or ▲ buttons and use the Enter button to select them.

Base

Check the basic settings.

Display unit Type
Displays the selected Display unit model.

Head Number
Displays the number of scanner heads that are connected. (1 to 3).

PNP/NPN Select
Displays the Selection of PNP or NPN settings. (PNP, NPN)

OSSD 1/2

Check the OSSD 1/2 settings.

Start Interlock
Displays the interlock settings when OSSD 1/2 starts.

Restart Interlock
Displays the interlock settings when OSSD 1/2 restarts.

ON-delay [s]
Displays the OSSD 1/2 interlock on-delay setting time.

EDM
Displays the OSSD 1/2 EDM settings.

EDM Delay Time [s]
Displays the OSSD 1/2 EDM time settings.

OSSD 3/4

*** When using the SZ-V04 or when PROFIsafe communication is used with the SZ-V32N**

Check the OSSD 3/4 settings.

Start Interlock
Displays the interlock settings when OSSD 3/4 starts.

Restart Interlock
Displays the interlock settings when OSSD 3/4 restarts.

ON-delay [s]
Displays the OSSD 3/4 interlock on-delay setting time.

EDM
Displays the OSSD 3/4 EDM settings.

EDM Delay Time [s]
Displays the OSSD 3/4 EDM time settings.

Protection Zone A Head 1

Check the Protection Zone A settings for the first scanner head.

Detectable Object Size
Displays the minimum detectable object settings.

Response Time [ms]
Displays the response time settings.

Operating Mode
Displays the mode selection settings.

Scan Cycle
Displays the scan cycle settings.

Protection Zone B Head 1

Check the Protection Zone B settings for the first scanner head.

Warning Zone A Head 1

Check the Warning Zone A settings for the first scanner head.

Detectable Object Size
Displays the minimum detectable object settings.

Response Time [ms]
Displays the response time settings.

Warning Zone B Head 1

Check the Warning Zone B settings for the first scanner head.

Protection Zone A Head 2

Check the Protection Zone A settings for the second scanner head.

Protection Zone B Head 2

Check the Protection Zone B settings for the second scanner head.

Warning Zone A Head 2

Check the Warning Zone A settings for the second scanner head.

Warning Zone B Head 2

Check the Warning Zone B settings for the second scanner head.

Protection Zone A Head 3

Check the Protection Zone A settings for the third scanner head.

Protection Zone B Head 3

Check the Protection Zone B settings for the third scanner head.

Warning Zone A Head 3

Check the Warning Zone A settings for the third scanner head.

Warning Zone B Head 3

Check the Warning Zone B settings for the third scanner head.

Multi-OSSD

*** When using the SZ-V04 or when PROFIsafe communication is used with the SZ-V32N**

Check the settings for the multi-OSSD function.

Multi-OSSD
Displays whether the multi-OSSD function is used or not.

OSSD 1/2 Head Assign
Displays the scanner head(s) for ON/OFF of OSSD 1/2.

OSSD 3/4 Head Assign
Displays the scanner head(s) for ON/OFF of OSSD 3/4.

Bank

Check the bank switching settings.

Bank Input Type
Displays the settings for the bank switching method.

Number of Banks
Displays the number of banks that are being used.

Bank Transition Time
Displays the settings for the bank transition time.

Bank Sequence Monitor
Displays the settings for the bank sequence monitoring function.

Laser Shutdown Bank No.
Displays the laser shutdown bank settings for the operation check function.

Independent Bank Switching
Displays whether the independent bank switching function is used or not.

Encoder

Check the encoder settings.

Number of Input Banks
Displays the number of banks that can be switched through the input for the single input method.

Number of Velocity Banks
Displays the number of banks that can be switched through the encoder input (velocity).

Allowed Difference [%]
Displays the allowable error settings.

Allowed Difference Time [s]
Displays the detection time tolerance settings.

Ch1 [pulses/mm]
Displays the settings for the number of pulses per millimeter for Encoder 1.

Ch2 [pulses/mm]
Displays the settings for the number of pulses per millimeter for Encoder 2.

Encoder Velocity

Check the encoder velocity settings.

Muting

Check the muting settings.

Period of Time between Inputs
Displays the settings for the time between muting inputs.

Input Sequence
Displays the settings for the muting input sequence.

Max. Muting Period
Displays the settings for the Maximum muting period of time.

Muting Lamp Failure
Displays operation settings when a muting lamp failure occurs.

Max. Override Period
Displays the maximum override time settings.

Function

Check the settings for other functions.

Reference Point Monitoring
Displays whether the reference point monitoring function is used or not.

Laser Off Input
Displays whether laser off input is used or not.

MI Error
Displays the MI error detection time settings.

AUX

Check the AUX output (non-safety output) settings.
*Depending on the model and functions used, the number of AUX outputs that can be used differs.
“AUX Output” (page 46)

AUX 1
Displays the function assigned to the AUX 1 output.

AUX 2
Displays the function assigned to the AUX 2 output.

AUX 3
Displays the function assigned to the AUX 3 output.

AUX 4
Displays the function assigned to the AUX 4 output.

AUX 5
Displays the function assigned to the AUX 5 output.

AUX 6
Displays the function assigned to the AUX 6 output.

State Information

Check the state information output settings.

State Information
Displays whether the state information output is used or not.

Pulse width
Displays the output pulse width when the state information output is used.

Display setting

Check display related settings.

Power saving mode
Displays the power saving mode settings.

Camera blur *Displayed only when a scanner head with camera is used.
Displays the blur settings for saved images.

Detection History

Check the detection history settings.

Saving Mode
Displays the settings for whether to save as a single frame mode or as a multi-frame mode.

First/Last Select
Displays the settings for the save sequence when save mode is multi-frame mode..

Ethernet Function *SZ-V32N type only

Check the Ethernet connection settings.

Protocol
Displays the protocol settings in use.

Endianness
Displays the endianness settings in use.

Measured Value Filter
Displays the filter settings for measured distance data.

IP setting *SZ-V32N type only

Check the IP address settings.

IP setting
Displays the settings for the method to assign IP addresses.

IP Address
Displays the IP address.

MAC Address
Displays the MAC address.

Subnet mask
Displays the subnet mask settings.

Default Gateway
Displays the default gateway settings.

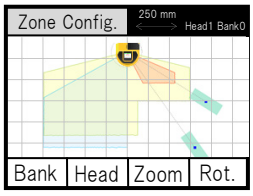
Device Name *SZ-V32N type only

Check the device name settings on the network.

Device Name
Displays the device name.

Checking the zone settings (Zone Config)

Check the settings for the currently set zones.

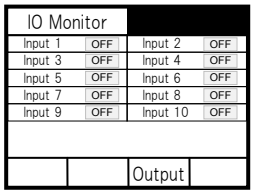


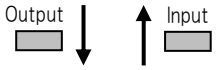
Item	Operation details
[Bank] button	Switch the displayed bank. Displayed only when the bank switching function is used. Bank 0 → Bank 1 → ... → Bank 31 → Bank 0
[Head] button	Switch the displayed scanner head. Displayed only when the scanner heads have been expanded. Scanner head 1→ 2 → 3 → 1
[Zoom] button	Zoom in on the display. There are 5 levels of zoom.
[Rot.] button	Switches the display direction in increments of 90°.

I/O monitoring functions (I/O Monitor)

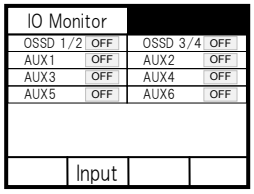
This shows the state of input and output wires.

Input





Output



Display	State
ON	Input (output) is ON.
OFF	Input (output) is OFF.

Reference When using the state information output, "AUX1&2: State Information" is displayed in the AUX1/AUX2 field. ON/OFF information is not displayed.

Other functions and settings (Other)

Display Brightness

Set 5 levels of screen brightness.

Restart Request

Restart the SZ-V. This operation is the same as when you turn on the SZ-V power again.

9-5 Displaying the Detection History (History)

Displays the detection history. The content displayed is the same as when selecting detection history in the menu.
“Checking the Detection History (Detection History)” (page 115)

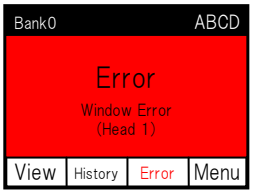
9-6 Display When an Error Occurs (Error/Alert)

When an error or alert occurs, find out the details on the display.

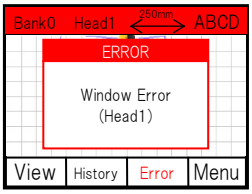
Display on the SZ-V when an error or alert occurs

Display on the SZ-V when an error occurs

Status view

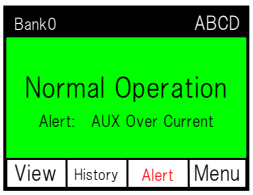


Monitor view or Camera view

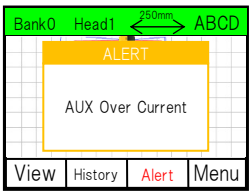


Display on the SZ-V when an alert occurs

Status view



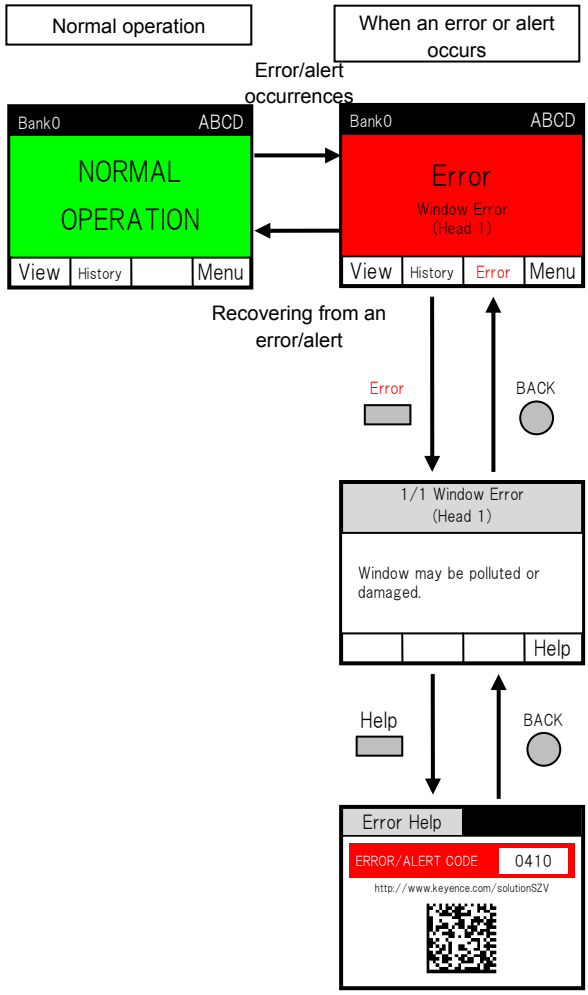
Monitor view or Camera view



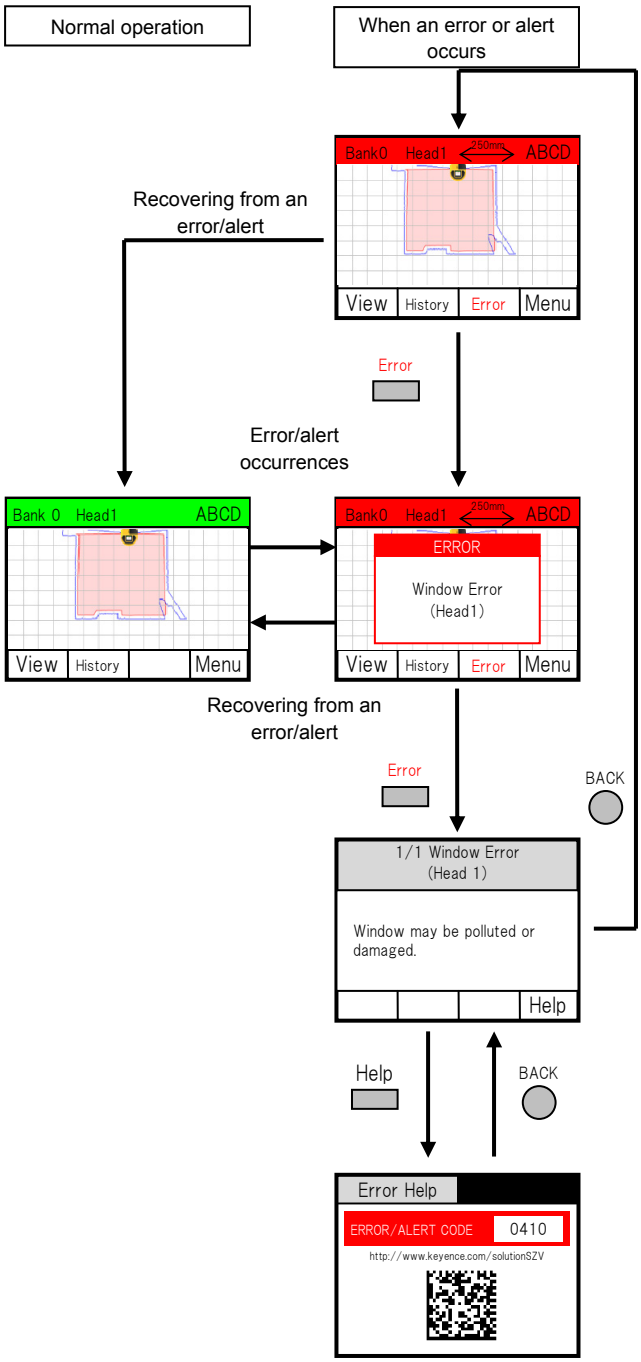
Reference If multiple errors occur at the same time, the detail on the error with the highest level of priority is displayed.

