World's Smallest

TYPE 3 SAFETY LASER SCANNER

Up to 48 Zones

Select from 3 different models for your application

- Simple function (SZ-01S)
- Multi-function (SZ-04M)
- Multi-zone sets (banks) (SZ-16V)
Incredibly small, versatile, and affordable

World's smallest

Die-cast body

16 protection zones & 32 warning zones (48 total) can be configured.*

Maximum protection zone

4.2m (13.77')

* Model: SZ-16V only
3 models available according to the application

<table>
<thead>
<tr>
<th>Simple function type</th>
<th>Multi-function type</th>
<th>Multi-zone sets (banks) type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SZ-01S</td>
<td>SZ-04M</td>
<td>SZ-16V</td>
</tr>
</tbody>
</table>

**Area Protection**
A safety laser scanner allows users to configure protection zones anywhere, even in complex-shaped zones.

**Access Protection**
A safety laser scanner is easy to install. Side-mounted installation significantly reduces labor related to beam axis adjustment and wiring.

**Collision Prevention**
A safety laser scanner can be mounted on an automated guide vehicle. The following three area settings are available: slow area, stop area, and emergency stop area. SZ-16V users can configure up to 16 different zone sets, each consisting of unique slow, stop, and emergency stop area settings for a total of 48 zones.
Area Protection

A type 3 safety laser scanner allows users to easily configure protection zones.

Configure zones anywhere and save space

AREA PROTECTION - CONVENTIONAL METHOD VS. SZ SERIES METHOD

Safety Mat

- A safety mat may break if something heavy or sharp drops on it
- Having to stock different sized mats can be cumbersome
- Change in the facility layout can make safety mats unusable
- Not easy to move due to its heavy weight
- Only rectangular shapes can be covered in the protection zone

SZ Series

- Non-contact detection is free from damage caused by falling objects or vehicle traffic
- No need to stock different size mats
- Protection zones easily modified for workspace layout changes
- Easy to move due to its compact body and light weight
- Complex-shaped zones can be configured
Easily configure zones with a safety laser scanner

A laser scanner can be installed anywhere since protection zones and/or warning zones can be easily configured for dangerous areas. Despite its compact body, the SZ Series has a maximum protection zone of 13.77' 4.2m and a maximum warning zone of 32.80' 10 m.

ZONE CONFIGURATION

PC CONFIGURATION

Zones can be easily configured with a PC.

* Simple rectangular shaped protection zones can be configured via the front operator buttons.

Complex protection zones can be automatically configured around obstacles.

Multiple protection zones/warning zones can be switched

Multiple zones (protection zones/warning zones) can be selected via remote input. For example, in the image on the right, the zone set is selected via feedback on the robot's position.

* SZ-04M: 4 zone sets (banks)  
  SZ-16V: 16 zone sets (banks)
A type 3 safety laser scanner is easy to install.

Simple installation covers complex-shaped zones

ACCESS PROTECTION - CONVENTIONAL METHOD VS. THE SZ SERIES METHOD

Light curtain

- Installation was difficult due to the clearance of a complex shape.
- The transmitter and receiver required it be installed on both sides.

SZ Series

- The SZ Series can be freely configured to protect clearances of any shape.

Light curtain

- The Muting function could nullify an area that requires protection.

SZ Series

- Safety is increased by minimizing the dead zone caused by the Muting function.

The SZ-16V (Multi-zone set type) is not equipped with the Reference Point Monitoring function.
First laser scanner with a built-in Muting function

Similar to KEYENCE SL-V Series safety light curtains, muting sensors signal the scanner to ignore certain areas of the protection zone to allow passage of a target. However, unlike light curtains, muting the scanner results in a much tighter protection zone, minimizing dead zones around the passing target.

