

KEYENCE

NEW Safety Laser Scanner
SZ-V Series

Maximum safety standard for scanners

Type3 **SIL2** **Category3** **PLd**



EtherNet/IP™



A NEW STANDARD FOR SAFETY LASER SCANNERS

SAFETY AND PRODUCTIVITY IN ONE



SZ-V Series

A NEW SAFETY LASER SCANNER OFFERING BOTH SAFETY AND PRODUCTIVITY

SZ-V SERIES



Safety measures are essential for any manufacturing site. However, sometimes those safety measures come at the cost of productivity. With KEYENCE's SZ-V Series, new technologies and concepts combine to provide both safety and productivity.



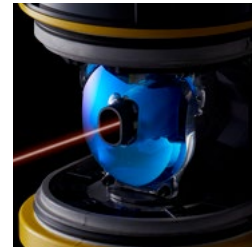
IMPROVED BASIC PERFORMANCE

NEW SCANNING TECHNOLOGY

Maximum Protection Zone of 8.4 m

Fine pitch × Multi-sampling

With a protection zone of 8.4 m—the longest in the industry—the SZ-V offers protection over a wide area. In addition, with a strong defence against dust and mist, the SZ-V helps reduce detection errors and contributes to maintaining a high level of productivity.



WORLD'S FIRST

STATUS MONITORING WITH JUST A MAIN UNIT

Monitor view / Camera view

Display unit separation

The SZ-V brings together the world's first concept featuring a main unit LCD and a detachable system in an effort to resolve the inability to visually see the point of detection, a common concern with conventional laser scanner models.

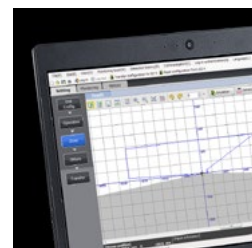


EASY TO USE IN ALL SCENARIOS

Drawing Assist function

Module structure

The SZ-V is designed for ease of use in a variety of situations, from laser scanner configuration to maintenance. This helps to reduce the number of man-hours required.



Integrated system



Separate system



NEW Safety Laser Scanner **SZ-V Series**

NEW SCANNING TECHNOLOGY

The SZ-V offers significantly improved laser scanner performance with highly efficient safety measures.

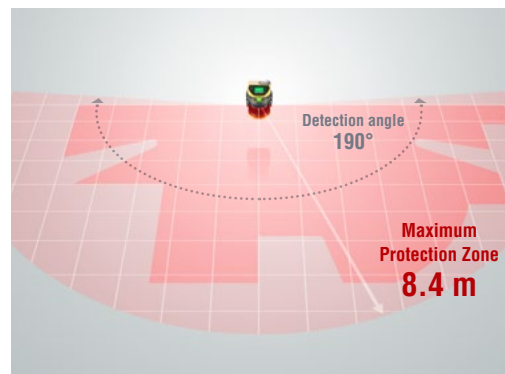


Wide area coverage with large protection zone

Industry-leading range

PROTECTION ZONE OF UP TO 8.4 m WITH JUST ONE UNIT

The SZ-V has a maximum protection zone of 8.4 m twice that of conventional models (comparison by KEYENCE). Get complete protective coverage with just one device. This makes the SZ-V great for wide area coverage applications, for example automotive body processing. In addition, with a warning zone of up to 26 m, the SZ-V can be used in a wide range of applications.

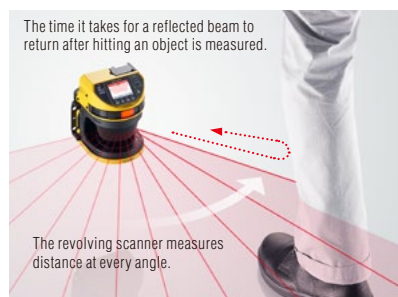


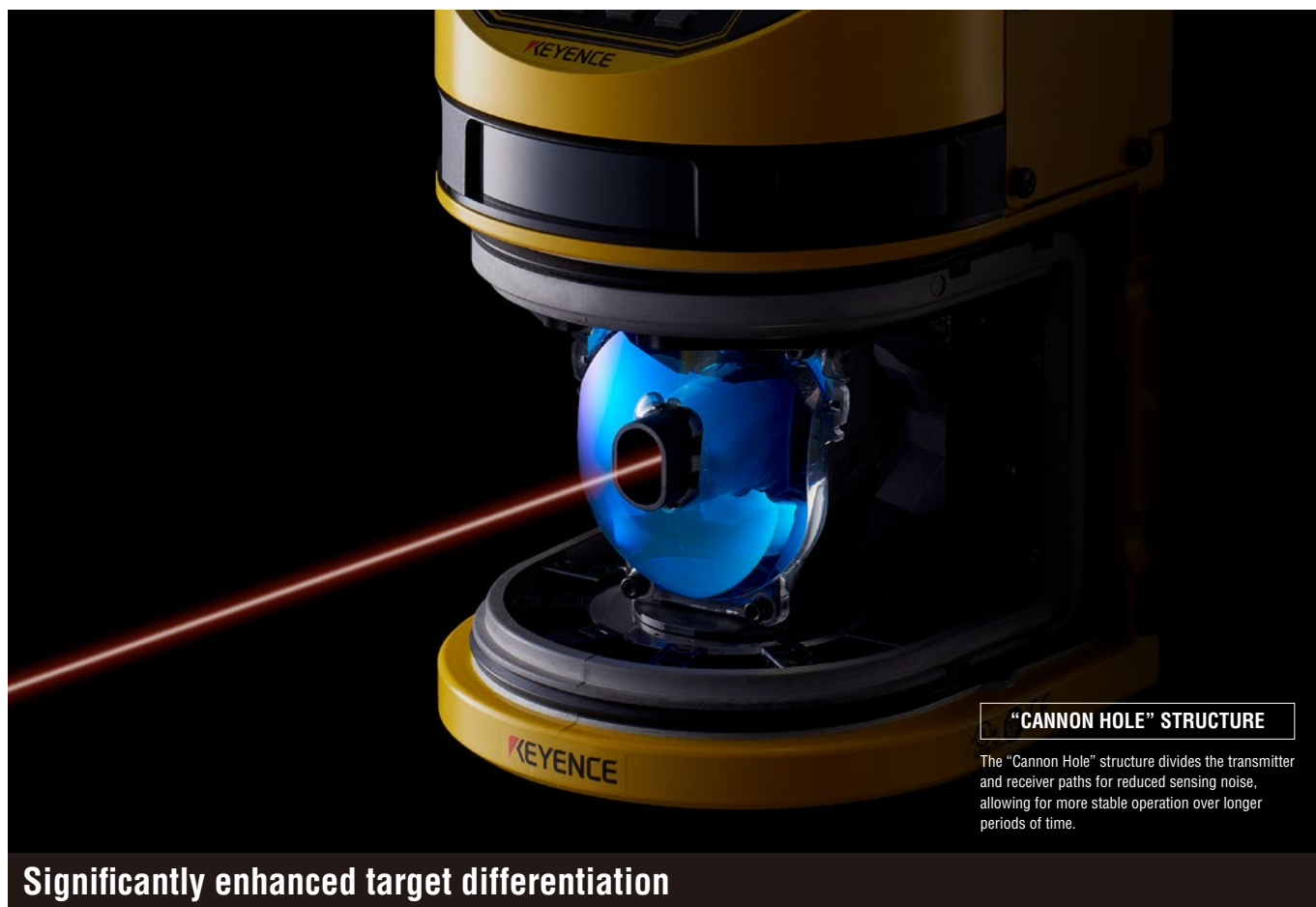
DETECTION PRINCIPLE

TIME OF FLIGHT (TOF) METHOD

Calculating distance by looking at the time it takes for a reflected laser beam to return after hitting an object

A laser beam is emitted at every scan angle, and by measuring the time it takes for that beam to return after hitting an object, the distance to that object can be calculated. The SZ-V Series uses this method to check for objects within a 190° detection angle.

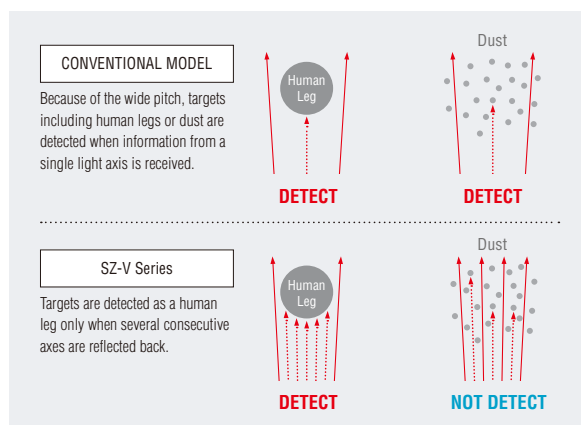




Vastly improved environmental resistance

FINE PITCH × MULTI-SAMPLING

The SZ-V Series includes a fine laser beam emission angle pitch of 0.1°, compared to 0.36° of conventional models, allowing for more than three times the multi-sampling of conventional models. In addition, the sensor beam spot size has been minimised to roughly half that of conventional models (at a distance of 4 m). Detection is also determined by multiple optical axes for increased environmental resistance and reduced false detections.

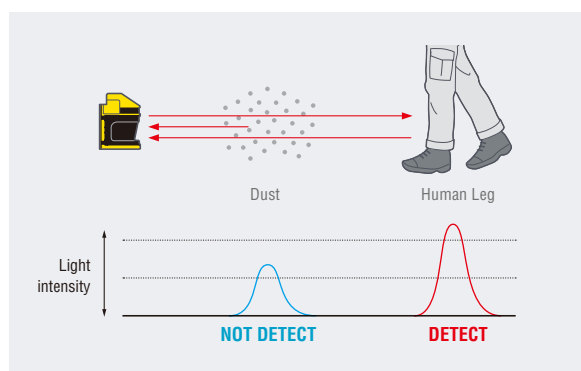


Differentiating between people and dust

RD² ALGORITHM

RD² = Reduction of Dust Detection

The SZ-V Series is equipped with a new algorithm that is capable of discerning the slight differences between reflected light from dust and mist—common causes of malfunctions—and reflected light from objects that must always be detected to ensure safety. Distance is measured quickly by detecting signals at two different levels. Detection of black objects that have a reflectance of 1.8% is performed reliably within the measurement error (Tolerance zone) while objects determined to be dust and mist are not detected.



STATUS MONITORING

World's first

The display unit features an LCD monitor that can be detached. This offers a real time visual of the operating status, which was not available with conventional models.



Status visualisation by LCD monitor

Monitor zones and detection statuses

MAIN UNIT MONITOR VIEW ON THE DISPLAY

World's first

The QVGA LCD monitor on the display unit makes it possible to check the status of the protection zone without the use of a PC. Visualising the normally unseen protection zone helps prevent accidental entry of workers, and thus reduce unnecessary machine stoppage.