Screen transition when an error occurs

From display state



From monitor view or camera view



Reference
- The SZ-V recovers automatically from an alert when the cause of the alert disappears. For details, see “Alert State” (page 135).
- Depending on the type of error, it may be necessary to turn the power OFF and ON to recover from the error. For details, see “Error State” (page 135).
- If an alert occurs, [ALERT] is displayed instead of [ERROR].If 30 seconds passes and the SZ-V has not recovered from the error or alert, the display will automatically return to the details of the error or alert.

9-7 Other Functions and Operations

Key lock

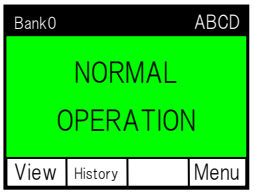
This function locks the SZ-V buttons to prevent incorrect operation.

Enabling key lock

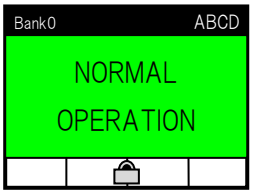
Holding down the furthest left button on the Display unit (button 1) and the furthest right button (button 4) simultaneously for more than 3 seconds, enables the key lock function.

Using the following screen as an example, hold down MENU and VIEW simultaneously for more than 3 seconds.

Normal state



Key lock state

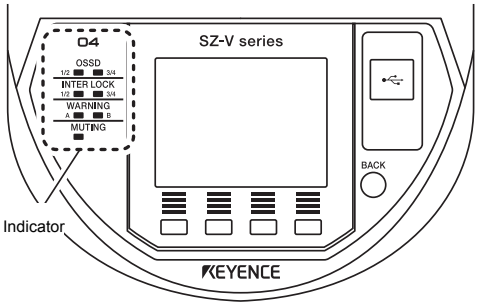


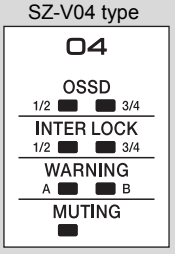
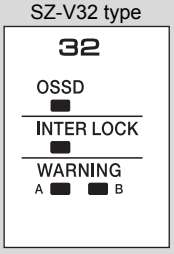
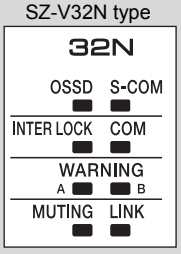
Disabling key lock

In the same manner as enabling key lock, holding down the furthest left button on the Display unit (button 1) and the furthest right button (button 4) simultaneously for more than 3 seconds, disables the key lock function.

9-8 How to Read the indicators

Display unit indicators



	SZ-V04 type	SZ-V32 type	SZ-V32N type
			
1	OSSD 1/2 indicator	OSSD indicator	OSSD indicator *1
2	OSSD 3/4 indicator	None	S-COM indicator *2
3	Interlock 1/2 indicator	Interlock indicator	Interlock indicator
4	Interlock 3/4 indicator	None	COM indicator
5	Warning zone indicator A	Warning zone indicator A	Warning zone indicator A
6	Warning zone indicator B	Warning zone indicator B	Warning zone indicator B
7	Muting indicator	None	Muting indicator
8	None	None	Link indicator

*1 Always off when PROFIsafe is used.

*2 Always off when PROFIsafe is not used.

■ **OSSD indicator**

Light color	Status	Details
Green	ON	OSSD 1/2 (3/4) is in the ON-state
Red	ON	OSSD 1/2 (3/4) is in the OFF-state
	Flashing	Error State
--	OFF	Power OFF state

For details on OSSD, see “OSSD” (page 44).

■ **Interlock indicator**

Light color	Status	Details
Yellow	ON	OSSD 1/2 (3/4) is in the interlock state
	Flashing	OSSD 1/2 (3/4) is in the interlock-reset-ready state
--	OFF	Other states

For details, see “Interlock function” (page 47).

■ **Warning zone indicator A (B)**

Light color	Status	Details
Orange	ON	Object or person detected in Warning Zone A (B)
--	OFF	Other states

■ **Muting indicator**

Light color	Status	Details
Orange	Flashing	The SZ-V is currently in a muted or override state
--	OFF	Other states

■ **S-COM indicator**

Light color	Status	Details
Green	ON	PROFIsafe communications are established
	Flashing	PROFIsafe user acknowledge
Red	ON	F-Parameter error
	Flashing	PROFIsafe passivation
--	OFF	Other states

■ **COM indicator**

Light color	Status	Details
Yellow	ON	PROFINET, EtherNet/IP or UDP data communication is established
--	OFF	Other states

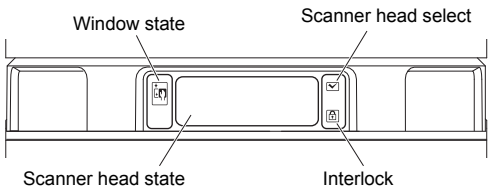
For details on Ethernet communications, see “Monitoring Using Communications” (page 100).

■ **Link indicator**

Light color	Status	Details
Orange	ON	Ethernet communication is established
	Flashing	Transmitting data
	Flashing slowly	Connected to the SZ-V Configurator
--	OFF	Other states

For details on connecting by Ethernet, see “Selecting an Ethernet connection device (for the SZ-V32N type only)” (page 68).

Scanner head indicators



■ **Window state indicator**

Light color	Status	Details
Orange	ON	This scanner head is in a window alert state or a window error state
--	OFF	Other states

■ **Scanner head state indicator**

Light color	Status	Details
Green	ON	The protection zone or warning zone for this scanner head is in a non-detection state
	Flashing slowly	In Simulation mode, the simulation zone is in a non-detection state “Simulation mode” (page 90) While dynamic drawing, the zone being edited is in an object non-detection state “Dynamic drawing function” (page 89)
Orange	ON	The protection zone for this scanner head is in a non-detection state but the warning zone is in a detection state
	Flashing	Muted or override condition
	Flashing slowly	While dynamic drawing, the dynamic drawing sheet is in a detection state “Dynamic drawing function” (page 89)
Red	ON	The protection zone for this scanner head is in a detection state
	Flashing	Error State
	Flashing slowly	In Simulation mode, the simulation zone is in a detection state “Simulation mode” (page 90) While dynamic drawing, the zone being edited is in an object detection state “Dynamic drawing function” (page 89)
--	OFF	• Power is OFF • During start-up • Setting from SZ-V Configurator • No operation for more than 30 seconds in Power Saving Mode.

■ **Scanner head selection indicator**

Light color	Status	Details
Orange	ON	• When checking the operation of this scanner head from the SZ-V Configurator or when checking the settings • When monitor view or camera view of this scanner head is displayed on the display unit.
--	OFF	Other states

■ **Interlock indicator**

Light color	Status	Details
Yellow	ON	Interlock condition
	Flashing	Interlock-reset-ready
--	OFF	Other states

10. Specifications

10-1 Models

SZ-V

Standard models

SZ-V32NX
(1)
(2)
(3)
(4)

(1)	Basic designation		
(2)	Number of banks	04:	4 Banks
		32:	32 Banks
(3)	Network	blank:	Without network connection capability
		N:	With network connection capability
(4)	Camera	blank:	Without camera
		X:	With Camera

DisplayDisplay unit model

SZ-VU32N
(1)
(2)
(3)

(1)	Basic designation		
(2)	Number of banks	04:	4 Banks
		32:	32 Banks
(3)	Network	blank:	Without network connection capability
		N:	With network connection capability

Scanner head model

SZ-VH1X
(1)
(2)
(3)

(1)	Basic designation		
(2)	Scanner head model number		
(3)	Camera	blank:	Without camera
		X:	With Camera

Cable

Connector free type

SZ-VP5
(1)
(2)
(3)

(1)	Cable type	P: Power cable
		S: Connection cable
(2)	Cable length	Example) 005: 0.05 m

Others

System memory

SZ-VSM

Window for replacement

SZ-VHW

Specifications

Model Name				SZ-V04(X)	SZ-V32(X)	SZ-V32N(X)
Type				Multi-function Type	Multi-bank Type	Network Type
Detection capability	Minimum detectable object size			Diameter 20, 30, 40, 50, 70, 150 mm (depends on the setting) Reflectance 1.8 % min., Speed 1.6 m/s max. *1		
	Detectable angle			190° (-5° to 185°)		
	Response time (ON to OFF)	Standard Mode *2	Scan Cycle A	160ms (2scans) to 1280ms (16scans) *3		
			Scan Cycle B	168ms (2scans) to 1344ms (16scans) *3		
			Scan Cycle C	176ms (2scans) to 1408ms (16scans) *3		
		High Speed Mode *2	Scan Cycle A	80ms (2scans) to 640ms (16scans) *3		
			Scan Cycle B	84ms (2scans) to 672ms (16scans) *3		
			Scan Cycle C	88ms (2scans) to 704ms (16scans) *3		
	Response time (OFF to ON)			Response time (ON to OFF) + 150 ms		
	Protection zone	Minimum detectable object size: 70 / 150 mm		8.4m (Standard Mode) 5.7m （High Speed Mode）		
		Minimum detectable object size: 50 mm		5.6m (Standard Mode) 3.8m (High Speed Mode)		
		Minimum detectable object size: 40 mm		4.3m (Standard Mode) 2.9m (High Speed Mode)		
		Minimum detectable object size: 30 mm		2.9m (Standard Mode) 2.0m (High Speed Mode)		
		Minimum detectable object size: 20 mm		1.6m (Standard Mode) 1.1m (High Speed Mode)		
	Warning zone	Minimum detectable object size: 70 / 150 mm		26m (Standard Mode) 23m (High Speed Mode) *4		
		Minimum detectable object size: 50 mm		25m (Standard Mode) 21m (High Speed Mode) *4		
		Minimum detectable object size: 40 mm		24m (Standard Mode) 20m (High Speed Mode) *4		
		Minimum detectable object size: 30 mm		23m (Standard Mode) 18m (High Speed Mode) *4		
		Minimum detectable object size: 20 mm		21m (Standard Mode) 15m (High Speed Mode) *4		
	Additional safety distance			100mm *5		
	Maximum measurement distance			60m *6		
Maximum number of banks				Max 4 banks	Max 32 banks	Max 32 banks
Multiple scanner heads				Max 3		
Monitor camera				Monitor area: over 190° (-5° to 185°) *7		
Display				QVGA 2.2inch color LCD		
Light source	Type, wavelength			Infrared laser diode, 905 nm		
	Laser Class		IEC	Class1 IEC / EN60825-1		
			FDA	Class1 FDA 21CFR 1040.10, 1040.11 (Laser Notice No.50) *8		
			JIS	Class1 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			11.8W (without load), 55.0W (with load) *9	11.8W (without load), 55.0W (with load) *9	13.4W (without load), 50.8W (with load) *9
Control Output (OSSD)	Output			Transistor outputs (NPN or PNP is selected by the dedicated PC software)		
	Number of outputs			4 outputs	2 outputs	2 outputs
	Max. load current			500mA *10		
	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 *11		
	Max. capacitive load			2.2 µF (with a load resistance of 100Ω)		
	Load wiring resistance			Max. 2.5Ω		
Input	PNP			ON-voltage: 10 to 30 V OFF-voltage: Open or 0 to 3 V Short-circuit current: Approx. 2.5 mA (Approx. 10 mA for EDM)		
	NPN			ON-voltage: 0 to 3 V OFF-voltage: Open or 10 V to Power voltage Short-circuit current: Approx. 2.5 mA (Approx. 10 mA for EDM)		
Non safety related output (AUX output)	Output type			Transistor outputs (NPN or PNP is selected by the dedicated PC software)		
	Number of outputs			6 outputs	4 outputs	4 outputs
	Max. load current			Max. 50 mA		
	Residual voltage (during ON)			Max. 2.5 V (with a cable length of 5 m)		
	Muting lamp			Incandescent lamp (24 VDC, 1 to 5.5 W) or LED lamp (load current :10 to 230 mA) can be connected	-	Incandescent lamp (24 VDC, 1 to 5.5 W) or LED lamp (load current :10 to 230 mA) can be connected
Interface	USB			USB2.0		
	Ethernet	Standard		-	-	IEEE802.3u (100BASE-TX)
		Transmission rate		-	-	100Mbps