Maintain safe conditions even after unexpected misalignment
Reference Point Monitoring function

For vertical guarding (access protection), reference points are required to prevent changes from creating an unsafe condition (e.g. removal of a door or hard guard, unintended or even deliberate misalignment of the scanner). Configuring reference points with our user-friendly software can be done in seconds. If the reference points are breached, a stop signal is sent, preventing a potentially unsafe situation. (Reference Point Monitoring function)

Can be easily installed anywhere due to its light-weight and super-compact body

The SZ Series installs easily for vertical guarding or access protection applications. Compared to conventional scanning devices, the SZ offers smaller overall footprint and lighter weight, enabling simple installation. A variety of mounting brackets are available to help reduce installation time for any application, vertical or horizontal. (For details, see P. 11)

Can be placed in almost any position to guard the desired area

Configuring zones with conventional scanners is unforgiving and inflexible. The simple, intuitive drawing tools of the SZ Configurator software make it easy to create protection zones to the left, right or directly along the scanner’s centerline. This allows the user to choose the most convenient location to mount the scanner.
Collision Prevention

A type 3 safety laser scanner can be mounted on an automated guide vehicle.

Up to 16 zone sets (banks) with 3 zones for a total of 48 zones can be configured

One protection zone (emergency stop) and two warning zones (stop/slow), 3 zones in total, can be configured per zone set (bank) and up to 16 zone sets (banks) can be configured. External inputs enable simple switching between the 16 zone sets according to the speed, direction, and environment.

Distance based detection detects even matte black targets

Conventional obstacle detection could fail due to something as simple as wearing a dark pair of pants. The SZ Series ensures reliable detection by limiting the influence of color and surface finish.
User-friendly operation and diagnostics

**Simultaneous control of two individual protection zones**
One unit provides the capability of two devices

Unlike conventional scanners which use a single set of safety signals (OSSD1,2) requiring external input signals to toggle between protection zones, the SZ-04M features true simultaneous protection of two independent zones. No switching is required since two sets of safety signals (OSSD1,2 and OSSD3,4) are provided.

<table>
<thead>
<tr>
<th>Protection zone 1</th>
<th>Protection zone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSSD output 1</td>
<td>OSSD output 3</td>
</tr>
<tr>
<td>OSSD output 2</td>
<td>OSSD output 4</td>
</tr>
</tbody>
</table>

* Independent EDM and Reset inputs are also available for each zone.

**Sends the current status to external devices**
State Information Output

This function can send a signal to a PLC or other non-safety device for the intent of displaying real-time status information on an HMI or other interface. For example "Lens is soiled, please wipe clean, then reset" or "EDM Error. Please check external devices".

**Protection zones/warning zones can be configured with just the main unit, without the need for a PC**

Rectangular zones can be configured without a PC through the information display. Configuration is easy and it is no longer necessary to bring a PC for on-site operation.

**OPERATING PRINCIPLE**

**Distance measurement using the TOF (Time of Flight) method**
Calculates the time during which a pulse-emitted beam returns after hitting the detection target.

**Measurement at high-resolution of 0.36° pitch**
270° range is measured in a radial fashion using the TOF method at 0.36° pitch by revolving the internal reflective mirror at the speed of 30 ms/per revolution.
The easiest, most intuitive, step-by-step scanner configuration software you will ever use

**SZ-H1S configuration software is fast, easy, and loaded with useful, time-saving tools**

---

**Automatic-Drawing function**
For the ultimate in ease of use, simply mount the SZ in the desired location, clear the area, and click the "Automatic Drawing" tool. Immediately the SZ draws a zone around existing obstacles.

---

**Setup navigation function**
Guides the user through a step-by-step setup of functions.

---

**OTHER FUNCTIONS**

**Suspension in Teaching mode**
This function temporarily overrides safety functions during the robot's "teach" mode. It can only be activated when the SZ receives the teach mode signal from the robot.

**Interference reduction function**
The SZ Series has two scanning cycles, which makes it possible to reduce mutual interference between the SZs installed face-to-face.

**Output connectable to either NPN/PNP**
Regardless of the OSSD output type (NPN, PNP) being used, all non-safety outputs can be wired for either NPN or PNP operation depending on input device polarity.
Product Lineup

Main Unit

* Cables and brackets are not included. Select separately.