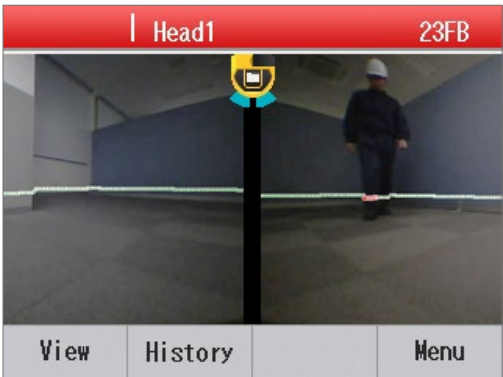
Real Time video to see detection status

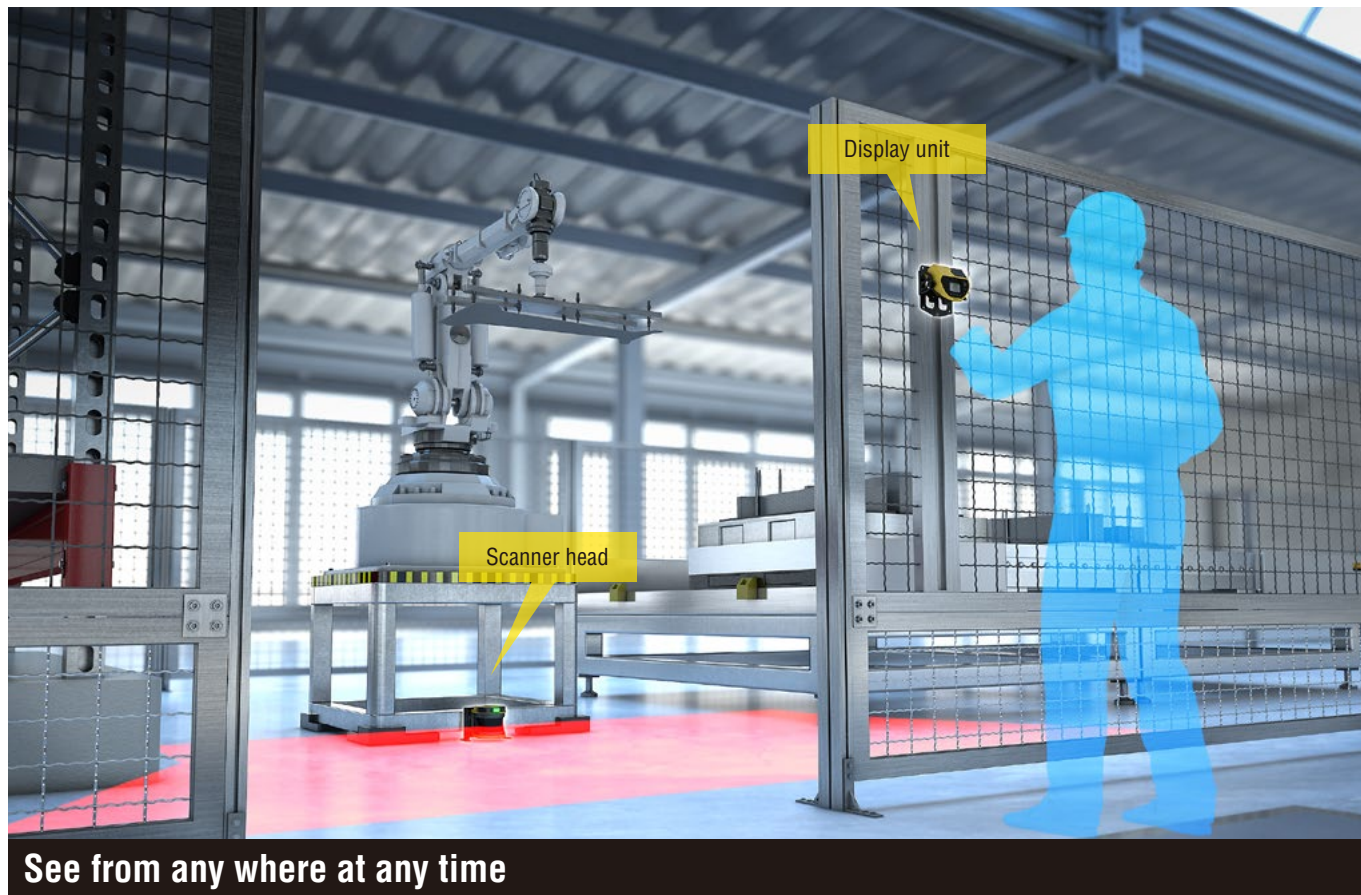
CAMERA VIEW ON DISPLAY UNIT

World's first

Camera type

With two built-in cameras, video from the scanner can be seen in real time. This feature not only helps with scanner installation, but images can also be saved. This reduces the time required for analysing the cause of machine stoppage.





Confirmation and operation from an easy-to-see location

DETACHABLE DISPLAY UNIT WITH USB PORT World's first

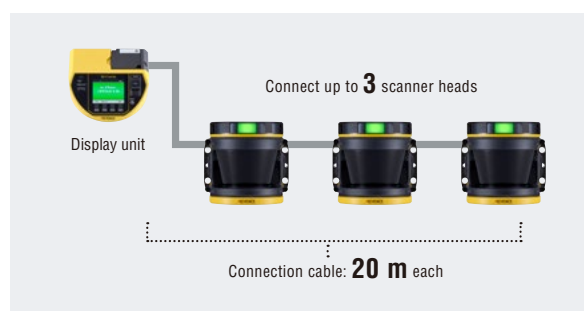
The detachable display unit makes it possible to easily see the scanner's status without using a PC even when the scanner head is located in difficult-to-access locations such as hazardous areas and high locations that cannot be accessed safely. This also allows for safe and easy operation when transferring the configuration.



Simplify wiring and reduce costs

CASCADE CONNECTION FOR INTERFERENCE PREVENTION AND SIMPLIFIED WIRING

When installing multiple laser scanners on one machine, up to three scanner heads can be connected (cascade connection) to a single display unit. Not only does this help simplify wiring and reduce costs, but mutual interference can also be prevented.



EASY TO USE

The SZ-V is designed for ease of use, reducing the amount of time required for configuration or maintenance.



*Configuration software is available as a free download.

Simple configuration just by following the steps

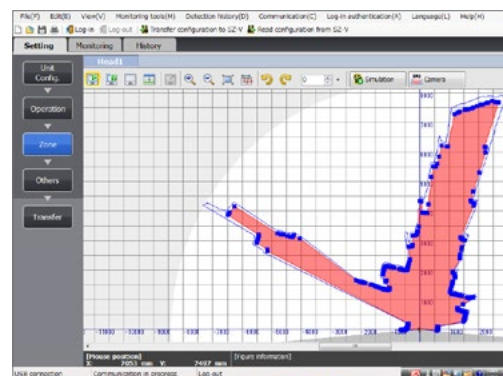
SIMPLIFIED DRAWING

Freely draw zones

DRAWING ASSIST FUNCTION

The configuration software not only allows zones to be drawn easily but also offers a Drawing Assist function. Choose from the Automatic Drawing function* that requires one button push to map out zones according to the surroundings, or the Dynamic Drawing function, which makes use of a special reflector to map out the corners of desired zones. With the SZ-V, ease of use extends even to zone drawing.

*This function is used for preliminary zone drawing.

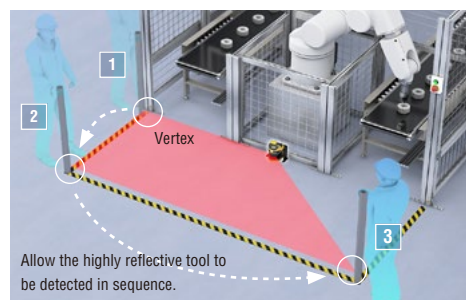


NEW FUNCTION

DYNAMIC DRAWING FUNCTION

Use a special tool to draw zones that suit the actual location

Rather than drawing zones on a PC screen, this function allows zones to be drawn in the actual workspace. Detecting the attached highly reflective tool at each vertex in sequence makes it possible to set the desired zone.

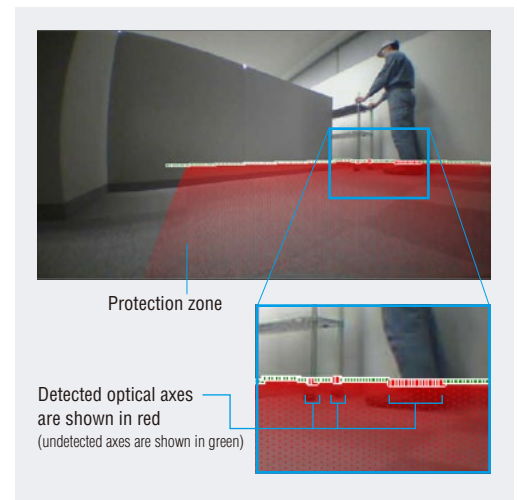


EASY INSTALLATION

Visualise the invisible laser beams

OVERLAY FUNCTION

The SZ-V laser scanner introduces the ability to view the laser scanning plane. The ability to clearly see where the laser beams are detecting offers precise optical-axis alignment during installation. Areas where detection has occurred are coloured red, and clear areas are coloured green, making it easy to see exactly what is in the protection zone. This function helps to dramatically reduce the time required for height and angle adjustment during setup.

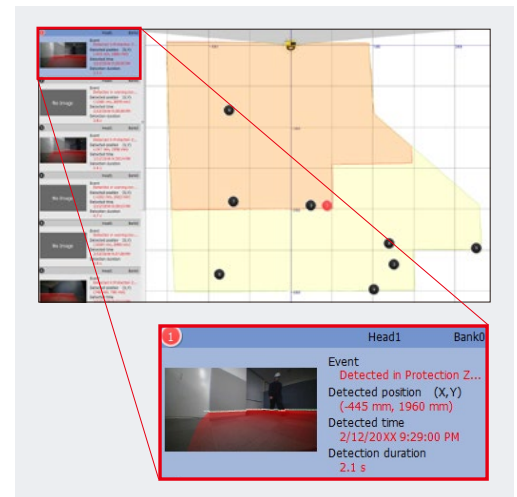


SIMPLE OPERATION

Know exactly when detection occurs

DETECTION HISTORY FUNCTION

Adding to the industry-first OSSD OFF History function, the SZ-V can store up to 500 events. Not only does this include OSSD OFF data but also warning zone detection, error and alert. Furthermore, models with built-in cameras take pictures of the moment the OSSD turns OFF enabling quick analysis of causes.