		Cable	-	-	STP(Shielded Twisted Pair) cable or UTP(Unshielded Twisted Pair) cable. Category 5 or higher.
		Connector	-	-	RF45 (IP65) 2 ports
Network function			-	-	PROFIsafe PROFINET EtherNet/IP UDP
Environmental resistance	Enclosure protection		IP65 (IEC60529)		
	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 *12		
	Vibration		10 to 55 Hz, 0.7 mm compound amplitude, 20 sweeps each in X, Y, and Z directions		
	Shock		100 m/s2 (Approx. 10 G) 16 ms pulse, in X, Y, Z directions 1,000 times each axis		
Material	Scanner head	Main unit case	Magnesium		
		Window	Polycarbonate, PEI		
		Indicator part	Aluminum, PES		
	Display unit	case	Magnesium, PPS, Polycarbonate		
	System memory	case	Aluminum, PPE		
Cable length	Power and I/O cable		30m or less *13		
	Between scanner head and display unit		20m or less *14		
	Ethernet cable		-	-	100m or less *15
Approved standards	EMC	EMS	IEC61496-1, EN61496-1, UL61496-1 (Type 3 ESPE)		
		EMI	EN55011 Class A, FCC Part15B Class A, ICES-003 Class A		
	Safety		IEC61496-1, EN61496-1, UL61496-1 (Type 3 ESPE) IEC61496-3, EN61496-3 (Type 3 AOPDDR) IEC61508, EN61508, IEC62061, EN62061 (SIL2 / SILCL2) EN ISO13849-1 : 2015 (PLd, Category3) IEC61784-3-3 UL508, UL1998 CSA C22.2 No.14, CSA C22.2 No.0.8		

*1 If the object to be detected moves perpendicular to the detection plane, SZ-V cannot detect the object moving at speed over 1.6m/s, regardless of the encoder setting.
*2 The response time, protection zone, and warning zone is determined by the operation mode.
*3 Add 6 ms when PROFIsafe is used.
*4 20% or more reflectance is necessary for the minimum detectable object in the warning zone.
*5 If there is a highly 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 when calculating the safety distance.
*6 Even when using the network data output, the maximum measured output distance is 60 m.
*7 Only applicable for the type with a camera.
*8 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.
*9 When using the SZ-V with series connected scanner heads, it is necessary to add 9.4W per scanner head. Also, power consumption may temporarily be higher (maximum 3.6W). Power consumption will be within the specification after SZ-V moves to normal operation.
*10 For the SZ-V04 type and the SZ-V32 type, the load current calculation of the OSSD output and AUX output is 1.5 A or less when using one scanner head, 1.0 A or less when using two scanner heads, and 0.5 A or less when using three scanner heads. For the SZ-V32N type, the load current calculation of the OSSD output and AUX output is 1.2 A or less when using one scanner head, 0.8 A or less when using two scanner heads, and 0.3 A or less when using three scanner heads.
*11 Includes when the power is OFF.
*12 An ambient light source should not be located within ±5° of the detection plane.
*13 10 m or less when supplying power from a battery.
*14 When supplying power from a battery, the length of each connection cable should be 10 m or less when using two scanner heads, and 5 m or less when using three scanner heads.
*15 Distance between SZ-V and Ethernet switch

IEC61508-related parameters

T1 (proof test interval)	20 years
Hardware fault tolerance	1
Type of element	B
Malfunction response time	Within the response time
Safe state	OSSD OFF state

PFH_D (dangerous failure rate per hour)

■ **No. of scanner heads: When there is 1 scanner head**

Type	OSSD1/2	OSSD3/4
SZ-V04 Type	7.98×10^{-9}	7.98×10^{-9}
SZ-V32 Type	8.02×10^{-9}	
SZ-V32N Type	8.02×10^{-9}	

■ **No. of scanner heads: When there are 2 scanner heads**

Type	OSSD1/2	OSSD3/4
SZ-V04 Type	8.47×10^{-9}	8.47×10^{-9}
SZ-V32 Type	8.50×10^{-9}	
SZ-V32N Type	8.50×10^{-9}	

■ **No. of scanner heads: When there are 3 scanner heads**

Type	OSSD1/2	OSSD3/4
SZ-V04 Type	8.95×10^{-9}	8.95×10^{-9}
SZ-V32 Type	8.98×10^{-9}	
SZ-V32N Type	8.98×10^{-9}	

EtherNet/IP Specifications

Compatible functions	Cyclic communication
	Compatible with UCMM and Class 3 messaging (Explicit messaging)
Number of connections	16
RPI (Transmission cycle)	5 to 10,000ms (0.5ms unit)
Tolerable communication bandwidth for cyclic communication	3,000pps
Conformance Test	Conform to CT12

PROFINET/PROFIsafe Specifications

Approved network		PROFINET IO communication
Basic specifications	Compatible functions	Cyclic communication (Data I/O communication)
		Acyclic communication (Record data communication)
	Conformance class	Conforms to conformance class B.
	GSDML version	Version 2.32
	Conformance test version	Conforms to Version 2.33
	MRP	Approved as client
	Approved Protocol	LLDP, SNMP, MRP, DCP
	Net load	Class 3
Cyclic communication Specifications	Update time	1 to 512 ms
PROFIsafe version		V2

■ **Input data (from SZ-V to Safety PLC)**

Byte offset	Item	Bit	Description	Value
0	Zone Detection State /SZ-V Status	0	Protection Zone A state (OSSD 1/2)	0: OFF 1: ON
		1	Protection Zone B state (OSSD 3/4)	
		2	Warning Zone A state	0: OFF 1: ON (No object within Warning Zone)
		3	Warning Zone B state	
		4	Interlock-Reset-Ready A	0: No-Interlock-Reset 1: Interlock-Reset-Ready
		5	Interlock-Reset-Ready B	
		6	Normal Operation State	0: Starting up/Error state/States other than normal operations 1: Normal operation
		7	Error State	0: No error 1: Error State
1	SZ-V Status	0	Bank Number	0 to 15
		1		
		2		
		3		
		4	Bank Number valid	0: Invalid Bank Number, or only one bank has been set 1: Bank number valid
		5	Laser off state	0: Normal operation 1: Laser off state
		6	Reserved	
		7	Reserved	
2	Window Pollution information / Head1 State	0	Head1 Window pollution State	0: Normal operation 1: Window alert or window error state
		1	Head2 Window pollution State	
		2	Head3 Window pollution State	
		3	Reserved	
		4	Head1 Protection Zone A State	0: Detection state/Undetectable/Head unconnected 1: Non-detection state
		5	Head1 Protection Zone B State	
		6	Head1 Warning Zone A State	
		7	Head1 Warning Zone B State	
3	Head2 State / Head3 State	0	Head2 Protection Zone A State	0: Detection state/Undetectable/Head unconnected 1: Non-detection state
		1	Head2 Protection Zone B State	
		2	Head2 Warning Zone A State	
		3	Head2 Warning Zone B State	
		4	Head3 Protection Zone A State	0: Detection state/Undetectable/Head unconnected 1: Non-detection state
		5	Head3 Protection Zone B State	
		6	Head3 Warning Zone A State	
		7	Head3 Warning Zone B State	
4	Protection Zone A state for each Bank	0	Protection Zone A State for Bank0	0: Detection state 1: Non-detection state
		…	…	
		15	Protection Zone A State for Bank15	
6	Protection Zone B state for each Bank	0	Protection Zone B State for Bank0	0: Detection state 1: Non-detection state
		…	…	
		15	Protection Zone B State for Bank15	
8	Warning Zone A State for each Bank	0	Warning Zone A State for Bank0	0: Detection state 1: Non-detection state
		…	…	
		15	Warning Zone A State for Bank15	
10	Warning Zone B State for each Bank	0	Warning Zone B State for Bank0	0: Detection state 1: Non-detection state
		…	…	
		15	Warning Zone B State for Bank15	

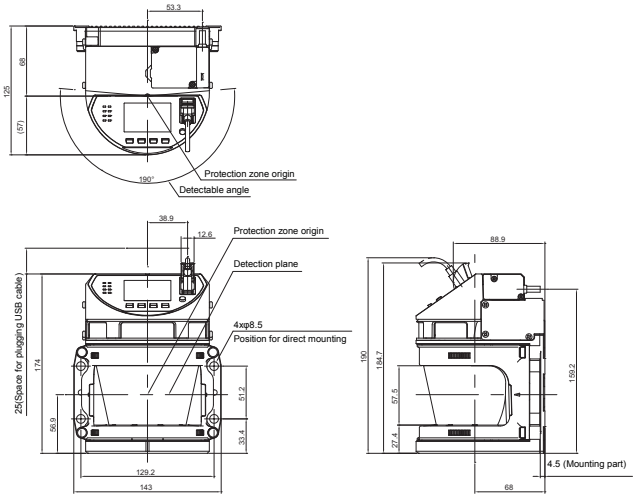
■ **Output data (from Safety PLC to SZ-V)**

Byte offset	Item	Bit	Description	Value
0	Output	0	Reset A	0: OFF 1: ON
		1	Reset B	
		2	Reserved	
		3		
		4		
		5	Laser OFF	0: During normal operation 1: Laser off state
		6	Reserved	
		7	Return to Normal Operation	0: Unaffected 1: Return to Normal Operation via Rising Edge
1	Bank number	0	Bank Number	0 to 15
		1		
		2		
		3		
		4	Bank Number (reverse)	0H to FH For each bit, specify opposite value of bit 0-3
		5		
		6		
		7		
2	Reserved	0	Reserved	
…		…		
10		15		

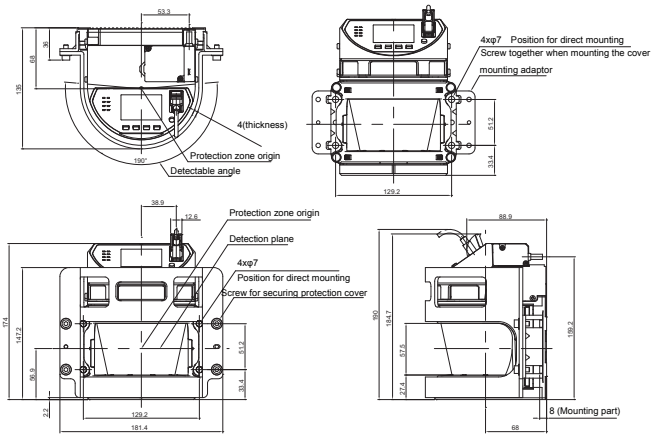
10-3 Dimensions

SZ-V

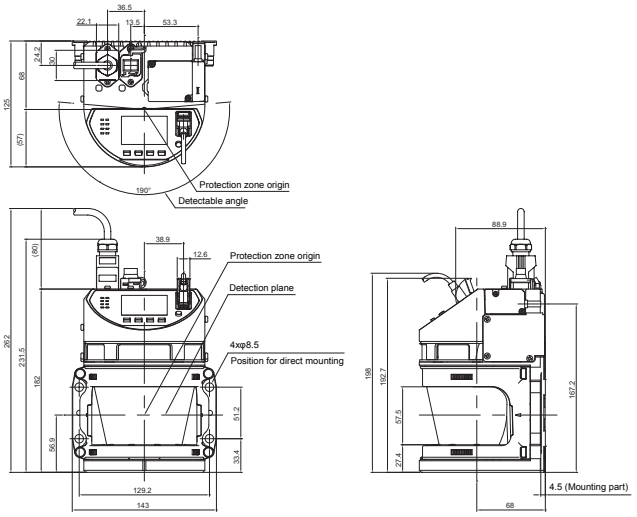
SZ-V04 type / SZ-V32 type



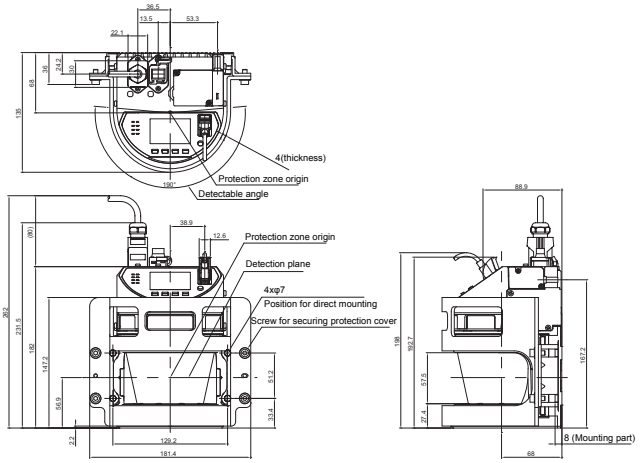
With Protection cover model: SZ-VB21



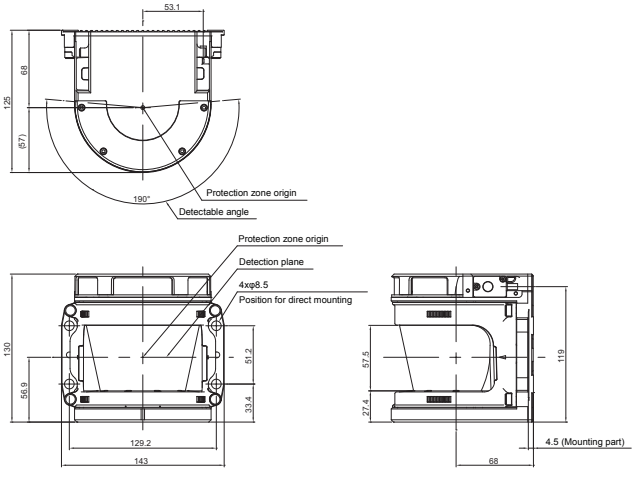
SZ-V32N type



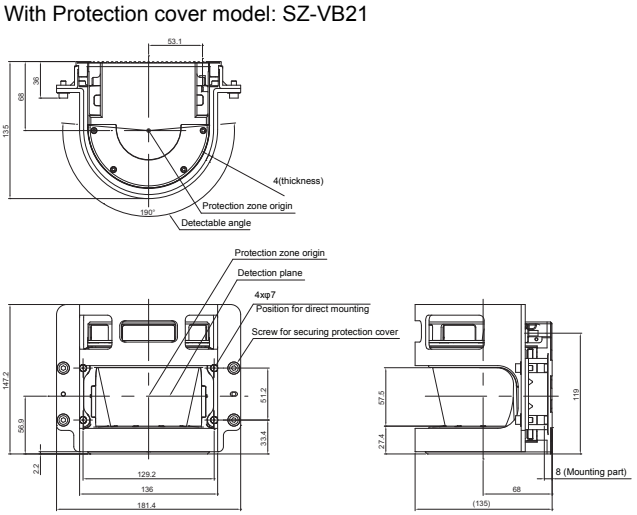
With Protection cover model: SZ-VB21



Head only : SZ-VH1(X)