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Type</th>
<th># of zone sets (# of banks)</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple function type</td>
<td>1</td>
<td>SZ-01S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multi-function type</td>
<td>4</td>
<td>SZ-04M</td>
<td>Approx. 1.6 kg</td>
</tr>
<tr>
<td></td>
<td>Multi-zone sets (banks) type</td>
<td>16</td>
<td>SZ-16V</td>
<td></td>
</tr>
</tbody>
</table>

Brackets (Appearance when mounted)

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard mounting bracket</td>
<td>OP-86935</td>
<td></td>
</tr>
<tr>
<td>Vertical mount</td>
<td>OP-86936</td>
<td></td>
</tr>
<tr>
<td>Horizontal mount</td>
<td>OP-86937</td>
<td></td>
</tr>
<tr>
<td>Vertical mount</td>
<td>OP-86938</td>
<td></td>
</tr>
<tr>
<td>L-shaped mount</td>
<td>OP-86939</td>
<td></td>
</tr>
</tbody>
</table>

Mounting bracket (Optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard mounting bracket</td>
<td>OP-86935</td>
<td>Approx. 250g</td>
</tr>
<tr>
<td>Vertical mounting bracket</td>
<td>OP-86936</td>
<td>Approx. 180g</td>
</tr>
</tbody>
</table>

Cable

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Name</th>
<th>Length</th>
<th>Output</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USB cable</td>
<td>5m 16.4'</td>
<td>PNP</td>
<td>SZ-PS</td>
<td>Approx. 280g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5m 16.4'</td>
<td>NPN</td>
<td>SZ-PS</td>
<td>Approx. 360g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10m 32.81'</td>
<td>PNP</td>
<td>SZ-PS</td>
<td>Approx. 530g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10m 32.81'</td>
<td>NPN</td>
<td>SZ-PS</td>
<td>Approx. 725g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20m 65.62'</td>
<td>PNP</td>
<td>SZ-PS</td>
<td>Approx. 1,040g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20m 65.62'</td>
<td>NPN</td>
<td>SZ-PS</td>
<td>Approx. 1,400g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>SZ Series Configuration Software</td>
<td>SZ-H15</td>
<td>Approx. 80g</td>
</tr>
</tbody>
</table>

USB Cable (Optional)

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Name</th>
<th>Length</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP-86941</td>
<td>5m 16.4'</td>
<td></td>
<td>Approx. 200g</td>
</tr>
</tbody>
</table>

PC Software (Standard accessory)