EASY MAINTENANCE

Replace only the required parts

MODULAR STRUCTURE

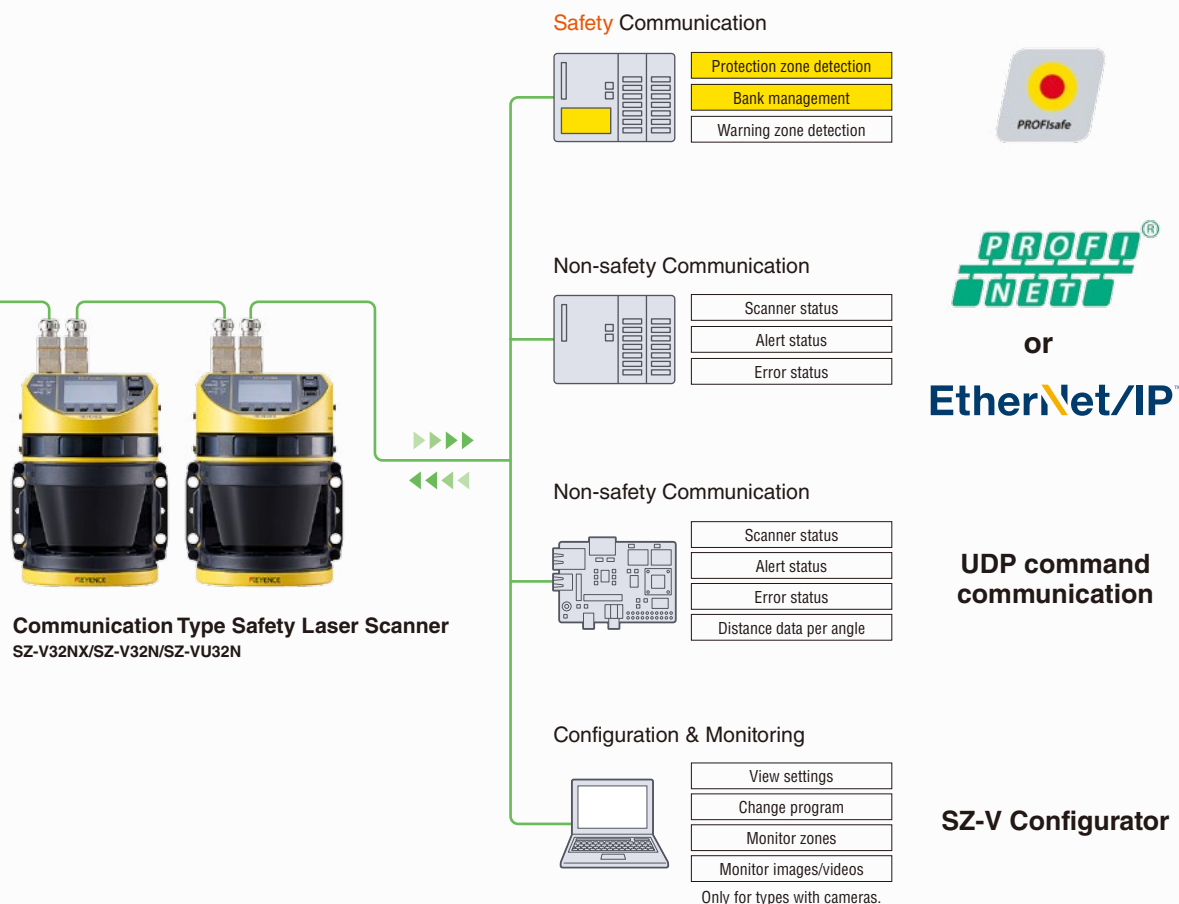
The SZ-V Series adopts a modular structure that makes it possible to replace parts independently. In the event a part breaks for any reason, only the damaged part will need to be replaced. In addition, the system memory stores all of the device settings, removing the need for a PC to reconfigure the system. The ability to prepare an inventory of individual parts can also help reduce maintenance costs.



EXPANDED NETWORK APPLICATIONS

In addition to conventional EtherNet/IP™ network communication, the SZ-V Series supports PROFI-safe and PROFINET communication.

EXTENSIVE NETWORK COMPATIBILITY



* PROFI-safe and EtherNet/IP™ cannot be used at the same time.

Broad network support

SUPPORTS PROFI-safe/PROFINET NEW

In addition to conventional EtherNet/IP™ network communication, the SZ-V Series also supports PROFI-safe and PROFINET communication. With a PROFI-safe safety network, it is possible to utilise information related to the OSSD status and manage banks with a safety PLC. What's more, when using a non-safety network, EtherNet/IP™ or PROFINET, it is also possible to monitor the status of the scanner over a network with a general-purpose PLC, simplifying wiring and increasing the speed of monitoring.

Remote setting and monitoring as well as obtaining distance measurement data

COUNTLESS APPLICATIONS

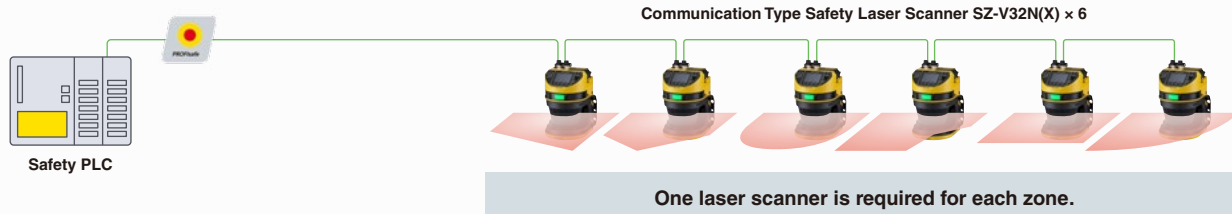
It is possible to communicate with the laser scanner not just through its USB interface but over a network as well. This makes it possible to monitor and transmit data to an on-site laser scanner from a remote location. Also, UDP command communication can be used to communicate not only the status of the scanner but also distance data for each angle at high speeds. These two functions can be used simultaneously when using open networks.



NEW APPLICATIONS MADE POSSIBLE WITH THE SZ-V AND PROFIsafe

Before

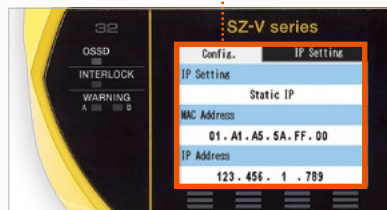
[Example] Monitoring six zones



Cost
reduced to $\frac{1}{3}$

After

[Example] Monitoring six zones



EASILY UNDERSTANDABLE DISPLAY WITH NETWORK PARAMETERS

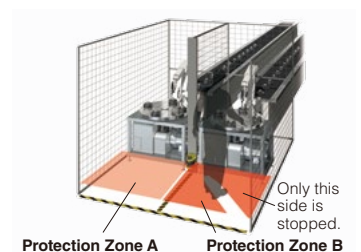
It is possible to easily view network parameters such as the IP address without needing to connect to a PC. It is also possible to monitor the communication status with the SZ-V at a glance.

One unit with the power of two

DETECT TWO PROTECTION ZONES SEPARATELY

It is possible to monitor two different protection zones at the same time with a single scanner. This makes it possible to perform the work of two scanners with just a single unit, simplifying wiring and reducing costs.

Furthermore, the bank management function supports up to 16 banks and 64 zones (including warning zones), enabling a wide variety of applications.

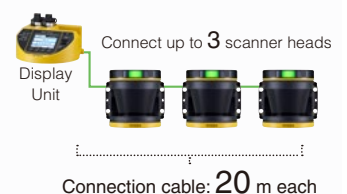


Up to three scanner heads can be connected

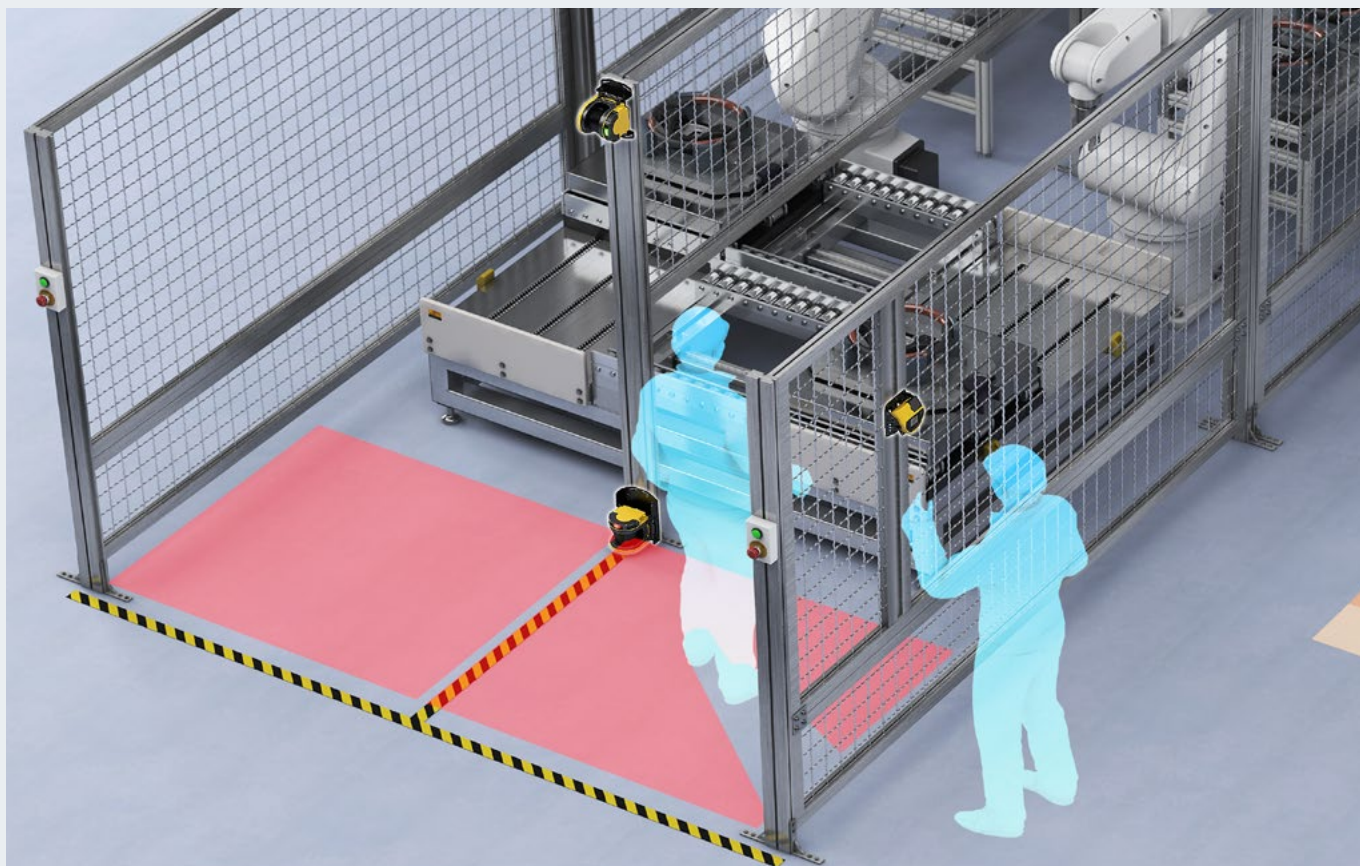
CASCADE CONNECTION FUNCTION

When installing multiple laser scanners on one machine, up to three scanner heads can be connected (cascade connection) to a single display unit.

Furthermore, if a communication type display unit is used, it is possible to manage all three connected scanner heads separately over the network. When utilised, this leads to major cost reductions.