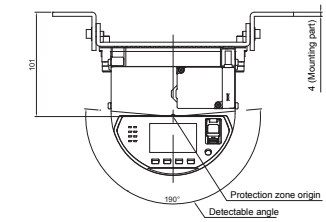


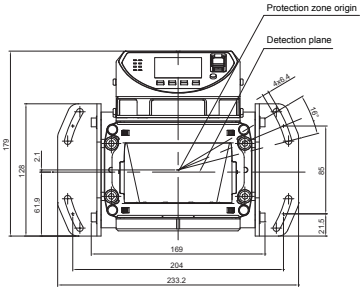
With Protection cover model: SZ-VB21

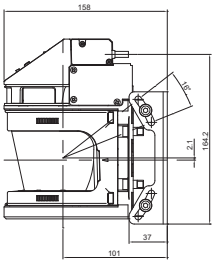


For integrated installation and separate scanner head installation

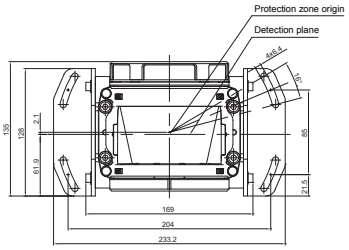
■ Angle adjustable bracket (horizontal) model: SZ-VB01



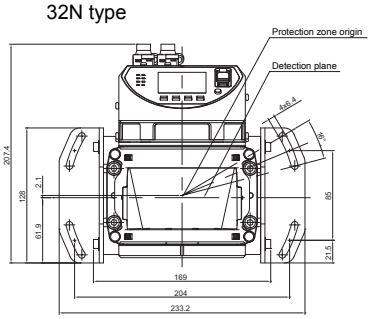


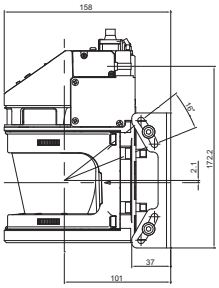


Head only



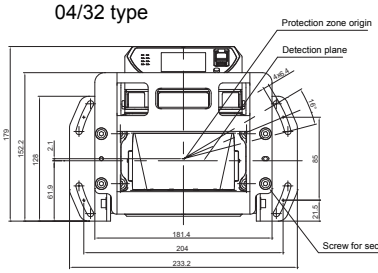
32N type

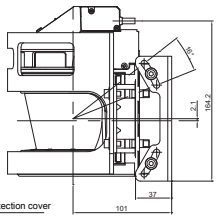




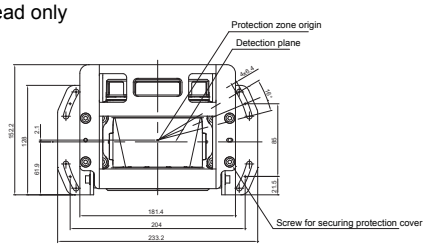
■ Angle adjustable bracket (horizontal) model: SZ-VB01 (with Protection cover model: SZ-VB21)

04/32 type

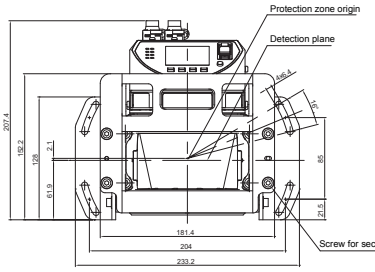


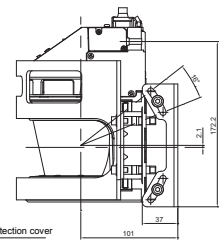


Head only

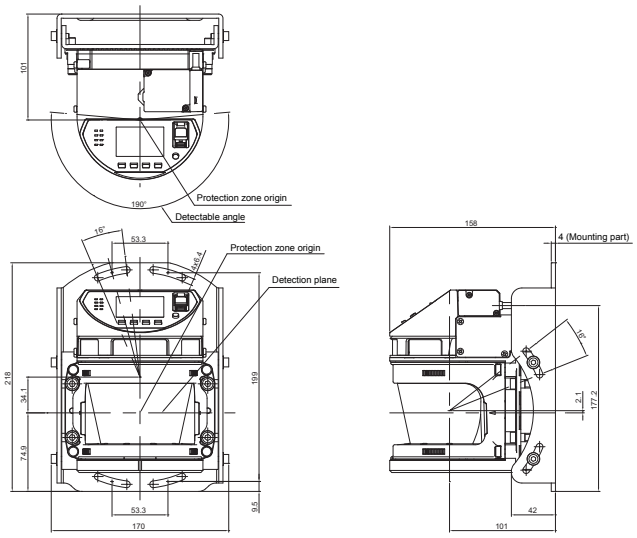


32N type

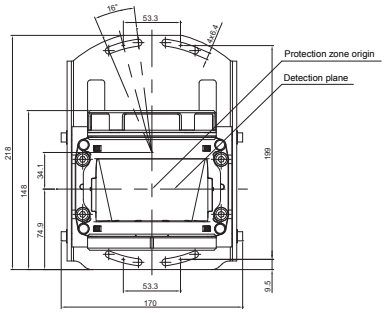




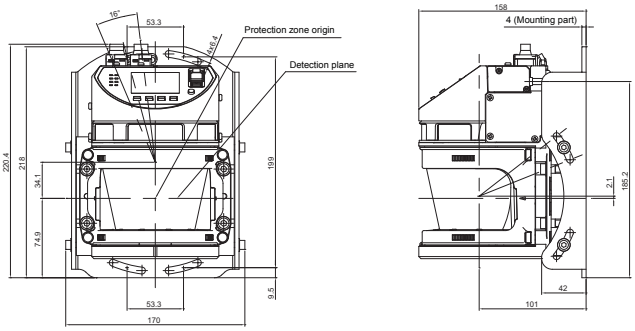
■ **Angle adjustable bracket (vertical) model: SZ-VB02**



Head only

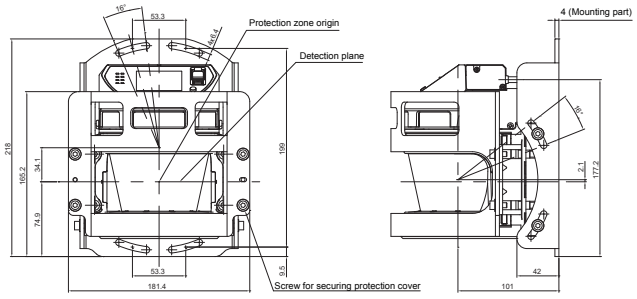


32N type

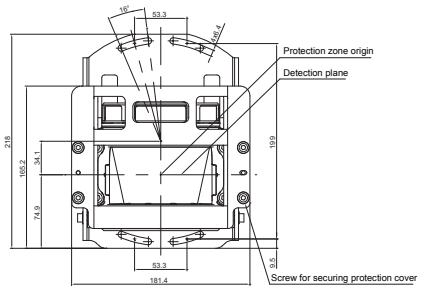


■ **Angle adjustable bracket (vertical) model: SZ-VB02 (with Protection cover model: SZ-VB21)**

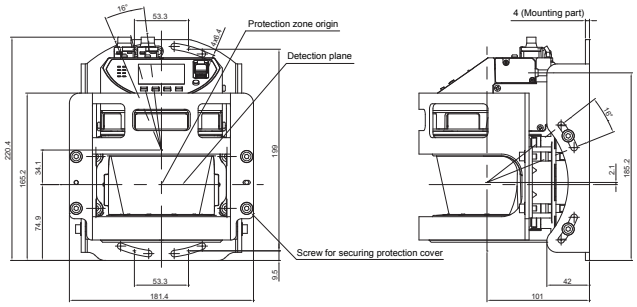
04/32 type



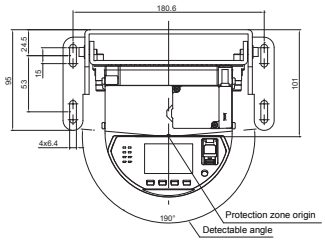
Head only

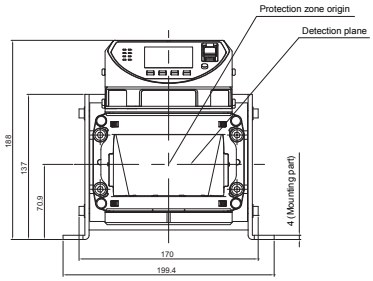


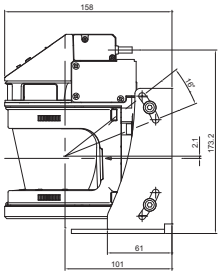
32N type



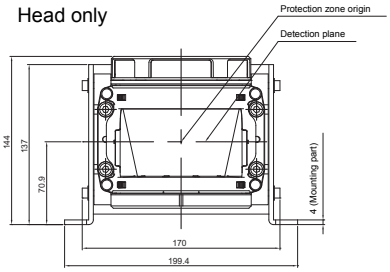
■ **Floor bracket model: SZ-VB03**



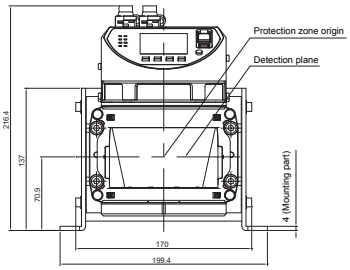


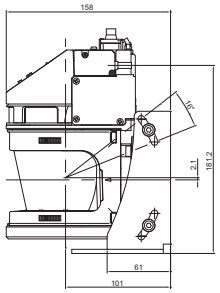


Head only



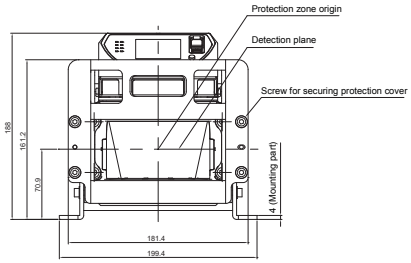
32N type

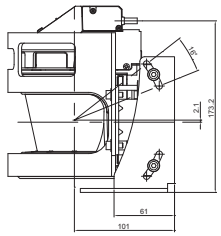




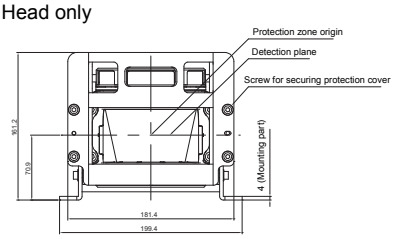
■ **Floor bracket model: SZ-VB03 (with Protection cover model: SZ-VB21)**