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>SZ Series Configuration Software</td>
<td>SZ-H15</td>
<td>Approx. 80g</td>
</tr>
</tbody>
</table>
## Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td><strong>Simple function type</strong></td>
</tr>
<tr>
<td><strong>Minimum detectable object size</strong></td>
<td><strong>Diameter 1.18&quot; 30 mm/1.5&quot; 40 mm, 1.87&quot; 50 mm, 2.56&quot; 70 mm, 5.91&quot; 150 mm (depends on the setting)</strong></td>
</tr>
<tr>
<td><strong>Detectable angle</strong></td>
<td><strong>270° (-45° to 225°)</strong></td>
</tr>
<tr>
<td><strong>Response time (ON to OFF)</strong></td>
<td><strong>General scan cycle (Scan cycle A)</strong></td>
</tr>
<tr>
<td><strong>Max. protection zone</strong></td>
<td><strong>Minimum detectable object size:</strong></td>
</tr>
<tr>
<td><strong>Max. detection zone</strong></td>
<td><strong>Minimum detectable object size:</strong></td>
</tr>
<tr>
<td><strong>Max. warning zone (non safety related)</strong></td>
<td><strong>Minimum detectable object size:</strong></td>
</tr>
<tr>
<td><strong>Additional safety distance</strong></td>
<td><strong>3.94&quot; 100 mm</strong></td>
</tr>
<tr>
<td><strong>Light source</strong></td>
<td><strong>Type, wavelength</strong></td>
</tr>
<tr>
<td><strong>Laser class</strong></td>
<td><strong>Class 1 IEC / EN 60825-1: 2007</strong></td>
</tr>
<tr>
<td><strong>Power voltage</strong></td>
<td><strong>24 V DC ±10% (Ripple P-P 10% or less); When using a converter power supply:</strong></td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td><strong>Max. 9.5 W (without load)</strong></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td><strong>PNP or NPN (Selectabe according to the connector cable)</strong></td>
</tr>
<tr>
<td><strong>Max. load current</strong></td>
<td><strong>500mA</strong></td>
</tr>
<tr>
<td><strong>Residual voltage (during ON)</strong></td>
<td><strong>Max. 2.5 V (with a cable length of 16.4’ 5 m)</strong></td>
</tr>
<tr>
<td><strong>OFF-state voltage</strong></td>
<td><strong>Max. 2.0 V (with a cable length of 16.4’ 5 m)</strong></td>
</tr>
<tr>
<td><strong>Leakage current</strong></td>
<td><strong>Max. 1 mA</strong></td>
</tr>
<tr>
<td><strong>Max. capacitive load</strong></td>
<td><strong>2.2 μF (with a load resistance of 1000Ω)</strong></td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td><strong>4.4 kΩ (for Input 1)</strong></td>
</tr>
<tr>
<td><strong>Max. load current</strong></td>
<td><strong>50mA</strong></td>
</tr>
<tr>
<td><strong>Residual voltage (during ON)</strong></td>
<td><strong>Max. 2.5 V (with a cable length of 16.4’ 5 m)</strong></td>
</tr>
<tr>
<td><strong>Non safety-related output (AUX output)</strong></td>
<td><strong>PNP/NPN totem pole output</strong></td>
</tr>
<tr>
<td><strong>Enclosure protection</strong></td>
<td><strong>IP65 (IEC60529)</strong></td>
</tr>
<tr>
<td><strong>Operating ambient temperature</strong></td>
<td><strong>-10 to +55°C (No freezing) 14 to 131°F</strong></td>
</tr>
<tr>
<td><strong>Storage ambient temperature</strong></td>
<td><strong>-25 to +60°C (No freezing) 13 to 140°F</strong></td>
</tr>
<tr>
<td><strong>Operating relative humidity</strong></td>
<td><strong>35 to 85% RH (No condensation)</strong></td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td><strong>35 to 95% RH</strong></td>
</tr>
<tr>
<td><strong>Surrounding light</strong></td>
<td><strong>Incandescent lamp: 1500 lx or less</strong></td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td><strong>100 m/s2 (Approx. 10 G), 16 ms pulse in X, Y, and Z directions, 1,000 times each axis</strong></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td><strong>Aluminum die casting, SPHC (Bottom)</strong></td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td><strong>65.62’ 20 m or less</strong></td>
</tr>
<tr>
<td><strong>EMC</strong></td>
<td><strong>IEC61496-1, EN61496-1, UL 61496-1</strong></td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td><strong>IEC61496-1, EN61496-1, UL 61496-1 (Type 3 ESPE)</strong></td>
</tr>
</tbody>
</table>

---

*1 20% or more reflectance is necessary for the minimum detectable object in the warning zone.
*2 3% The total load current of the OSSD output and the AUX output must be 1.5 A or less in case of the converting equipment for power supply, while it must be 1.0 A (0.5 A with 10% ± 1% of cable length) or less in case of the battery.
*3 This also takes into account the situations when power is either off or disconnected.
*4 The wiring resistance between the OSSD output and the connected equipment (excluding the resistance of the cable) must be 25 D or less to ensure operation. However, it must be 1.0 D or less if the load current is 500 mA or more.
*5 3% The SZ should not be installed so as to have light interference within ±5° to the detection plane.
*6 It must be 32.81’ 10 m or less if the power is supplied by the battery.
Example of wiring for simple function type (SZ-01S)  
Configuration of start/restart mode: Manual/Manual

For the PNP output type cable

- K1, K2: External device (Safety relay, magnet contactor, etc.)
- K3: Solid state contactor
- S1: Switch for reset operation (N.O.)
- S2: Switch for override (N.O.)
- PLC: Used for monitoring, not for control systems related to safety.

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, the yellow wire should be short-circuited to +24 V.
- In case of NOT applying the EDM function, the red wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 and PLC are non-safety-related systems.