IMPROVED AREA PROTECTION EFFICIENCY



Flexible installation with 8.4 m protection zone

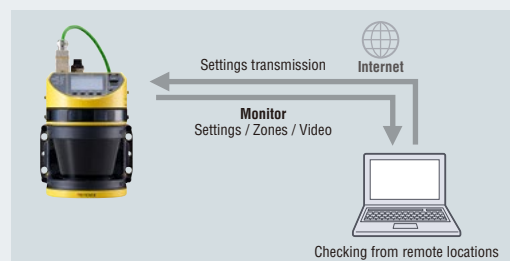
Maximum 190°, radius 8.4 m protection zone enables installation of scanners outside of the active workspace, reducing the chances of the scanner being damaged by operators.



Checking and configuring from remote locations

Network compatibility SZ-V32N

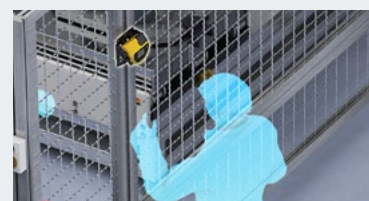
With the SZ-V, communication with the laser scanner can be done via not only USB but also a network, allowing data to be sent to a laser scanner from a remote location. Network communication can also be used to see detection history and offers monitoring functionality that includes the camera view function. This also allows for remote maintenance.



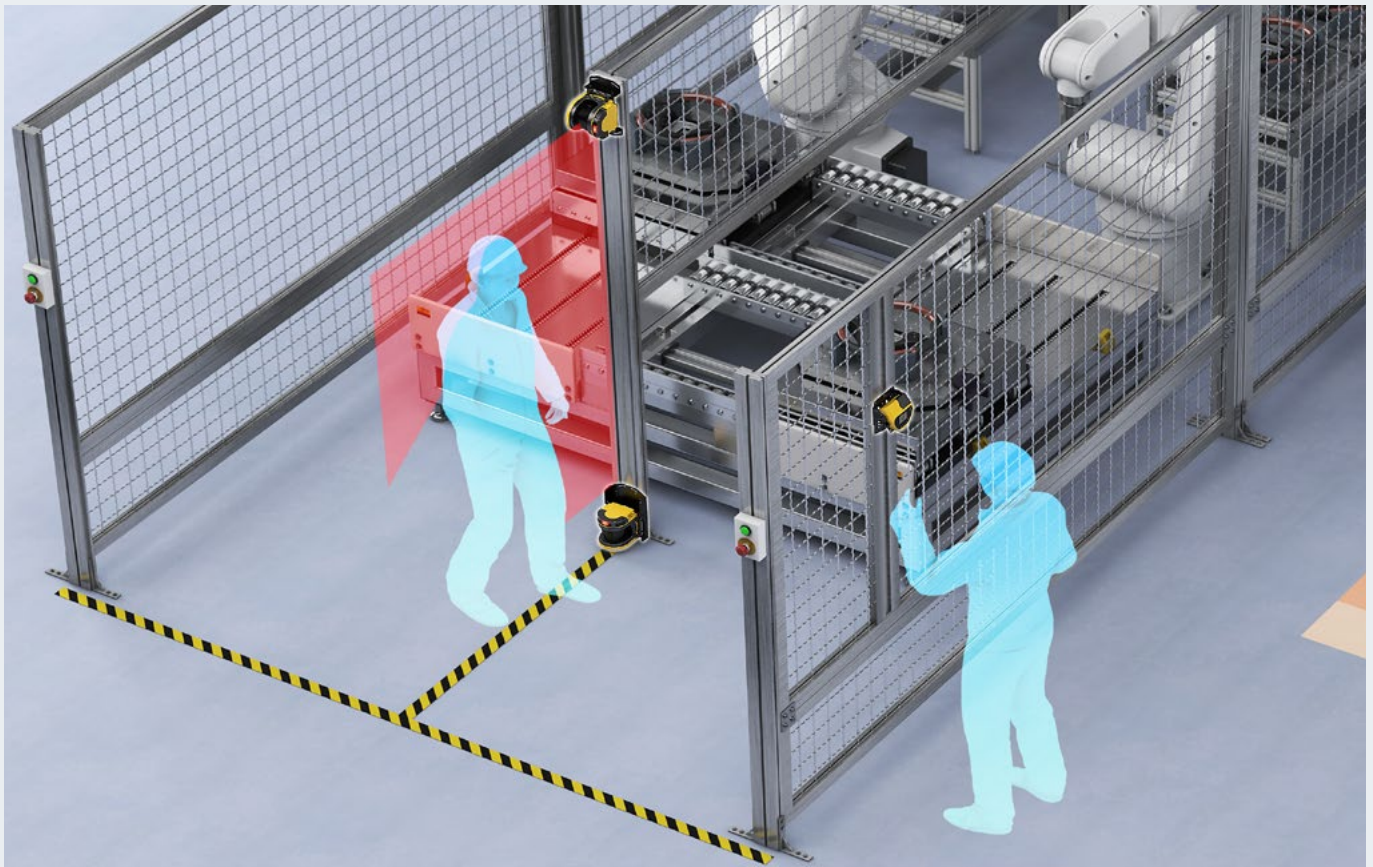
MONITORING AND SEPARATE DISPLAY UNIT:

Condition checking from outside the hazardous region

By installing the display unit outside the hazardous area, protection and warning zones can be safely checked without stopping the machine. This eliminates the need for a connection to a PC, which was required with conventional models.

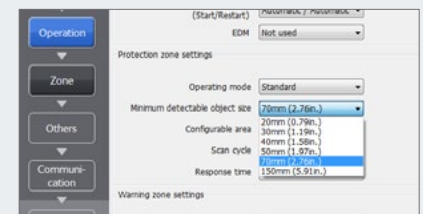


FURTHER IMPROVED ACCESS PROTECTION SAFETY



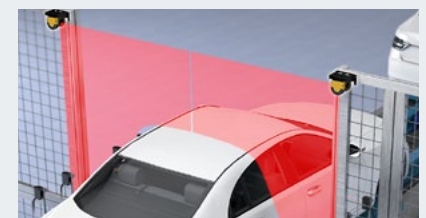
Reduced safety distance [ø20 mm Minimum detectable object size mode]

The SZ-V uses the most effective diameter for the minimum detectable object size in order to reduce safety distances. By shortening the safety distance both safety and productivity can be increased, a key requirement for numerous applications e.g. access protection.



Configurable muting function eliminates blind spots SZ-V32N

The SZ-V features a Muting function to prevent workers from entering the hazardous region at the same time as large targets. By eliminating blind spots, which are common occurrences when using light curtains, safety can be greatly enhanced.



VISUALISATION AND SEPARATE DISPLAY UNIT:

No need to access high locations

The display unit is equipped with a built-in USB port. This allows for simple and safe communication with a PC even when the scanner head is installed in a location that is not easily accessible.



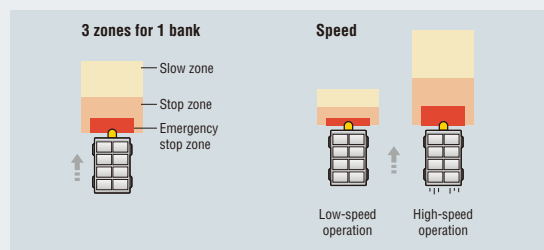
COLLISION PREVENTION



96 Configurable zones

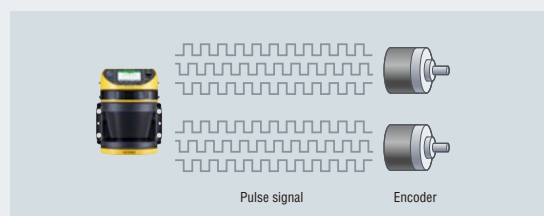
[Max. 32 Banks, 3 Zones for 1 Bank] SZ-V32/V32N

One protection zone and two warning zones can be configured per bank. With maximum 32 configurable banks, the most appropriate zone can be selected by use of external signals.



Encoder input support SZ-V32/V32N

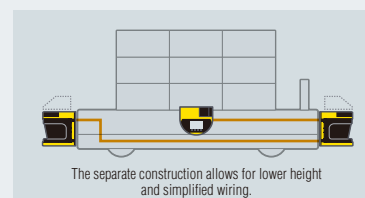
The SZ-V can be used with two encoders, making it possible to switch between 8 zone stages according to the speed. Zones are switched according to the actual speed of vehicle, contributing to improved safety.



SEPARATE CONSTRUCTION FOR

Lower height and simplified wiring

The ability to detach the display unit allows for lower mounting height than is possible with conventional models. In addition, support for cascade connections makes it possible to simplify wiring when used with safety control devices.



MORE CONVENIENT AND SIMPLE SAFETY MEASURES

Built-in mounting brackets

The SZ-V Series includes a direct mounting mechanism that enables the unit to be mounted directly without a separate bracket. The mounting direction can be accessed from the front of the device rather than the rear, as is the case with conventional models, allowing for easy installation.



Protection cover

The dedicated SZ-VB21 protection cover is made of metal and designed to protect the plastic window of the main unit. This cover reduces the risk of damage to the window should the scanner be hit by an object.



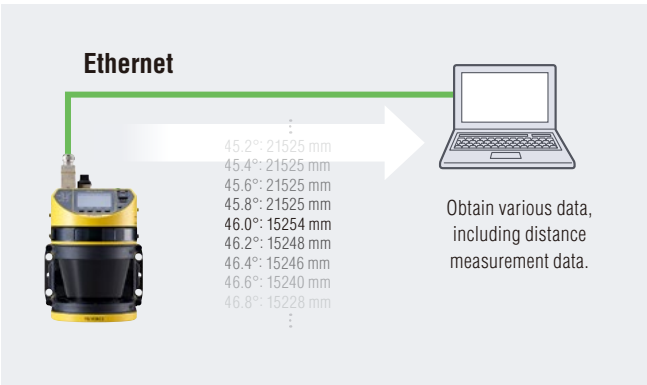
An Industry First — 2D Code display function

In addition to displaying the error code the SZ-V also displays a 2D code, when an error occurs. This 2D code can be read by handheld terminals and other portable devices to easily check troubleshooting steps.



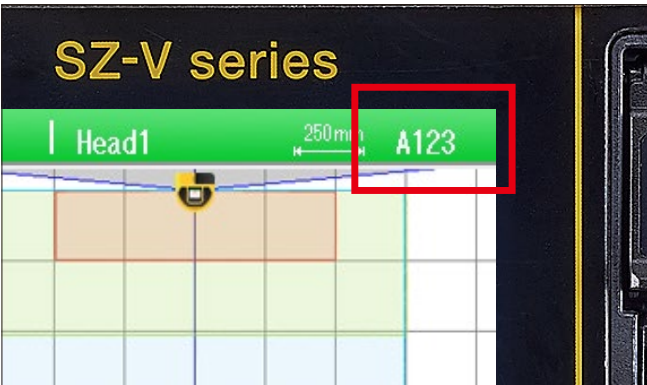
Ethernet data communication function SZ-V32N

The SZ-V allows for easy communication of information including distance measurement data and error/alert statuses using EtherNet/IP™ and PROFINET for PLCs and UDP command communication for PCs.