04/32 type

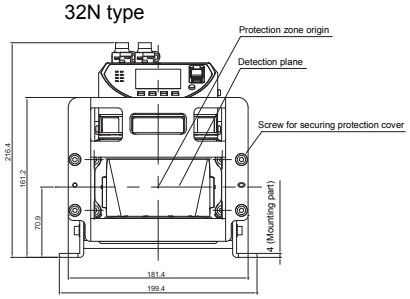


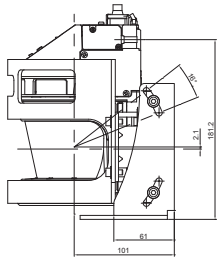


Head only



32N type

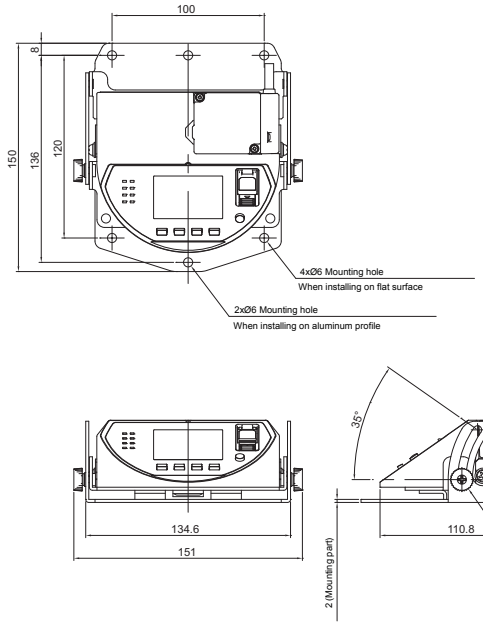




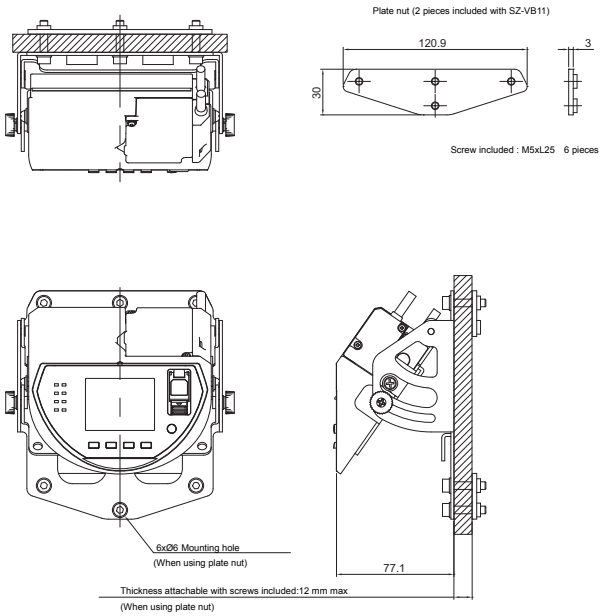
Separate installing of the Display unit

■ **Display unit standard bracket model: SZ-VB11**

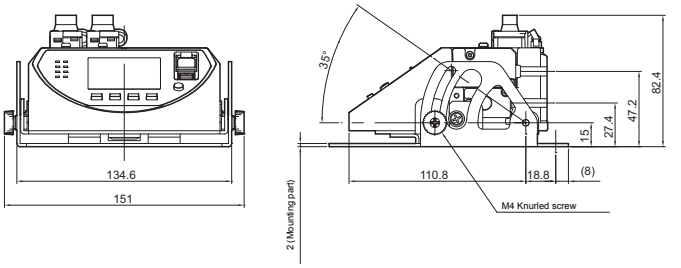
Horizontal installation



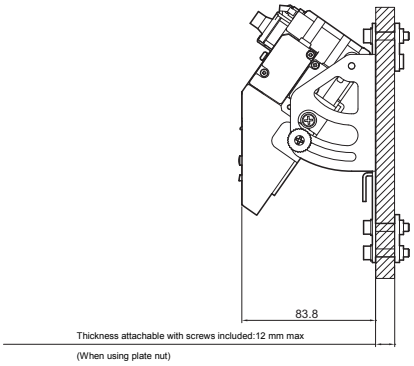
Vertical installation



32N type

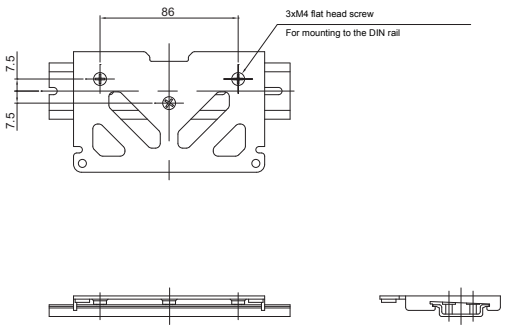


32N type

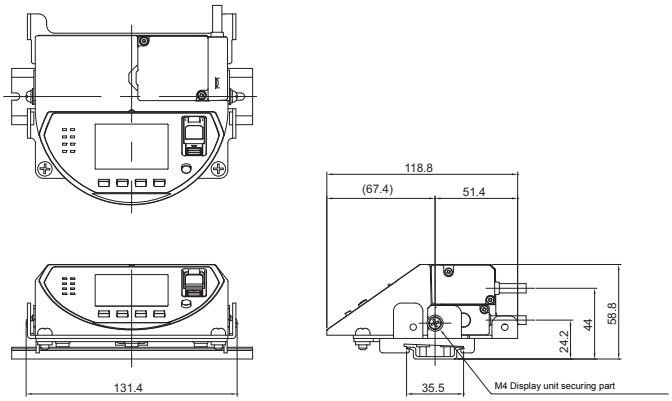


■ **Display unit DIN rail mounting bracket (flat) model : SZ-VB12**

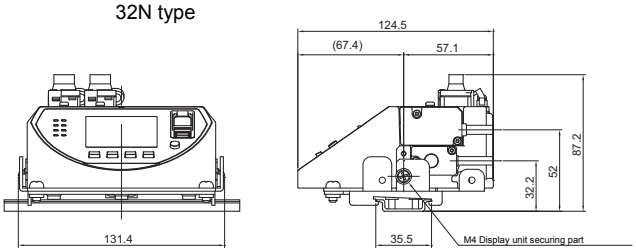
DIN attachment



With main unit

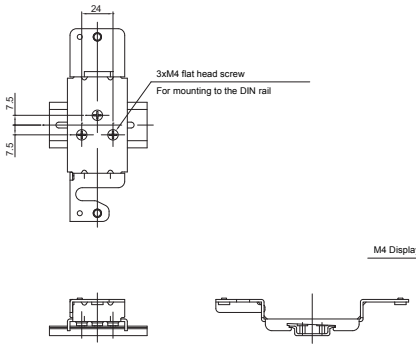


32N type

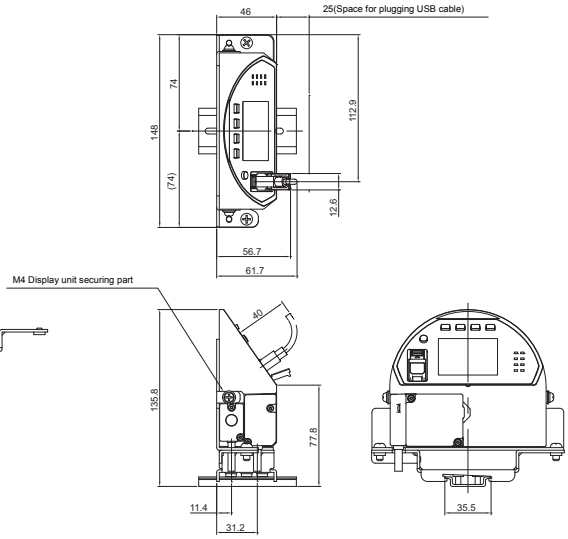


■ **Display unit DIN rail mounting bracket (slim) model : SZ-VB13**

DIN attachment



With main unit



* The SZ-VB13 cannot be used with communication type display unit (SZ-VU32N).

11. Troubleshooting

Check the state of the SZ-V through messages shown on the Display unit display. Attempt to resolve the problem related to the message shown on the display if the SZ-V does not operate as intended.

11-1 Error State

The SZ-V runs a self-diagnosis after starting and checks for any errors. In addition to self-diagnosis, the SZ-V also periodically runs a self-diagnosis test during normal operation.
If an error is found through this self-diagnosis test, the SZ-V turns the OSSD OFF, and displays and outputs an error. Until the procedure is executed to recover from the error state, the OSSD is held in the OFF state.

Display and output of the error information

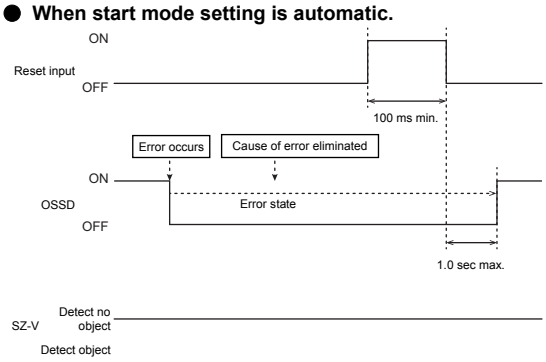
Item	Description
Display	Indicates the factor causing the failure. “Display during an error state” (page 138)
Output	If the functions below are assigned to an AUX output and an error occurs, the output enters an OFF state. ・ Error output ・ Error or alert output ・ Encoder error output(Only during an encoder error) The number of pulses in accordance with the error type can be output by using the state information output. “State information output” (page 60)
Configuration software SZ-V Configurator	Check error information in the monitor section. “Monitoring Operations” (page 92)

Recovering from an error state

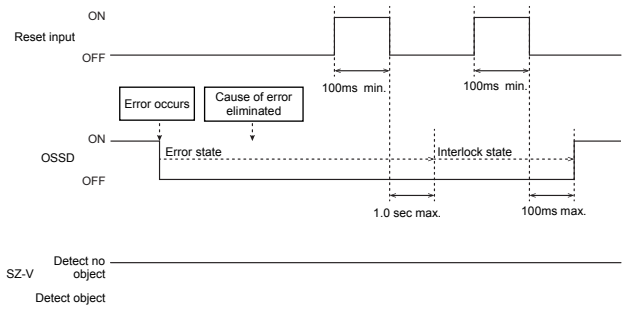
The method to recover from an error differs according to the error details. For details, see “Information on the Display” (page 136).
- The SZ-V automatically returns to normal operation if the cause of the error is removed.
- The SZ-V returns to normal operation if the cause of the error is removed and the SZ-V is reset.
- When using PROFIsafe with the SZ-V32N, control the Return to Normal Operation bit instead of the reset input.
- The SZ-V returns to normal operation if the cause of the error is removed, and power is turned off and back on again.

<Timing chart for reset operation> In the case where the SZ-V returns to normal operation with the reset operation.

● **When start mode setting is automatic.**



● **When start mode setting is manual.**



Reference If OSSD 3/4 are being used with the SZ-V04 type, the following procedure is applied. Two reset operations (reset input (1/2) (yellow) and reset input (3/4) (yellow/black)) are required to return the SZ-V to normal operation with the reset operation. You cannot recover from an error using the laser off input.

11-2 Alert State

The SZ-V goes to the alert state if it detects either a failure having impact on the operation or an external interference. In this situation, alert information is indicated on the information display and is output. (OSSD continues normal operation)

Indication and output of the alert information

Item	Description
Display	Indicates the factor causing the alert. “Display during alert state” (page 137)
Output	If the functions below are assigned to an AUX output and an alert occurs, the output enters the OFF state. ・ Alert output ・ Error or alert output The number of pulses in accordance with the alert type can be output by using the state information output. “State information output” (page 60)
Configuration software SZ-V Configurator	Check alert information in the monitor section. “Monitoring Operations” (page 92)

Recovering from the alert state

The SZ-V automatically returns to normal operation if the cause of the alert is removed.

11-3 Information on the Display

The following table shows the messages on the Display unit's display, the state of the SZ-V, and an explanation. It also shows the number of pulses for the state information output. If an error occurs on the SZ-V, see the table below.

Display during normal operation

Display state	Background Color	Type	The number of pulses for state information output	Details	Countermeasures
Normal Operation	Green	Normal	1	The SZ-V is under normal operation. The OSSD is ON.	None.
		Normal	6 to 8 20 to 26	The SZ-V is under normal operation. The OSSD is ON. The bank switching function is used and Bank 1 to 31 is selected.	
	Red	Normal	3	The SZ-V is under normal operation. Scanner head 1 protection zone is in detection state	None. If the OSSD goes to the OFF-state when nothing is present in the protection zone, see “Troubleshooting the OSSD Operation” (page 140).
		Normal	4	The SZ-V is under normal operation. Scanner head 2 protection zone is in detection state	
		Normal	5	The SZ-V is under normal operation. Scanner head 3 protection zone is in detection state	
Normal Operation ON Delay	Red	Special	2	The on-delay function is operating, OSSD is OFF.	"ON-delay” (page 47)
Normal Operation Laser Shutdown	Red	Special	3	The laser shutdown bank is selected.	Switch to a bank other than the laser shutdown bank. “Operation Check Function” (page 57)
				Laser off input is ON.	Turn off the laser off input. “Operation Check Function” (page 57)
Interlock	Red	Special	3	The interlock function is operating, OSSD is OFF. The SZ-V has detected a person or an object in the protection zone.	Terminate the interlock function by returning the SZ-V to a state in which it does not detect an object in the protection zone, and then perform reset operation using the reset input. “Terminating the interlock state” (page 47)
Interlock Reset Ready	Red	Special	2	The interlock function is operating, OSSD is OFF. Perform the reset operation to restart the SZ-V because the conditions for disabling the interlock are met.	Terminate the interlock function by performing the reset operation using the reset input. “Terminating the interlock state” (page 47)
Interlock Reset Ready 1/2	Red	Special	2	The interlock function is operating, OSSD 1/2 is OFF. Engage reset input 1/2 to restart the SZ-V because the conditions for terminating the interlock are met.	
Interlock Reset Ready 3/4	Red	Special	2	The interlock function is operating, OSSD 3/4 is OFF. Engage reset input 3/4 to restart the SZ-V because the conditions for terminating the interlock are met.	
Normal Operation Ref. Point Undetected	Red	Special	3 to 5	One of the scanner heads does not detect a reference point(s), OSSD is OFF.	Ensure that the scanner head detects the reference points. “Reference Points Monitoring Function” (page 57)
Muting	Green	Special	6	Muting state. The safety function has been temporarily disabled and OSSD is ON.	“Muting function” (page 55)
Override	Green	Special	7	Override state. The safety function has been temporarily disabled and OSSD is ON.	“Override function” (page 56)
Waiting for Bank Input	Red	Special	9	Waiting for bank input state. A bank has not been selected, OSSD is OFF.	Check that the bank input is correct. “Bank Switching Function” (page 49)
Normal Operation History Saving	Green or red	Special	-	The detection history is being saved. The next detection history will not be saved until saving of the detection history is complete.	The SZ-V returns to the Normal Operation screen once the detection history has been saved. Videos take about 30 seconds to save.
Normal Operation History Saving Suspended	Green or red	Special	-	In preparation of saving the detection history. The next detection history will not be saved until preparation is done.	The SZ-V returns to the Normal Operation screen once the preparation is done.
PC Connection	Black	Normal	-	The SZ-V is under normal operation. Communicating with SZ Configurator.	If the connection with SZ Configurator is terminated, the SZ-V returns to the Normal Operation screen.
		Special	-	Operations, such as transferring settings from the SZ Configurator are being performed. OSSD is fixed to OFF.	Once the operations from the SZ Configurator are complete and the connection is terminated, the SZ-V returns to the Normal Operation screen.