For the NPN output type cable

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

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, the yellow wire should be short-circuited to 0 V.
- In case of NOT applying the EDM function, the red wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 and PLC are non-safety-related systems.

Example of wiring for multi-function type (SZ-04M)  
Multi-OSSD function: Mode A, B, C and Not use, configuration of start/restart mode: Manual/Manual in case of applying the muting function

For the PNP output type cable

- K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
- K5, K6: Solid state contactor
- S1: Switch for reset operation (N.O.)
- S2: Switch for override (N.O.)
- P1, P2: Muting devices (ex. PZ series with PNP output, Keyence Corp.)
- M: 3-phase motor
- L: Muting lamp

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- K3 and PLC are NON SAFETY-RELATED systems.

For the NPN output type cable

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

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to 0 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 and PLC are NON SAFETY-RELATED systems.
For the PNP output type cable

K1, K2: External device (Safety relay, magnet contactor, etc.)
K3: Solid state contactor
S1: Switch for reset operation (N.O.)
- In case of “Manual/Automatic” on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of “Automatic/Automatic” on the configuration of start/restart, yellow wire should be short-circuited to +24 V.
- In case of NOT applying the EDM function, red wire must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K3 is NON SAFETY-RELATED system.

Input / output circuit

Input circuit
- For the PNP output type cable
- For the NPN output type cable

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

OSSD output circuit (Safety output)
- For the PNP output type cable
- For the NPN output type cable

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

OSSD Time chart for self-diagnosis pulse

When the SZ detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state.
The OSSD is a safety output for safety-related part of a machine control system.
OSSD 1/2 is a pair of safety outputs that performs the output of same state. Similarly, OSSD 3/4 is also a pair of safety outputs that performs the output of same state.
The SZ generates self-diagnosis signals on its internal control circuit to perform diagnostics on the OSSD. Those signals periodically force the OSSD into a temporary OFF-state when the OSSD is in the ON-state (when the SZ detects no object in the protection zone.). The internal control circuit receives a feed-back signal (OFF-signal) based on the self-diagnosis, the SZ determines that its OSSD is in the normal operation. If the OFF-signal is not returned to the internal control circuit, the SZ determines that there is a problem in its OSSD or wiring and goes to the error state.

NOTE: The devices connected to the OSSD, such as safety relay or contactor, should not respond to those temporary, self-diagnostic OFF-signals.
With the new functions, it is no longer necessary to purchase an additional control unit. Functions like muting and beam axis intensity monitoring that used to be difficult or impossible, are now easy to setup using the software. As a result, on-site installation time will be greatly reduced.

### Fixed Blanking function
For Stationary Objects

### Floating Blanking function
For Moving Objects

### Specifications

**Safety Light Curtain SL-V Series**

**Super Slim Line-up**

- **SL-VF series**
- **SL-VH series**

**Super Heavy Duty Line-up**

- **SL-VFM series**
- **SL-VHM series**
- **SL-VH series**

**Additional Equipment**

- **NEW Safety Relay Terminal SL-T11R**
- **NEW Safety Controller SC-S11**
- **NEW PC Configuration Software SL-VH1S**
- **NEW Interface Unit SL-V1UB**
- **NEW USB Cable (2m 6.56’) OP-51580**

**Fixed Blanking function**
Increase safety by muting specific beams according to target height.

**Clearance height 1**

**Clearance height 2**

---

**Correspondence**

HEAD OFFICE

KEYENCE CORPORATION OF AMERICA

50 Tice Blvd., Woodcliff Lake, NJ 07677

Phone: 201-930-0100  Fax: 201-930-0099

E-mail: keyence@keyence.com

---

**KEYENCE MEXICO S.A. DE C.V.**

Phone: +52-81-8220-9097  Fax: +52-81-8220-9097

E-mail: keyencemexico@keyence.com

---

**KEYENCE CANADA INC.**

Head Office  Phone: 905-696-9970  Fax: 905-696-8340  E-mail: keyencecanada@keyence.com

Montreal  Phone: 514-694-4740  Fax: 514-694-3206

---

Specifications are subject to change without notice.