CRC Display function CRC=Cyclic Redundancy Code

A CRC code—encoded setting information (cyclic redundancy code)—is shown on the display unit. CRC management using external equipment is also possible when using network-compatible models.





Transfer history function

The configuration software “SZ-V Configurator” can be used to see the history of data transferred to the main unit. This, coupled with CRC support, allows for more diligent safety management.



Transfer date/time	File name	Configurati...	Display unit used for t...	Transferred by
3/25/2016 10:11:32 ...	Untitled_0325.szvd	651F	Serial number 885115...	Responsible p...
3/25/2016 10:09:53 ...	Untitled_0325.szvd	651F	Serial number 885115...	Responsible p...
3/25/2016 10:01:36 ...	Untitled_0325.szvd	29F1	Serial number 885115...	Responsible p...
3/25/2016 9:52:57 AM	Untitled_0325.szvd	29F1	Serial number 885115...	Responsible p...
3/10/2016 6:56:08 AM	Untitled_0305.szvd	1CD0	Serial number 885115...	Responsible p...
3/7/2016 4:44:40 PM	Untitled_0305.szvd	9D24	Serial number 885115...	Responsible p...
3/7/2016 4:37:19 PM	Untitled_0305.szvd	B8B6	Serial number 885115...	Responsible p...
3/6/2016 4:41:53 PM	Untitled_0305.szvd	9D24	Serial number 885115...	Responsible p...
3/6/2016 4:20:37 PM	Untitled_0305.szvd	D284	Serial number 885115...	Responsible p...
3/6/2016 2:36:09 PM	Untitled_0305.szvd	448D	Serial number 885115...	Responsible p...
3/5/2016 6:58:13 PM	Untitled_0305.szvd	A1A4	Serial number 885115...	Responsible p...
3/5/2016 6:15:14 PM	Untitled_0305.szvd	5370	Serial number 885115...	Responsible p...
3/5/2016 5:13:44 PM	Untitled_0305.szvd	0709	Serial number 885115...	Responsible p...
3/5/2016 4:43:55 PM	Untitled_0305.szvd	8AC1	Serial number 885115...	Responsible p...
3/5/2016 3:43:29 PM	Untitled_0305.szvd	D62E	Serial number 885115...	Responsible p...

Integrated models



Function		Model	Weight
 Standard type	Camera	SZ-V32X	Approx. 2100 g
	Standard	SZ-V32	Approx. 2100 g
 Multi-function and Network type	Camera	SZ-V32NX	Approx. 2300 g
	Standard	SZ-V32N	Approx. 2300 g

*Integrated models include display unit, scanner head, system memory, and a connection cable (SZ-VS005).


Display units

Function		Model	Weight
 Standard type		SZ-VU32	Approx. 420 g
 Multi-function and Network type		SZ-VU32N	Approx. 600 g


Scanner heads

Function		Model	Weight
 Camera type		SZ-VH1X	Approx. 1600 g
 Standard type		SZ-VH1	Approx. 1600 g


System memory

	Model	Weight
	SZ-VSM	Approx. 60 g

Protection cover


	Model	Weight
	SZ-VB21*1	Approx. 1000 g

Protection cover (visor)

	Model	Weight
	SZ-VB22*1	Approx. 660 g

*1 The SZ-VB21/SZ-VB22 protection covers can be mounted over a mounting bracket.

Replacement window

	Model	Weight
	SZ-VHW	Approx. 130 g

Configuration software



Configuration software <Safety Device Configurator> can be downloaded from the KEYENCE website for free.

Mounting brackets

Installation	Name / Model	Weight
	Adjustable angle mounting bracket (horizontal) SZ-VB01	Approx. 900 g
	Adjustable angle mounting bracket (vertical) SZ-VB02	Approx. 1800 g
	Floor bracket SZ-VB03	Approx. 1350 g
	Display unit standard bracket SZ-VB11	Approx. 700 g
	Display unit DIN rail mounting bracket (flat) SZ-VB12	Approx. 350 g
	Display unit DIN rail mounting bracket (slim) SZ-VB13*2	Approx. 350 g


*2 SZ-VB13 cannot be used with SZ-VU32N.

Power cable


	Type	Length	Model	Weight
	Standard	5 m	SZ-VP5	Approx. 400 g
		10 m	SZ-VP10	Approx. 800 g
		20 m	SZ-VP20	Approx. 1500 g
		30 m	SZ-VP30	Approx. 2200 g
	Power Cable When Using PROFiSafe	10 m	SZ-VP10PW	Approx. 650 g
	M12 Quick Disconnect	0.3 m	SZ-VPC03*3	Approx. 80 g

*3 SZ-VPC03 is equipped with only 4 pins: 24 V, 0 V, OSSD1, OSSD2.





Extension cable (for use with SZ-VPC03)

	Type	Length	Model	Weight
	Power Cable Extension (M12)	10 m	SZ-VCC10	Approx. 750 g

Connection cable

	Length	Model	Weight
	0.05 m	SZ-VS005	Approx. 80 g
	5 m	SZ-VS5	Approx. 350 g
	10 m	SZ-VS10	Approx. 700 g
	20 m	SZ-VS20	Approx. 1300 g

Ethernet cable/USB cable

	Length	Model	Weight
 Main unit connection cable	0.3 m	SZ-VNC03	Approx. 110 g
 Ethernet extension cable (RJ45)	2 m	OP-88086	Approx. 160 g
	5 m	OP-88087	Approx. 340 g
	10 m	OP-88088	Approx. 660 g
 Ethernet extension cable (M12)	2 m	OP-88089	Approx. 160 g
	5 m	OP-88090	Approx. 340 g
	10 m	OP-88091	Approx. 660 g
	20 m	OP-88092	Approx. 1280 g
 USB cable	2 m	OP-51580	Approx. 70 g
	5 m	OP-86941	Approx. 200 g

SPECIFICATIONS

Model				SZ-V32 (X)		SZ-V32N (X)		
Type				Standard type		Multi-function and 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	160 ms (2scans) to 1280 ms (16scans)*3				
			Scan Cycle B	168 ms (2scans) to 1344 ms (16scans)*3				
			Scan Cycle C	176 ms (2scans) to 1408 ms (16scans)*3				
		High Speed Mode*2	Scan Cycle A	80 ms (2scans) to 640 ms (16scans)*3				
			Scan Cycle B	84 ms (2scans) to 672 ms (16scans)*3				
			Scan Cycle C	88 ms (2scans) to 704 ms (16scans)*3				
	Response time (OFF to ON)			Response time of ON to OFF + 150 ms				
	Protection zone	Minimum detectable object size: 70/150 mm			Standard Mode: 8.4 m / High Speed Mode: 5.7 m			
		Minimum detectable object size: 50 mm			Standard Mode: 5.6 m / High Speed Mode: 3.8 m			
		Minimum detectable object size: 40 mm			Standard Mode: 4.3 m / High Speed Mode: 2.9 m			
		Minimum detectable object size: 30 mm			Standard Mode: 2.9 m / High Speed Mode: 2.0 m			
		Minimum detectable object size: 20 mm			Standard Mode: 1.6 m / High Speed Mode: 1.1 m			
	Warning zone	Minimum detectable object size: 70/150 mm			Standard Mode: 26 m / High Speed Mode: 23 m*4			
Minimum detectable object size: 50 mm			Standard Mode: 25 m / High Speed Mode: 21 m*4					
Minimum detectable object size: 40 mm			Standard Mode: 24 m / High Speed Mode: 20 m*4					
Minimum detectable object size: 30 mm			Standard Mode: 23 m / High Speed Mode: 18 m*4					
Minimum detectable object size: 20 mm			Standard Mode: 21 m / High Speed Mode: 15 m*4					
Additional safety distance			100 mm*5					
Maximum measurement distance			60 m*6					
Maximum number of banks				Max. 32 banks				
Multiple scanner heads				Max. 3				
Camera				Monitor area: over 190° (-5° to 185°)*7				
Display				QVGA 2.2inch colour LCD				
Light source	Type, wavelength		Infrared laser diode, 905 nm					
	Laser class	IEC	Class 1 IEC/EN 60825-1					
		FDA	Class 1 FDA 21 CFR 1040.10, 1040.11 (Laser Notice No.50)*8					
		JIS	Class 1 JIS C6802					
Rating	Power voltage		24 VDC ±10% (Ripple P-P 10% or less); When using a converter power supply, 24 VDC +20%/ -30%; When using a battery					
	Power consumption		11.8 W (without load), 55.0 W (with load)*9		13.4 W (without load), 50.8 W (with load)*9			
Control output (OSSD output)	Output type		PNP or NPN transistor output (settings configurable with SZ-V Configurator)					
	Number of outputs		2 outputs					
	Max. load current		500 mA*10					
	Residual voltage		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 100 Ω)					
Input (safety-related)	Load wiring resistance		Max. 2.5 Ω					
	PNP		ON-voltage: 10 to 30 V, OFF-voltage: Open or 0 to 3 V, Short-circuit current: Approx. 2.5 mA (EDM input: Approx. 10 mA)					
Non safety-related output (AUX output)	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)					
	Output type		Transistor output (PNP or NPN, settings configurable with SZ-V Configurator)					
	Number of outputs		4 outputs					
	Max. load current		50 mA					
	Residual voltage (during ON)		Max. 2.5 V (with a cable length of 5 m)					
Interface	Muting lamp		—		Connectable to incandescent lamp (24 VDC, 1 to 5.5 W) and LED lamp (load current: 10 to 230 mA)			
	USB		USB2.0					
	Ethernet	Standard	—		IEEE802.3u (100BASE-TX)			
		Transmission rate	—		100 Mbps			
		Cable	—		Category5 or higher STP (Shielded Twisted Pair) or UTP (Unshielded Twisted Pair) cable			
Connector		—		RJ45 (IP65 connector) 2 ports				
Networking/data output			—		PROFIsafe, PROFINET, EtherNet/IP™, UDP			
Environmental resistance	Enclosure rating		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 lux or less*12					
	Vibration		10 to 55 Hz, 0.7 mm compound amplitude, 20 sweeps each in X, Y, and Z directions					
Material	Shock		100 m/s ² (Approx. 10 G) 16 ms pulse in X, Y, Z directions, 1000 times each axis					
	Scanner head		Main unit case		Magnesium			
			Window		Polycarbonate, PEI			
			Indicator part*7		Aluminium, PES			
	Display unit		Case		Magnesium, PPS, polycarbonate			
System memory		Case		Aluminium, PPE				
Cable length	Power cable		30 m or less*13					
	Connection cable		20 m or less each*14					
	Ethernet cable		—		100 m or less*15			
Approved standards	EMC	EMS	IEC61496-1, EN61496-1, UL61496-1 (Type3 ESPE)					
		EMI	EN55011 Class A, FCC Part15B Class A, ICES-003 Class A					
	Safety		IEC61496-1, EN61496-1, UL61496-1 (Type3 ESPE), IEC61496-3, EN61496-3 (Type3 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 1.6 m/s, regardless of the encoder setting. *2 The response time, protection zone, and warning zone are affected by the operation mode. *3 When PROFIsafe is used with the SZ-V32N, 6 ms is added to the response time. *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 minimum 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 sensor heads, it is necessary to add 9.4 W per scanner head. Also, power consumption may temporarily be higher (maximum 3.6 W). Power consumption will be within the specification after SZ-V moves to normal operation. *10 For 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