Reference

- If the type is "Special", the details are shown on the display. If the SZ-V display is “Monitor view” or “Camera view”, the special state is displayed in a frame. “How to Read the Display” (page 112)
- If the computer and the SZ-V are connected by Ethernet and disconnected without logging out, "PC Connection" is shown on the display for about 90 seconds.

Display during alert state

This table shows the message displayed when an alert occurs.

Display state	Background Color	Type	The number of pulses for state information output	Code	Details	Countermeasures
AUX Over Current	Green or red	Normal	14	0003	Alert: AUX Overcurrent The SZ-V detects an overcurrent on the AUX output. The AUX output enters the OFF-state after the SZ-V detects this alert. (The check pulse is intermittently output.) The OSSD continues normal operation.	Check the wiring between the AUX outputs and the loads, and whether the loads are broken or not. Also check the current on AUX outputs. "Specifications" (page 125)
Conflict IP Address		Normal	14	0300	Alert: IP address duplication The SZ-V IP address is duplicated by another device.	Reconfigure the IP address. "Selecting an Ethernet connection device (for the SZ-V32N type only)" (page 68)
Window Pollution (Head1)		Normal	11	0400	Window alert The window of scanner head 1 may be polluted or damaged.	The OSSD may go to the OFF-state if the situation is left as it is. Clean the window in accordance with "Cleaning the Window" (page 144).
Window Pollution (Head 2)		Normal	11	0800	Window alert The window of scanner head 2 may be polluted or damaged.	
Window Pollution (Head 3)		Normal	11	0C00	Window alert The window of scanner head 3 may be polluted or damaged.	
Light Interference Head1:		Normal	12	0401	Light interference alert Scanner head 1 is experiencing light interference, such as from an incandescent lamp, fluorescent lamp, stroboscopic light, or photoelectric sensor. There may also be mutual interference between SZ-Vs.	While the SZ-V is operating normally, the OSSD may go to the OFF-state unintentionally. Take countermeasures in accordance with "Light interference" (page 18) and "Mutual interference" (page 18).
Light Interference (Head 2)		Normal	12	0801	Light interference alert Scanner head 2 experiencing light interference, such as from an incandescent lamp, fluorescent lamp, stroboscopic light, or photoelectric sensor. There may also be mutual interference between SZ-Vs.	
Light Interference (Head 3)		Normal	12	0C01	Light interference alert Scanner head 3 experiencing light interference, such as from an incandescent lamp, fluorescent lamp, stroboscopic light, or photoelectric sensor. There may also be mutual interference between SZ-Vs.	
High Reflection (Head 1)	Red	Normal	13	0402	Alert: Highly-reflective background There is a highly-reflective background behind the specified protection zone of scanner head 1, which may impact the detection capability.	Highly reflective backgrounds must not be positioned within 1.5 m from the boundary of the protection zone. (the background itself must be removed or the reflectance must be reduced). Unless the above-mentioned countermeasures are taken, 200 mm must be added as supplementary necessary distance to the protection zone during the calculation of the safety distance. "Highly reflective backgrounds" (page 19)
High Reflection (Head 2)		Normal	13	0802	Alert: Highly-reflective background There is a highly-reflective background behind the specified protection zone of scanner head 2, which may impact the detection capability.	
High Reflection (Head 3)		Normal	13	0C02	Alert: Highly-reflective background There is a highly- reflective background behind the specified protection zone of scanner head 3, which may impact the detection capability.	
Muting lamp open	Green or red	Normal	14	0001	Muting Lamp Alert (Disconnection) There is a problem where the muting lamp is connected to the muting lamp output. (The muting lamp is disconnected or it is broken.)	Please check the following: • If the muting lamp output is correctly connected to the muting lamp • If the muting lamp is broken • If the rating/specification of the muting lamp is within the range of the muting lamp output "Muting lamp output" (page 56)
Muting lamp Over current		Normal	14	0002	Muting Lamp Alert (Overcurrent) The muting lamp connected to the muting lamp output has an overcurrent exceeding the rated current.	Please check the following: • If the muting lamp output is correctly connected to the muting lamp • If the muting lamp is broken • If the rating/specification of the muting lamp is within the range of the muting lamp output? "Muting lamp output" (page 56)
Camera (Head 1)		Normal	14	0600	Camera error An error has occurred with the camera area of scanner head 1.	Turn the power of the SZ-V off and then on again. If turning the power back on does not resolve the error, replace the scanner head.
Camera (Head 2)		Normal	14	0A00	Camera error An error has occurred with the camera area of scanner head 2.	
Camera (Head 3)		Normal	14	0E00	Camera error An error has occurred with the camera area of scanner head 3.	
History Store		Normal	14	0200	Detection History Error The detection history cannot be retrieved correctly.	Transfer the settings again. If that does not resolve the error, replace the display unit.
History Store (Head1)		Normal	14	0601	Detection history error The detection history for scanner head 1 cannot be retrieved correctly.	Transfer the settings again. If that does not resolve the error, replace the scanner head.
History Store (Head 2)		Normal	14	0A01	Detection history error The detection history for scanner head 2 cannot be retrieved correctly.	
History Store (Head 3)		Normal	14	0E01	Detection history error The detection history for scanner head 3 cannot be retrieved correctly.	

EEPROM Access Error		Normal	14	0201	EEPROM access error Cannot read EEPROM data correctly.	Transfer the settings again. If that does not resolve the error, replace the display unit.
PROFIsafe Parameter (F_Source_Add)	Green or red	Normal	14	000A	PROFIsafe parameter error. F_Source_Add is incorrect.	Transfer the PROFIsafe related settings again. If that does not resolve the error, replace the display unit.
PROFIsafe Parameter (F_Dest_Add)				000B	PROFIsafe parameter error. F_Dest_Add is incorrect.	
PROFIsafe Failsafe Parameter				000C	PROFIsafe parameter error. PROFIsafe parameter error was detected.	
PROFIsafe Transmission				000D	PROFIsafe communication error. PROFIsafe Communication failed.	Check the network cable connection and the value of F_WD_Time.

Display during an error state

The method to recover from an error differs depending on the error type.

- Error 1: The SZ-V automatically returns to normal operation if the cause of the error is removed.
- Error 2: The SZ-V returns to normal operation if the cause of the error is removed and the SZ-V is reset.
- Error 3: The SZ-V returns to normal operation if the cause of the error is removed, and power is turned off and back on again.

Display state	Background Color	Type	The number of pulses for state information output	Code	Details	Countermeasures
Window Error (Head1)	Red	Error 1	15	0410	Window error The window of scanner head 1 may be polluted or scratched.	Clean the window in accordance with “Cleaning the Window” (page 144). If the error continues after cleaning, replace the window in accordance with “Replacing the Window” (page 144).
		Error 3		0421	Window error The window of scanner head 1 may be broken.	
Window Error (Head 2)		Error 1	15	0810	Window error The window of scanner head 2 may be polluted or scratched.	
		Error 3		0821	Window error The window of scanner head 2 may be broken.	
Window Error (Head 3)		Error 1	15	0C10	Window error The window of scanner head 3 may be polluted or scratched.	
		Error 3		0C21	Window error The window of scanner head 3 may be broken.	
MI Error (Head 1)	Red	Error 1	16	0411	MI error (man-made interference error) (1) A structure with extremely low reflectance is located close to the SZ-V. (2) The SZ-V does not detect any diffuse reflection from the object to be detected or the structure outside the protection zone. The SZ-V generates an error if it does not detect anything over 60 degrees.	(1) Remove the structure with low reflectance close to the SZ-V. (2) Position a structure outside the protection zone so that the SZ-V detects diffuse reflection from the structure.
MI Error (Head 2)		Error 1	16	0811		
MI Error (Head 3)		Error 1	16	0C11		
OSSD 1 Error	Red	Error 2	18	0010	OSSD error (1) The OSSD is short-circuited. Alternatively, the wiring is wrong. (2) The OSSD experienced a surge in voltage due to an inductive load. (3) The OSSD is being affected by an EMC environment. (4) The OSSD is broken.	(1) Check the wiring for the OSSD. “Wiring” (page 30) (2) Use a load with a surge absorber function, or apply surge protection to the load. (3) Check the surrounding wiring and EMC environment. (4) Replace the display unit.
OSSD 2 Error		Error 2	18	0011		
OSSD 3 Error		Error 2	18	0012		
OSSD 4 Error		Error 2	18	0013		
OSSD 1 Overcurrent Error	Red	Error 2	18	0014	OSSD 1 Overcurrent Error Overcurrent occurs on OSSD 1.	Check the wiring between OSSD 1 and the load, and whether the load is broken or not. “Wiring” (page 30)
OSSD 2 Overcurrent Error	Red	Error 2	18	0015	OSSD 2 Overcurrent Error Overcurrent occurs on OSSD 2.	Check the wiring between OSSD 2 and the load, and whether the load is broken or not. “Wiring” (page 30)
OSSD 3 Overcurrent Error	Red	Error 2	18	0016	OSSD 3 Overcurrent Error Overcurrent occurs on OSSD 3.	Check the wiring between OSSD 3 and the load, and whether the load is broken or not. “Wiring” (page 30)
OSSD 4 Overcurrent Error	Red	Error 2	18	0017	OSSD 4 Overcurrent Error Overcurrent occurs on OSSD 4.	Check the wiring between OSSD 4 and the load, and whether the load is broken or not. “Wiring” (page 30)
Output Over Current Error (in Total)	Red	Error 2	19	002A	Output Over Current Error (in total) Total amount of current on each output exceeds the specification.	Check the wiring between each output and the load, and whether the load is broken or not. “Wiring” (page 30) Check if the total amount of current is within the specification. “Specifications” (page 125)
Muting Lamp Open Error	Red	Error 2	10	0018	Muting Lamp Error (Disconnection) There is a problem where the muting lamp is connected to the muting lamp output. (The muting lamp is disconnected or it is broken.)	Please check the following: • If the muting lamp output is correctly connected to the muting lamp • If the muting lamp is broken • If the rating/specification of the muting lamp is within the range of the muting lamp output “Muting lamp output” (page 56)

Muting Lamp Over Current Error	Red	Error 2	10	0019	Muting Lamp Error (Overcurrent) The muting lamp connected to the muting lamp output has an overcurrent exceeding the rated current.	Please check the following: • If the muting lamp output is correctly connected to the muting lamp • If the muting lamp is broken • If the rating/specification of the muting lamp is within the range of the muting lamp output? "Muting lamp output" (page 56)
EDM (OSSD 1/2) Error	Red	Error 2	17	001A	EDM error (1) EDM input is not connected to the external device correctly. (2) The external device connected to the OSSD is broken.	(1) Check the EDM input wiring. "EDM Function" (Page 48), "Wiring" (page 30) (2) Check the external device and replace if it is broken.
EDM (OSSD 3/4) Error	Red	Error 2	17	001B		
BANK Input Error	Red	Error 2	10	001C	Bank Input 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.	(1) Check the wiring of the bank inputs. (2) Confirm that bank switching is performed during the specified bank transition time.
BANK Sequence Error	Red	Error 2	10	001D	Bank Sequence Error The bank switching was not performed according to the specified bank sequence.	Check the bank sequence and the configuration of bank sequence monitoring. "Bank Sequence Monitoring Function" (page 53)
Encoder Velocity Error	Red	Error 2	10	001E	Encoder velocity error The encoder velocity exceeds the set velocity range.	Ensure that the encoder velocity does not exceed the velocity range.
Encoder Pulse Frequency Error (Ch.1)	Red	Error 2	10	001F	Encoder Pulse Frequency Error (Ch.1) The input of Encoder Input 1 exceeds the maximum pulse frequency (100 kHz).	Ensure that the output from the encoder does not exceed the maximum pulse frequency.
Encoder Pulse Frequency Error (Ch.2)	Red	Error 2	10	0020	Encoder Pulse Frequency Error (Ch.2) The input of Encoder Input 2 exceeds the maximum pulse frequency (100 kHz).	
Encoder Ch.1/Ch.2 Error	Red	Error 2	10	0021	Encoder Mismatch Error (1) The difference in velocity between the two encoders exceeds the specified tolerance. (2) Two encoders are rotating in opposite direction. (3) The wiring for the encoder input is not correct.	(1) Ensure that the difference in velocity between the two encoders does not exceed the tolerance range. (2) Make two encoders rotate in the same direction. (3) Check the encoder input wiring. "Wiring" (page 30)
Encoder Connection Error (Ch.1)	Red	Error 2	10	0022	Encoder Input Error (Ch.1) Wiring of encoder input 1 is incorrect.	Check the encoder input wiring. "Wiring" (page 30)
Encoder Connection Error (Ch.2)	Red	Error 2	10	0023	Encoder Input Error (Ch.2) Wiring of encoder input 2 is incorrect.	
Head Communication Error	Red	Error 2	19	0024 0210	Communication Error (1) The connection cable is not correctly connected or the wires are damaged. (2) The connected cable is being affected by an EMC environment. (3) The power voltage is temporarily or continuously falling.	(1) Check the cable connection. (2) Check the wiring and the surrounding EMC environment. (3) Replace the power source, increase the power capacity, or prepare a SZ-V-dedicated power source.
Incorrect Wiring Error (input2)	Red	Error 2	19	0028	Unused Wiring Error (Input 2) Input 2 is set as unused but is not in an open circuit.	If Input 2 is set to unused, make an open circuit on Input 2 with insulation.
Incorrect Wiring Error (input6)	Red	Error 2	19	0029	Unused Wiring Error (Input 6) Input 6 is set as unused but is not in an open circuit.	If Input 6 is set to unused, make an open circuit on Input 6 with insulation.
System Memory Error (Type)	Red	Error 3	19	0030	System Memory Error (Type) The display unit type does not match the settings in the system memory.	Check the display unit type.
System Memory Error (Head)	Red	Error 3	19	0031	System Memory Error (Scanner head) Thu number of scanner heads does not match the settings in the system memory.	Check the number of scanner heads.
System Memory Error (Data)	Red	Error 3	19	0032	System Memory Error (Data) (1) The system memory data is not correct or is corrupt. (2) The system memory data cannot be retrieved.	(1) Transfer the data to the system memory again. (2) Check the wiring and the surrounding EMC environment.
System Config. Error (Display unit)	Red	Error 3	19	0033	System Configuration Error (Display unit) The Display unit is paired to another system memory.	Transfer new settings from the SZ Configurator again, or delete the system configuration information. "Clear system configuration" (page 106)
System Config. Error (Head1)	Red	Error 3	19	0424	System Configuration Error (Head 1) Scanner head 1 is paired to another system memory.	
System Config. Error (Head2)	Red	Error 3	19	0824	System Configuration Error (Head 2) Scanner head 2 is paired to another system memory.	
System Config. Error (Head3)	Red	Error 3	19	0C24	System Configuration Error (Head 3) Scanner head 3 is paired to another system memory.	
Window Calibration Error (Head1)	Red	Error 3	19	043E	Window Calibration Error (1) Window calibration did not execute correctly. (2) The SZ-V is broken.	(1) Execute window calibration again. "Window calibration" (page 105) (2) Replace the SZ-V.
Window Calibration Error (Head2)		Error 3	19	083E		
Window Calibration Error (Head3)		Error 3	19	0C3E		

System Error	Red	Error 3	19	Other than above	System Error (1) The SZ-V is being affected by an EMC environment. (2) The SZ-V has experienced strong vibration or shock. (3) The power was disconnected during configuration. (4) The SZ-V is broken.	(1) Check the wiring and the surrounding EMC environment. (2) Install the SZ-V so as not to have the vibration and/or shock exceeding the specification. (3) Perform the configuration again. (4) Replace the SZ-V.

Reference If multiple errors occur at the same time, the details on the error with the highest level of priority is displayed.

Other states

Display state	Background Color	Type*	The number of pulses for state information output	Details	Countermeasures
(Nothing is displayed)	-	Normal	-	The power is OFF or the voltage is insufficient.	• Ensure that the voltage is within the rated range. Check the wiring. “Wiring” (page 30)
				The SZ-V is in “Reducing Power Consumption” (page 58)	Turn power saving mode off. “Display settings” (page 82)
		Broken		The SZ-V may be broken.	Replace the Display unit.
SZ-V Series Start Up	-	Starting	-	This is the start screen displayed after the power is turned on.	In approximately 8 seconds, the screen will transition to normal operation.
Waiting for Configuration	Red	Special	-	(1) The SZ-V is not configured. (2) The settings are not approved yet.	(1) Transfer the settings. (2) Approve the settings. “Setting Procedure” (page 73)

*In regards to the display of the "Special" type, if the SZ-V display is "Monitor view" or "Camera view", the details of the special state is displayed in a frame.

“How to Read the Display” (page 112)

11-4 Troubleshooting the OSSD Operation

Situation	Details	Countermeasures
The OSSD goes to the OFF-state when nothing is present in the protection zone.	Light interference may be occurring.	Take countermeasures according to the description in “Light interference” (page 18). Check the status of light interference through the SZ-V Configurator. “View” (page 102)
	Mutual interference due to another SZ-V may be occurring.	Take countermeasures according to the description in “Mutual interference” (page 18).
	The SZ-V may detect the floor or the surrounding (background) because the SZ-V is installed with some inclination.	Adjust the SZ-V installation angle and position it so that the SZ-V does not detect the floor or the surroundings (background).
	The background is close to the boundary of the specified protection zone.	The SZ-V detects the surroundings (background). Move it away from the specified protection zone. “Protection zone” (page 17) If the surroundings are highly reflective backgrounds, take into account the additional safety distance. “Highly reflective backgrounds” (page 19)
	The position of the SZ-V or the surroundings (background) has been changed.	Restore the position of the SZ-V or the surroundings (background). Perform the configuration on the protection zone again.
	The structure for the reference points is not present or is not located within the specified tolerance.	Check the position of the structure on the reference points and the tolerance. Change the configuration on the reference points, if necessary. “Reference Points Monitoring Function” (page 57)
	Laser shutdown function is activated.	Either turn OFF the laser OFF input, or switch to a different bank from laser shutdown bank. “Operation Check Function” (page 57)
	The SZ-V has pollution on the window.	Clean the window according to "Cleaning the Window” (page 144).
	The SZ-V detects particles in the air, such as dust, spatter or moisture.	Take countermeasures so that the particles in the air do not go into the protection zone.

11-5 Troubleshooting Related to Connection with the SZ-V Configurator

Situation	Details	Countermeasure
Cannot communicate with the SZ-V. (Cannot log-in.)	The power is not supplied to the SZ.	Supply power to the SZ.
	For a USB connection	
	The USB cable is not connected to the SZ-V, or is disconnected.	Check the USB cable and USB port on the computer.
	The USB driver is not installed on the computer.	Double-click the "DPInst" file to execute it. Installation of the USB driver starts. The "DPInst" file is in the folder where the SZ-V Configurator is installed. (C:\Program Files\KEYENCE\SZ-V Configurator\Driver\)
	In cases where NPN is selected in PNP/NPN Select, the SZ-V with positive grounding is connected to the PC with negative grounding through the USB cable.	Before connecting the SZ-V and computer with a USB cable, either the SZ-V or the computer should not be grounded. The brown wire need to be grounded in order to start normal operation.
	For Ethernet connection (for the SZ-V32N type only)	
	The Ethernet cable is not connected to the SZ-V, or is disconnected.	Check the Ethernet cable and the Ethernet port on the computer.
	The SZ-V network is not correctly configured.	Check the SZ-V network settings. “Ethernet Function” (Page 120)
	Which SZ-V to communicate with is not selected.	Select the SZ-V to communicate with through the SZ-V Configurator. "Selecting an Ethernet connection device (for the SZ-V32N type only)” (page 68)
Cannot transfer the configuration.	The model specified in the SZ-V Configurator mismatches the actual SZ-V model.	Check the SZ-V model in "Properties" on the Settings tab. If the SZ-V model does not match, create new settings. “New” (page 101)
	Configured number of scanner heads is different from the actually connected number of scanner heads.	Check the number of connected scanner heads.
	All configurations are not completed.	Check that all settings have been configured
	The specified protection zone or warning zone is configured beyond the specification.	Check the configuration of the protection zone, warning zone, and minimum detectable object size.
	You do not have the authorization level to transfer settings.	If transferring settings that have not been approved, log in as the responsible personnel. If transferring settings that have been approved, log in as the responsible personnel or maintenance personnel. “Authorization Level and Settings” (page 71)
	The power is not supplied to the SZ-V.	Supply power to the SZ-V.
Cannot perform the monitoring on the SZ-V.	The settings in the software do not match the settings in the SZ-V.	Match the settings between the SZ-V Configurator and the SZ-V before starting monitoring. Run the settings on the SZ-V Configurator and to monitor the SZ-V operation, transfer the settings to the SZ-V. On the other hand, retrieve the configuration in the SZ-V to monitor the SZ-V operation according to the current configuration in the SZ-V. In this case, all settings in the SZ-V Configurator are deleted. Save the file as required.
	The configuration is not completed.	Start monitoring after transferring the configuration to the SZ-V.

11-6 Troubleshooting Related to Ethernet Communication

For troubleshooting related to UDP command communication, EtherNet/IP communication, PROFINET communciation and PROFIsafe communication, refer to "SZ-V32N Communications Manual".

12. Inspection and Maintenance

12-1 Precaution During Inspection

DANGER	**Do not use the machine on which the SZ-V is installed if the SZ-V 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.**

Performance of maintenance and inspections are critical factors that you must take into account in your risk assessment. When you perform the risk assessment on your machine application, you must take performance of maintenance and inspections into account.
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-V.
When you mount the SZ-V onto a device, perform the following inspection.
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-V is installed and the laws, rules, regulations and standards in the country or region in which the SZ-V is used/installed.
You must keep the inspection result along with the machine log.

12-2 Initial Inspection

When the installation of the SZ-V is completed, the responsible personnel must verify the operation of the SZ-V in accordance with the checklist shown below.

(1) Pre-check for installation conditions
- The SZ-V is installed without loose fixture screws, in accordance with the specification of tightening torque in this manual.
- The machine under SZ-V control can stop running when the OSSD is in the OFF-state.
- The SZ-V 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-V.
- The SZ-V 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-V 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.
- Safety distance is ensured, which has been calculated according to the laws, regulations, and standards of the country and region in which the SZ-V is installed. “Safety Distances” (page 20)
- The SZ-V is installed at a location free from light interference, for example an incandescent lamp and a halogen lamp. “Tips on installation” (page 18)
- When two or more SZ-V are installed nearby, the countermeasures against mutual interference are taken based on the description of “Tips on installation” (page 18).
- 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-V and those devices are used. “Muting function” (page 55)
- 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-V and those devices are used. “Override function” (page 56)
- The reference points monitoring function is enabled for access protection. Additionally, two or more reference points are set on one structure so as to ensure the detection of its position change. “Reference Points Monitoring Function” (page 57)

(2) Pre-check for wiring
- The SZ-V power supply is 24 V DC, fulfilling the conditions for the power supply as specified in this manual. “Power Supply” (page 30)
- For the wiring between the SZ-V 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.
- If you selected PNP for selection of PNP or NPN, the OSSD is +24 V and not short-circuited.
- If you selected PNP for selection of PNP or NPN, the load is connected between the OSSD and 0 V.
- If you selected NPN for selection of PNP or NPN, the OSSD is 0V and not short-circuited.
- If you selected NPN for selection of PNP or NPN, the load is connected between the OSSD and +24V.
- 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 do the following pre-check test with the test piece in order to make sure the operation of the SZ-V while the machine is stopped. In this case, you should supply the power only to the SZ-V.
The 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-V, 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-V detects the test piece at the intended detection plane (height) while the test piece vertical to the detection plane moves in the protection zone. This test must be performed for the whole specified 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-V starts normal operation after power on (when "SZ-V Start Up" is changed to "Normal Operation" on the 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-V starts normal operation after power on (when "SZ-V Start Up" is changed to "Normal Operation" on the 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-V 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-V 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 flashes in yellow 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 ON-delay function is applied to the SZ-V.
- The SZ-V 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-V detects an object in the protection zone other than muting zone. This is only applicable if the muting function is applied.
- The SZ-V does not go to the muted condition if the muting inputs are activated with different sequence from the specified one. The SZ-V 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 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-V when it goes through that space. This is only applicable if the SZ-V 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-V 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 ensure 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-V, this test must be performed for the specified protection zone for each bank.
- 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-V, this test must be performed for the specified protection zone for each bank.
- The machine (hazard) stops its operation when the power for the SZ-V 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.

12-3 Daily Inspection

The daily inspection for the SZ-V operation and the machine operation should be performed based on the following check items.

(1) Pre-check for installation conditions
- The SZ-V 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-V.
- The SZ-V 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-V belonging to the bank switching function.
- The SZ-V 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-V while the machine is stopped. In this case, you should supply the power only to the SZ-V.
The 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-V, 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-V detects the test piece at the intended detection plane (height) while the test piece vertical to the detection plane moves in the protection zone. This test must be performed for the whole specified protection zone.
- The OSSD indicator lights in green when the SZ-V starts normal operation after power on (when "SZ-V Start Up" is changed to "Normal Operation" on the 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-V starts normal operation after power on (when "SZ-V Start Up" is changed to "Normal Operation" on the 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-V 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-V 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 flashes in yellow 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 ON-delay function is applied to the SZ-V.
- The SZ-V 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-V detects an object in the protection zone other than muting zone. This is only applicable if the muting function is applied.
- The SZ-V does not go to the muted condition if the muting inputs are activated with different sequence from the specified one. The SZ-V 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 protection zone can be switched according to the signal combination of bank inputs in case of bank switching function.
- If there is an unprotected space between the protection zone and the protective structure, test piece is always detected by the SZ-V when it goes through that space. This is only applicable if the SZ-V 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-V 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 ensure 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-V, this test must be performed for the specified protection zone for each bank.
- 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-V, this test must be performed for the specified protection zone for each bank.
- The machine (hazard) stops its operation when the power for the SZ-V 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.

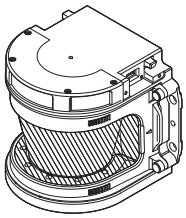
12-4 Regular (Periodic) Inspection

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-V and on the machine on which the SZ-V is installed.
Regular (periodical) inspection items include the following, in addition to “Daily Inspection” (page 143).