Step1

Select main unit

1 Select system**2** Select functions**3** Select camera model or standard model**Integrated system**

Standard type

Camera

**SZ-V32X**

Standard

**SZ-V32**

Multi-function and Network type

Camera

**SZ-V32NX**

Standard

**SZ-V32N****Separate system**

Standard type



Camera


 Display unit: **SZ-VU32**
 Scanner head: **SZ-VH1X**
 System memory: **SZ-VSM**
 Connection cable: **SZ-VSxx**

Standard


 Display unit: **SZ-VU32**
 Scanner head: **SZ-VH1**
 System memory: **SZ-VSM**
 Connection cable: **SZ-VSxx**

Multi-function and Network type



Camera


 Display unit: **SZ-VU32N**
 Scanner head: **SZ-VH1X**
 System memory: **SZ-VSM**
 Connection cable: **SZ-VSxx**

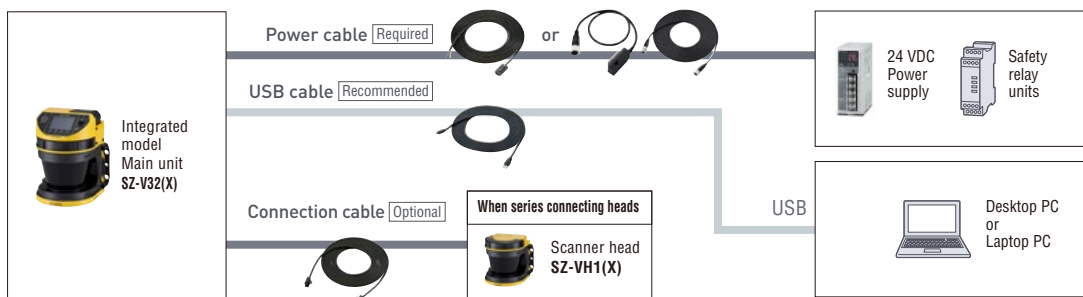
Standard


 Display unit: **SZ-VU32N**
 Scanner head: **SZ-VH1**
 System memory: **SZ-VSM**
 Connection cable: **SZ-VSxx**

Step2 Select cables

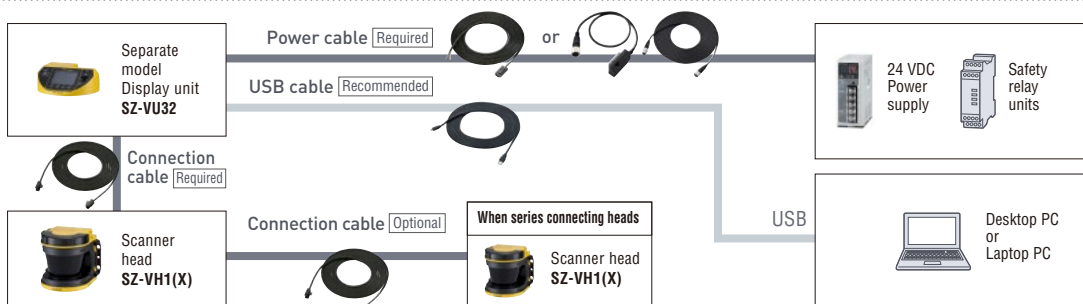
Integrated system

Required: Power cable
Recommended: USB cable
Optional: Connection cable (only if performing series connection)



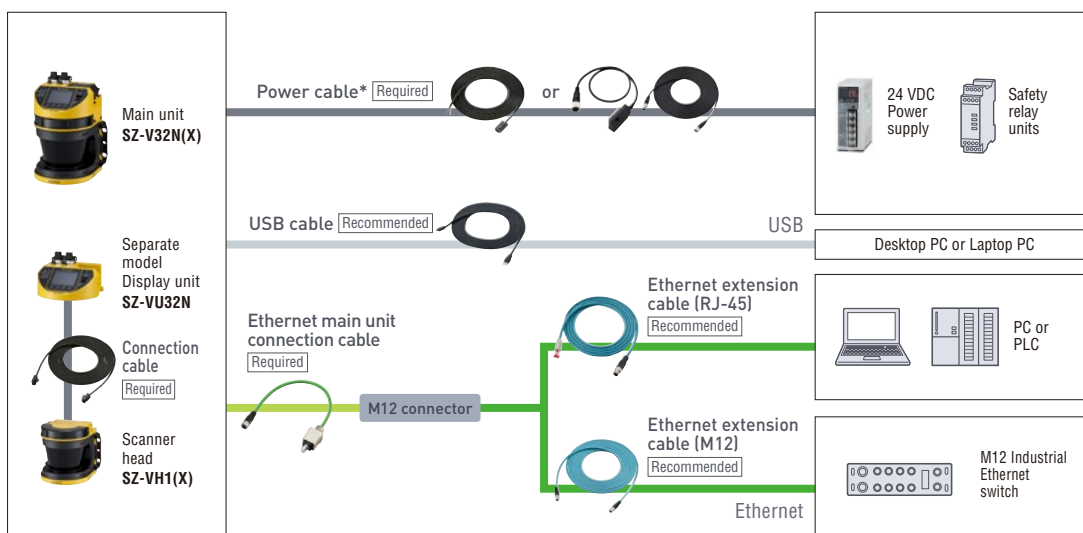
Separate system

Required: Power cable and Connection cable
Recommended: USB cable
Optional: Additional Connection cable (only if performing series connection)



Network communication type

Required: Power cable, Connection cable (if separate system), Ethernet main unit connection cable
Recommended: USB cable, Ethernet extension (M12) or Ethernet extension (RJ-45)
Optional: Connection cable (if performing series connection)



Power cable (Standard)

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

Power Cable Extension (M12)

0.3 m	SZ-VPC03
10 m	SZ-VCC10

Power Cable When Using PROFI-safe

10 m	SZ-VP10PW
------	-----------

Connection cable

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

Ethernet extension cable (RJ45)

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

* Select Power Cables

Model	Description	Safety Output	
		OSSD	PROFI-safe
SZ-VP5/10/20/30	Standard Cable	✓	—
SZ-VP10PW	Power Cable When Using PROFI-safe	—	✓
SZ-VPC03, SZ-VCC10	Power Cable Extension (M12)	▲*1	✓*2

✓: Possible ▲: Possible with limitations —: Impossible

*1 SZ-VPC03 is equipped with only 4 pins: 24 V, 0 V, OSSD1, OSSD2. *2 OSSD1, OSSD2 is disabled when using PROFI-safe.

Ethernet main unit connection cable

SZ-VNC03

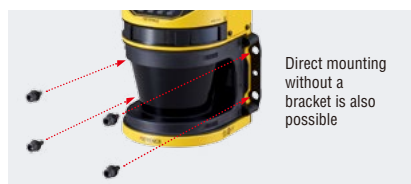
USB cable

2 m	OP-51580
5 m	OP-86941

Ethernet extension cable (M12)



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

Step3 Select bracket [optional]



Direct mounting without a bracket is also possible

	Adjustable angle mounting bracket (horizontal) SZ-VB01		Adjustable angle mounting bracket (vertical) SZ-VB02		Floor bracket SZ-VB03
	Display unit standard bracket SZ-VB11		Display unit DIN rail mounting bracket (flat) SZ-VB12		Display unit DIN rail mounting bracket (slim) SZ-VB13

Model		SZ-V32 (X)	SZ-V32N (X)	
				
Type		Standard	Multi-Function and Network	
			Not using PROFSafe	Using PROFSafe
Detection capability	Protection zone	✓ 1 zone	✓ 1 zone	✓ 2 zones
	Warning zone	✓ 2 zones	✓ 2 zones	✓ 2 zones
	Minimum detectable object size	Diameter 20, 30, 40, 50, 70, 150 mm		
Camera		✓ ^{*1}	✓ ^{*1}	✓ ^{*1}
Interlock function		✓	✓	✓ ^{*3}
EDM function		✓	✓	—
Bank function	Maximum number of banks	32	32	16
	Switching through wiring inputs	✓	✓	—
	Switching through encoder inputs	✓	✓	—
	Monitoring multiple banks via network	—	—	✓
Muting function		—	✓	—
Reference points monitoring function		✓	✓	✓
Number of AUX outputs		✓ 4 outputs ^{*2}	✓ 4 outputs ^{*2}	— ^{*3}
State information output		✓	✓	— ^{*3}
Detection history		✓	✓	✓
Ethernet Communication		—	✓	✓
Cascading scanner heads		Max. 3 units		

*1 Only when using a scanner head with a camera.

*2 The number of usable AUX outputs varies depending on the settings.

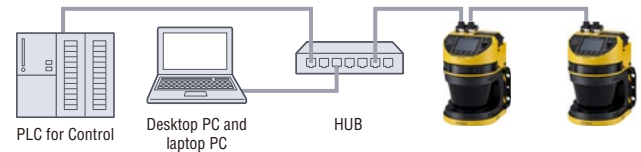
*3 When using PROFSafe, all physical I/O wires will be deactivated. Corresponding information can be read/written over PROFSafe/PROFINET communication.


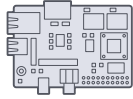

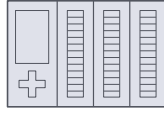
Reference: Depending on the settings, some functions cannot be used simultaneously. For details, refer to the SZ-V Series user's manual.

ETHERNET COMMUNICATION DETAILS

ETHERNET COMMUNICATION

An Ethernet cable can be used with the SZ-V32N type for data handling with a PC or PLC. Select the optimal communication method according to the connected device.



Functions available via communication	Communication to SZ-V Configurator	UDP Command ^{*1}	EtherNet/IP™, PROFINET ^{*1*4}	PROFIsafe ^{*4}
Configure SZ-V protection zones	✓	—	—	—
Configure SZ-V functions	✓	—	—	—
Check detection status with monitor view	✓	—	—	—
Read distance measurement data	—	✓	▲	▲ ^{*3}
Read error status of SZ-V	✓	✓	✓	✓ ^{*3}
Read error history of SZ-V	✓	—	—	—
Check configuration code (CRC)	✓	✓	✓	✓ ^{*3}
Monitor camera image of SZ-V	✓ ^{*2}	—	—	—
Use OSSD status for safety related controls	—	—	—	✓
Monitor multiple banks	—	—	—	✓
Send interlock reset signal to SZ-V	—	—	—	✓
Typical devices to be connected	 Desktop PC and laptop PC	 Original program on board computers	 PLC or industry PC	 Safety PLC
Application examples	Monitor remote SZ-V	AGV control using measurement data	Show scanner status on HMI	Safety related control

✓: Possible ▲: Possible with limitations —: Impossible

^{*1} Information that can be retrieved through UDP command communication, EtherNet/IP™ communication and PROFINET communication cannot be used for control related to safety.