(1) Additional inspection items
- The SZ-V is installed without losing 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-V.
- The SZ-V does not have any change on its position. (Safety distance is ensured. The detection plane has also not changed.)
- All 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-V 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 muting period of time has been passed. This is only applicable if the muting function 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.
- "Bank sequence 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.

12-5 Cleaning the Window

The SZ-V window is a critical part of the detection system. Clean the window whenever there is dust or pollution on it.
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.



NOTICE

- **OSSD might go to the OFF-state if the window has a scratch, because the SZ-V falsely detects that scratch as the object approaching into the protection zone. Be sure to not scratch the window during cleaning.**
- **Be careful of static electricity while cleaning due to the collection of dust. You should use a cloth that that does not easily generate static electricity when rubbed on polycarbonate.**

Reference

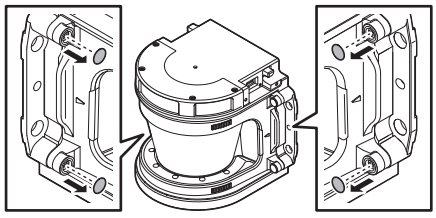
Detection capability might decrease due to the attenuation of light if the window has pollution. The OSSD goes to the OFF-state before the pollution on the window leads to loss of detection capability because the SZ-V has a function to monitor the pollution on the window. Furthermore, the OSSD might go to the OFF-state if the window has pollution because the SZ-V detects that pollution as an object approaching into the protection zone. Be sure to keep the window clean to avoid unnecessary OFF-state of OSSD.

12-6 Replacing the Window

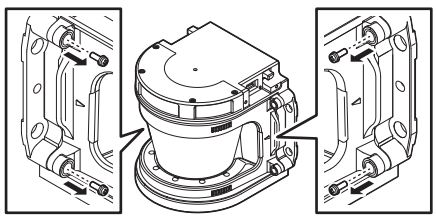
The SZ-V window is a critical part of the detection system. If the window becomes extremely dirty or is scratched, replace it.

Replacement procedure

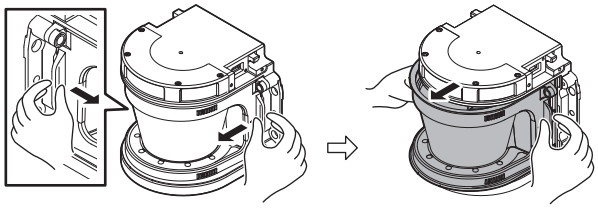
1. Prepare SZ-V and replacement window (SZ-VHW).
2. Turn OFF the SZ-V and all devices that are connected to the SZ-V.
3. Remove the stickers (x4) before removing the screws that secure the window.
   Discard the removed stickers.



4. Remove the four screws which secure the window to the main unit.



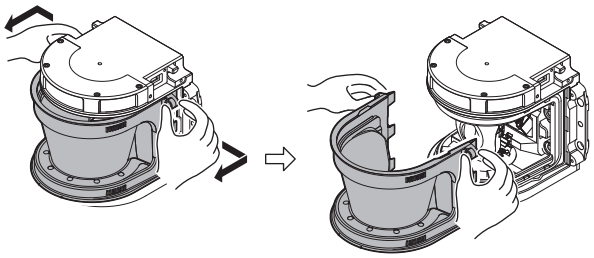
5. Hold onto both sides of the window as shown below, and gently pull it forward.
   Do not pull it out completely, it should stop shortly after separating from the back of the unit.



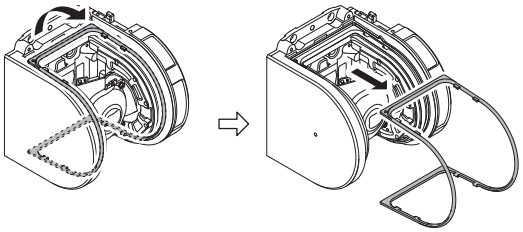
6. Hold onto both sides of the window as shown below. Gently pull the right and the left sides of the window away from the center of the unit as shown below. While doing this, carefully pull the window forward completely.

NOTICE

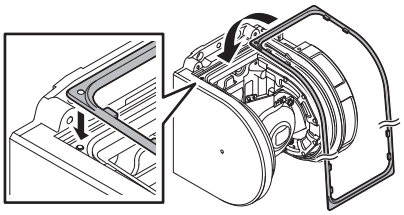
If the sides are not pulled out enough, the window may touch the internal structure and damage it. Please make sure to pull the sides adequately while removing the window.



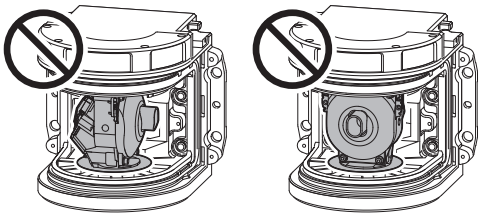
7. Remove the gasket.
   It is easier if the main unit is positioned as shown in the figure below.



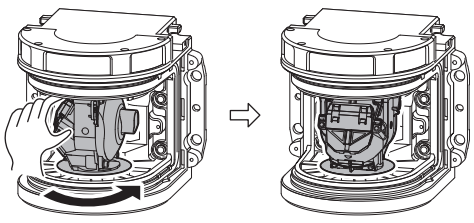
8. Insert the new gasket.
   It is easier if the main unit is positioned as shown in the figure below.



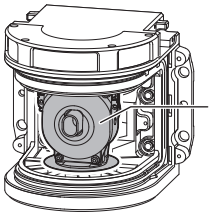
9. Check the direction of the internal structure.
   If the lens is facing forward, rotate the internal structure backward.
   Be sure that the lens is not touched while rotating the internal structure.



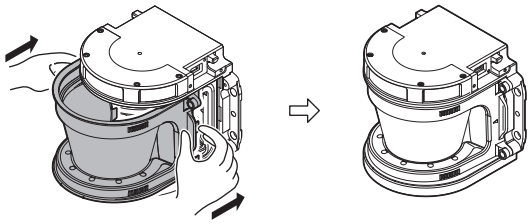
How to rotate the internal structure.



NOTICE



10. Insert the new window.
Insert the window until it touches the very back of the unit.



11. Attach the four screws to secure the window.
Recommended tightening torque : 0.6N· m.

12. Turn ON the SZ-V power and execute the window calibration.
For details on the window calibration procedure, see the “Window calibration” (page 105).

13. Reinstall the SZ-V in its designated area. After reinstalling it, perform an initial inspection.

DANGER	**・No person other than the responsible personnel or maintenance personnel should be allowed to replace the SZ-V window.** **・Always turn off the power to the SZ-V when replacing the window.** **・After replacing the window, always perform window calibration. If you do no perform the window calibration, the SZ-V will not work properly.** **・Perform window calibration in an environment with ambient temperature of 5 to 35 °C and with no dust or dirt on the window.**
NOTICE	**Do not touch the lens part inside the window. If you touch the lens part inside of the housing, you may break the SZ-V.**

Important

- **Replace the window in an environment with no dust or dirt, and replace it as quickly as possible.**
- **Make sure that the replacement window is not dirty or scratched, and has never been used. Also be sure not to dirty or scratch the new window when you install it.**
- **When replacing the window, do not leave the SZ-V with the window removed.**
- **Make sure that dust or dirt does not enter the inside of the window.**
- **If you do not follow the procedure, you may lose the IP65 rating.**

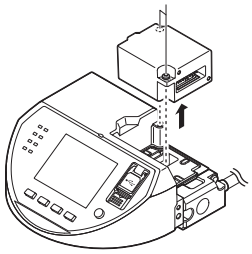
12-7 Replacing the Display unit

By using the system memory, the same settings can be maintained, even if replacing the Display unit. It is not necessary to transfer the settings from the SZ-V Configurator.

Replacement procedure

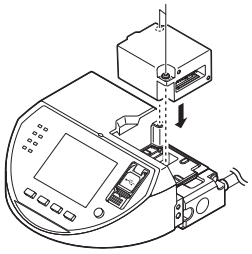
1. Prepare system memory (SZ-VSM) for the SZ-V.
2. Turn off the SZ-V and all devices that are connected to the SZ-V.
3. Remove the system memory that is currently connected to the Display unit.

M2.6 cross slot screws



4. Insert system memory into the new Display unit.

M2.6 cross slot screws
Tightening torque0.36 N·m



DANGER	**Always turn off the power to the SZ-V when replacing the Display unit.**

Appendices

A-1. Functions That Cannot Be Set Together

SZ-V04 type

When using the Interlock function (page 47)

- **“Bank Switching Function” (page 49)**
  - When used in combination with Multi-OSSD Function, the number of banks that can be used is limited to two or less.
  - In that case, even if the "Bank Switching Method" is changed to binary input, the maximum number of banks cannot be set to three or more.
- **“Independent bank switching” (page 54)**
  - Cannot be used.
- **“Operation Check Function” (page 57)**
  - Laser off input cannot be used.

When using the Bank Switching Function (page 49)

- **“Muting function” (page 55)**
  - Cannot be used.

■ **If using three or more banks**

- **“Interlock function” (page 49)**
  - Cannot be used, when used in combination with Multi-OSSD Function.
- **“Operation Check Function” (page 57)**
  - Laser off input cannot be used.

■ **When using the bank sequence monitoring function**

- **“Independent bank switching” (page 54)**
  - Cannot be used.

When using the Multi-OSSD Function (page 54)

“Muting function” (page 55)

- Cannot be used.

When using Independent bank switching (page 54)

- **“Interlock function” (page 49)**
  - Cannot be used.
- **“Bank Switching Function” (page 49)**
  - The number of banks that can be used is limited to two or less.
  - The bank switching method changes to the independent method. (page 54)
  - Cannot use the “Bank Sequence Monitoring Function” (page 53)
- **“Operation Check Function” (page 57)**
  - Cannot be used.

When using the Muting function (page 55)

- **“Bank Switching Function” (page 49)**
  - Cannot be used.
- **“Multi-OSSD Function” (page 54)**
  - Cannot be used.
- **“Independent bank switching” (page 54)**
  - Cannot be used.

When using Operation Check Function (page 57)

- **“Independent bank switching” (page 54)**
  - Cannot be used.

■ **If using the laser off input**

- **“Interlock function” (page 49)**
  - Cannot be used.
- **“Bank Switching Function” (page 49)**
  - The number of banks that can be used is limited to two or less.
  - Even if the "Bank Switching Method" is changed to binary input, the maximum number of banks cannot be set to three or more.

SZ-V32 type

When using the AUX Outputs (page 46)

■ **When using three or more AUX outputs**

- **“Bank Switching Function” (page 49)**
  - The number of banks that can be used is limited to 16 or less.
  - Cannot set “Bank switching methods” (page 49) to switching through encoder input.

When using the Interlock function (page 47)

- **“Operation Check Function” (page 57)**
  - Laser off input cannot be used.

When using the Bank Switching Function (page 49)

■ **If using 11 or more banks**

- **“Bank switching methods” (page 49)**
  - Cannot set the bank switching method to single input.

■ **If using 17 or more banks**

- **“AUX Output” (page 46)**
  - The number of AUX outputs that can be used is limited to two or less.

■ **When “Bank switching methods” (page 49) is set to switching through encoder input**

- **“AUX Output” (page 46)**
  - The number of AUX outputs that can be used is limited to two or less.

When using the Operation Check Function (page 57)

■ **If using the laser off input**

- **“Interlock function” (page 49)**
  - Cannot be used.

SZ-V32N type (When PROFIsafe is not used)

- **Multi-OSSD function**
  - Cannot be used.
- **All Bank function**
  - Cannot be used.

When using AUX Outputs (page 46)

■ **When using three or more AUX outputs**

- **“Bank Switching Function” (page 49)**
  - The number of banks that can be used is limited to 16 or less.
  - Cannot set "Bank switching methods” (page 49) to switching through encoder input.

When using the Interlock function (page 47)

- **“Operation Check Function” (page 57)**
  - Laser off input cannot be used.

When using the Bank Switching Function (page 49)

■ **If using 11 or more banks**

- **“Bank switching methods” (page 49)**
  - Cannot set the bank switching method to single input.

■ **If using 17 or more banks**

- **“AUX Output” (page 46)**
  - The number of AUX outputs that can be used is limited to two or less.

■ **When “Bank switching methods” (page 49) is set to switching through encoder input**

- **“AUX Output” (page 46)**
  - The number of AUX outputs that can be used is limited to two or less.

When using the Muting function (page 55)

- **“Bank Switching Function” (page 49)**
  - Cannot be used.

When using the Operation Check Function (page 57)

■ **If using laser off input**

- **“Interlock function” (page 49)**
  - Cannot be used.

SZ-V32N type (When PROFIsafe is used)

- **All of the input and output wires cannot be used.**
- **"EDM Function" (page 48)**
  - Cannot be used.
- **"Bank Switching Function" (page 49)**
  - Cannot be used.
- **"Operation Check Function" (page 57)**
  - The laser shutdown bank cannot be configured.
- **"Muting function" (page 55)**
  - Cannot be used.

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Revision history

Revision history	Edition number	Revision details
May 2016	Official release	
July 2016	1st (a) edition	Language added, contents revised
August 2016	1st (b) edition	Language added.
May 2017	2nd edition	Supported network added, misdescription revised.
November 2017	3rd edition	Correction

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