^{*2} Only when using a scanner head with a camera.

^{*3} Can be read by PROFINET communication. PROFINET communication can be used simultaneously with PROFIsafe communication.

^{*4} Only available with version 2 or later of Network Type models.

COMMUNICATION FUNCTIONS THAT CAN BE USED SIMULTANEOUSLY



When using network communication, it is necessary to select one of the following communication protocols.

The relation between a selected communication protocol and the communication functions that can be used is shown in the following table.

Selected communication protocol	Communication functions that can be used at the same time				
	Communication to SZ-V Configurator	UDP Command	EtherNet/IP™	PROFINET	PROFIsafe
UDP	✓	✓	—	—	—
EtherNet/IP™	✓	✓	✓	—	—
PROFINET	✓	✓	—	✓	—
PROFIsafe	✓	✓	—	✓	✓

NETWORK SPECIFICATIONS

Ethernet General Specifications

Standard	IEEE 802.3u (100BASE-TX)
Transmission rate	100 Mbps
Cable	Category5 or higher STP (Shielded Twisted Pair) or UTP (Unshielded Twisted Pair) cable
Connector	RJ45 (IP65 connector) 2 ports

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 10000 ms (0.5 ms unit)
Tolerable communication bandwidth for cyclic	3000 pps
Conformance Test	Conform to CT12

PROFINET Specifications

Compatible Network		PROFINET IO Communication
Basic Specifications	Compatible functions	Cyclic communication (Data I/O Communication) Acyclic communication (Record I/O Communication)
	Conformance Class	Conformance Class B
	GSDML version	Version 2.32
	Conformance Test Version	Based on version 2.33
	MRP	Available as client
	Applicable Protocols	LLDP, SNMP, MRP, DCP
Cyclic Specification	Netload	Class 3
	Update time	1 to 512 ms

PROFIsafe Specification

PROFIsafe Version	V2
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DATA AVAILABLE WITH PROFIsafe COMMUNICATION

INPUT (from SZ-V to Safety PLC)

Byte offset	Details	bit	Description
0	Zone Detection Status / SZ-V Status	0	Protection Zone A State (OSSD 1/2)
		1	Protection Zone B State (OSSD 3/4)
		2	Warning Zone A State
		3	Warning Zone B State
		4	Interlock-Reset-Ready A
		5	Interlock-Reset-Ready B
		6	Normal Operation State
		7	Error State
1	SZ-V Status	0	Bank Number (A)
		1	Bank Number (B)
		2	Bank Number (C)
		3	Bank Number (D)
		4	Bank Number valid
		5	Laser off state
		6	Reserved
		7	Reserved
2	Window Pollution Information / Head1 State	0	Head1 Window Pollution State
		1	Head2 Window Pollution State
		2	Head3 Window Pollution State
		3	Reserved
		4	Head1 Protection Zone A 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
		1	Head2 Protection Zone B State
		2	Head2 Warning Zone A State
		3	Head2 Warning Zone B State
		4	Head3 Protection Zone A 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
	
		15	Protection Zone A State for Bank15
6	Protection Zone B State for each Bank	0	Protection Zone B State for Bank0
	
		15	Protection Zone B State for Bank15
8	Warning Zone A State for each Bank	0	Warning Zone A State for Bank0
	
		15	Warning Zone B State for Bank15
10	Warning Zone B State for each Bank	0	Warning Zone B State for Bank0
	
		15	Warning Zone B State for Bank15

OUTPUT (from Safety PLC to SZ-V)

Byte offset	Details	bit	Description
0	Output	0	Reset A
		1	Reset B
		2	Reserved
		3	Reserved
		4	Reserved
		5	Laser OFF
		6	Reserved
		7	Return to Normal Operation
1	Bank Number	0	Bank Number
		1	
		2	
		3	
		4	Bank Number (reverse) For each bit, specify opposite value of bit 0-3
		5	
		6	
		7	
2	Reserved	0	Reserved
...	
...		15	Reserved
...	
10		0	Reserved
...	
...		15	Reserved

* Protection Zone States on Byte offset 4 to 10 may be easily affected by mutual interference or other environmental factors, compared to states in Zone Detection Status (Byte offset 0)



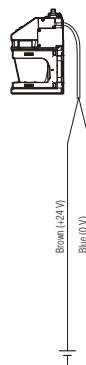
Please do not use information other than Protection Zone States for control related to safety.

PROFIsafe / PROFINET DIAGNOSTICS

SZ-V is compatible with PROFINET Diagnostics function. The following information can be sent to a safety PLC as PROFINET Diagnostic alert information.

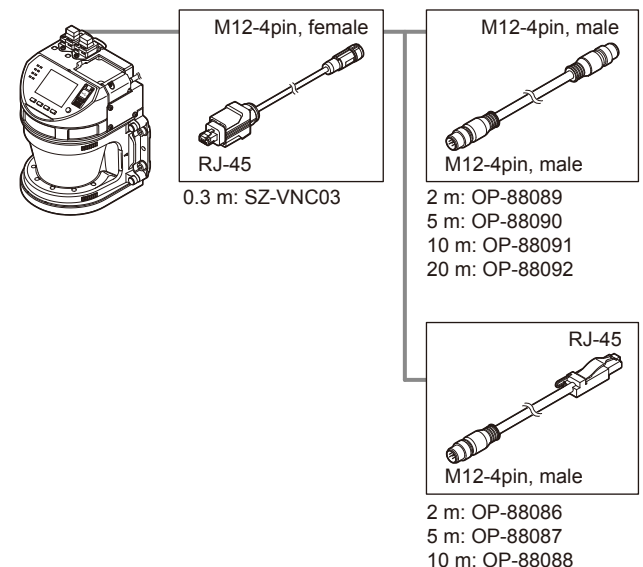
Alert notification item	PROFINET	PROFIsafe
PROFIsafe Parameter Error	—	✓
PROFIsafe Transmission Error	—	✓
Window pollution Alert	✓	✓
Window pollution Error	✓	✓
MI Error	✓	✓
Bank Input Error	✓	✓
Bank Sequence Error	✓	✓
Configuration Error	✓	✓
System Error	✓	✓
AUX Error	✓	—
EDM Error	✓	—
Encoder Error	✓	—
OSSD Error	✓	—
Other Error	✓	✓
Other Alert	✓	✓

WIRING AND CABLES FOR PROFIsafe



* When PROFIsafe communication is used, all physical I/O wires (OSSDs, EDM, Reset, AUX, etc.) will be deactivated.

* For Ethernet cable selection, please refer to the selection guide on p.18 as well as the figure below.



SZ-V32 type

Bank switching: Used

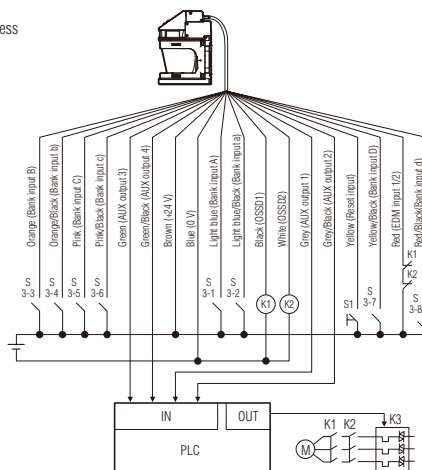
Bank switching method: Single or binary

No. of banks: Single: 8 or less, Binary: 16 or less

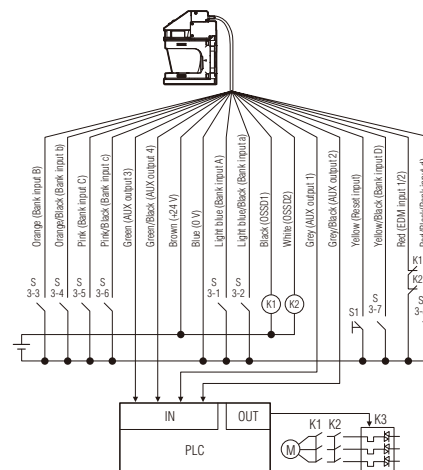
Interlock: Used

EDM: Used

PNP WIRING EXAMPLE



NPN WIRING EXAMPLE



SZ-V32N type

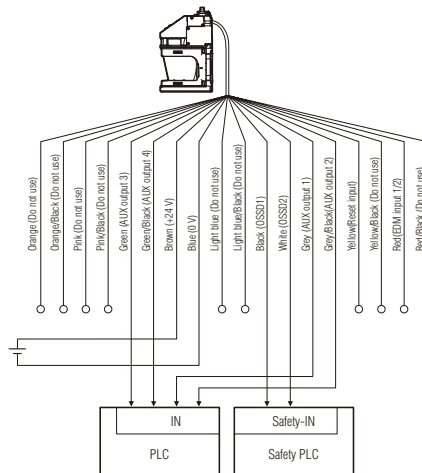
Bank switching: Not used

Muting: Not used

Interlock: Not used

EDM: Not used

When not using PROIsafe PNP/NPN WIRING EXAMPLE



Symbols

K1, K2: External device
(Safety relay, magnet contactor, etc.)

K3: Solid state contactor

S1: Switch for resetting OSSD1/2 (N.O.)

PLC: Used for monitoring, not for control systems related to safety.

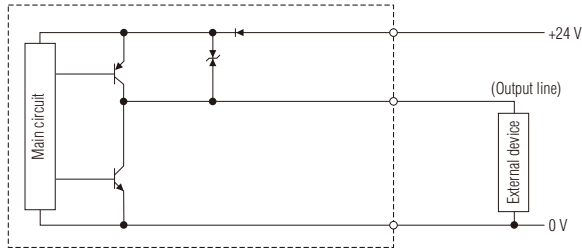
Safety PLC: Control systems related to safety.

S3-1, S3-2, S3-3, S3-4, S3-5, S3-6, S3-7, S3-8: Switch for bank switching.

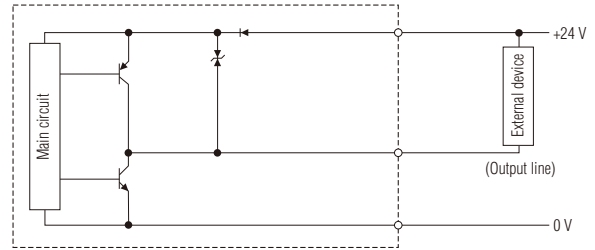
M: 3-phase motor

OSSD output circuit (Safety output)

PNP output

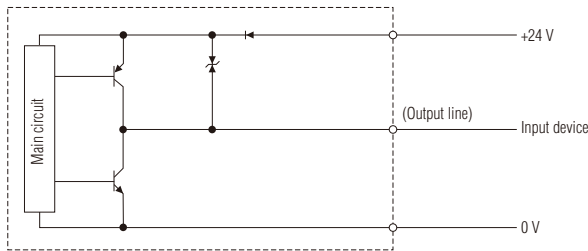


NPN output



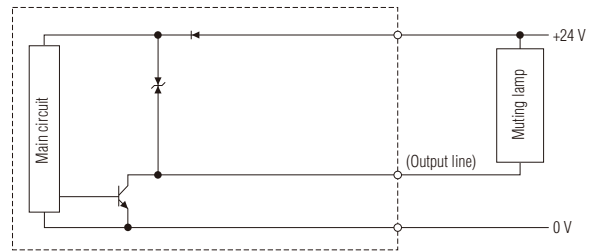
AUX output circuit

Common for both PNP and NPN output



Muting lamp output circuit

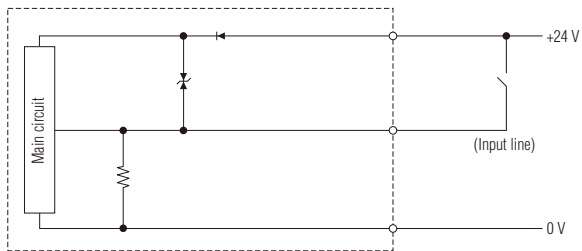
NPN output



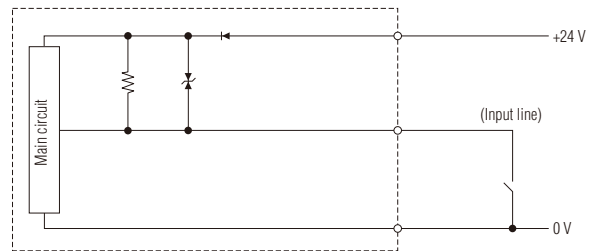
*Regardless of the PNP/NPN selection setting, muting lamp output will be NPN output.

Input circuit

PNP input



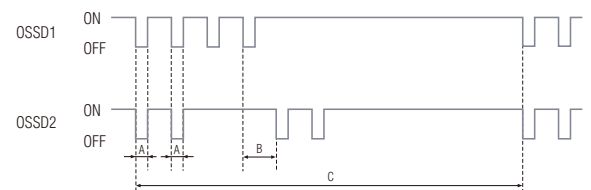
NPN input



OSSD OUTPUT

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. OSSD 1/2 is a pair of safety outputs that are redundant. 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 normally. 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 an error state.

Self-diagnosis pulse



A: 50 μ s (If a capacitive load is connected, max. 250 μ s can apply.)

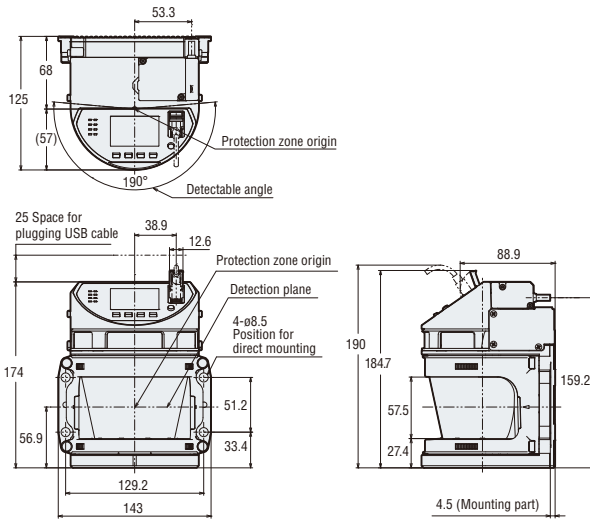
B: Approximately 60 ms

C: Approximately 920 ms

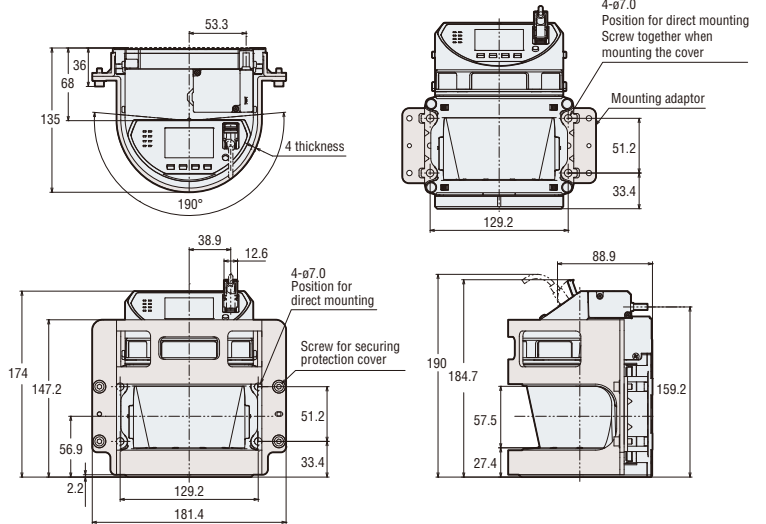
NOTE

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

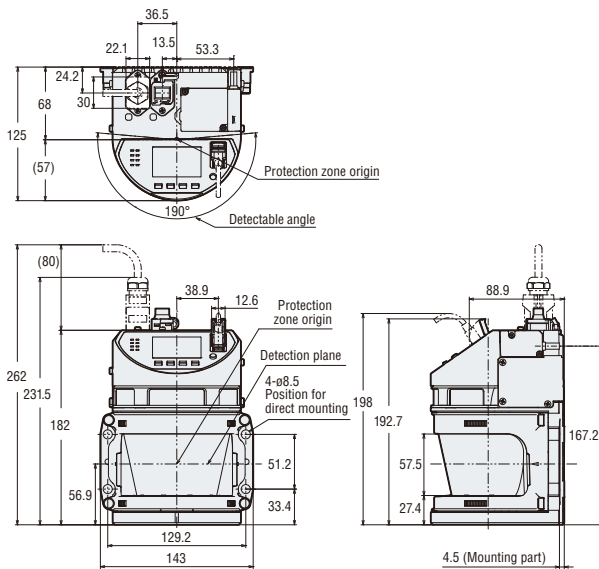
SZ-V32(X)



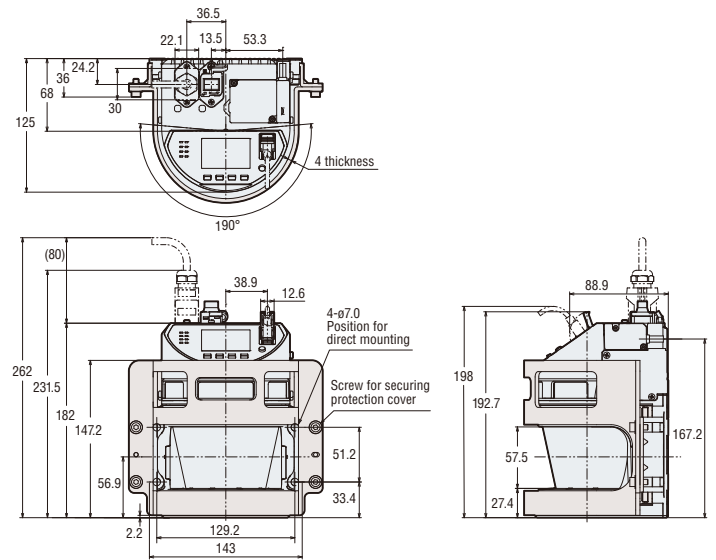
SZ-V32(X) + SZ-VB21



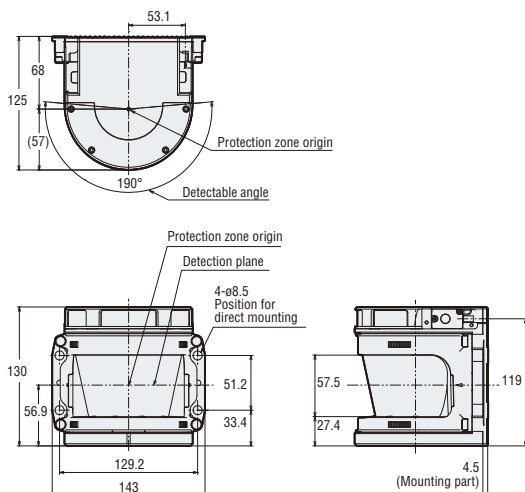
SZ-V32N(X)



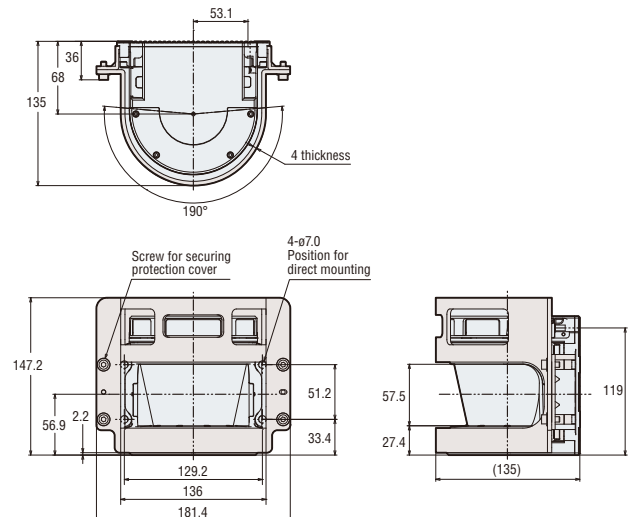
SZ-V32N(X) + SZ-VB21



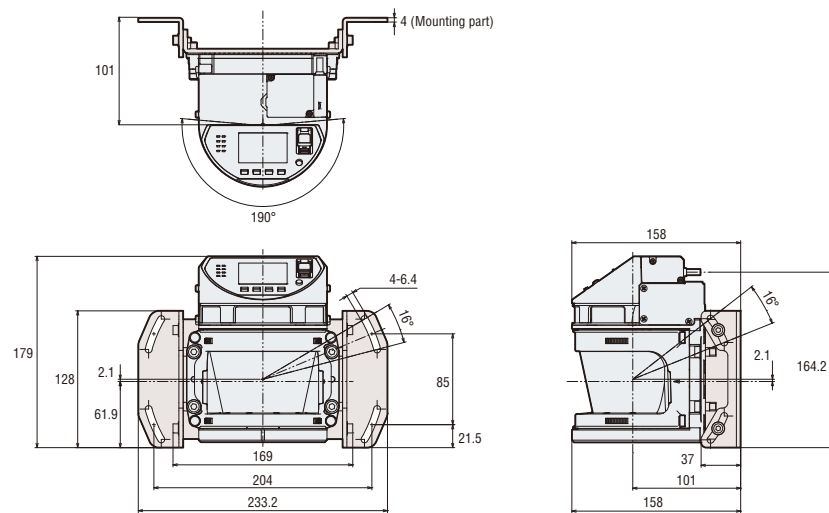
SZ-VH1(X)



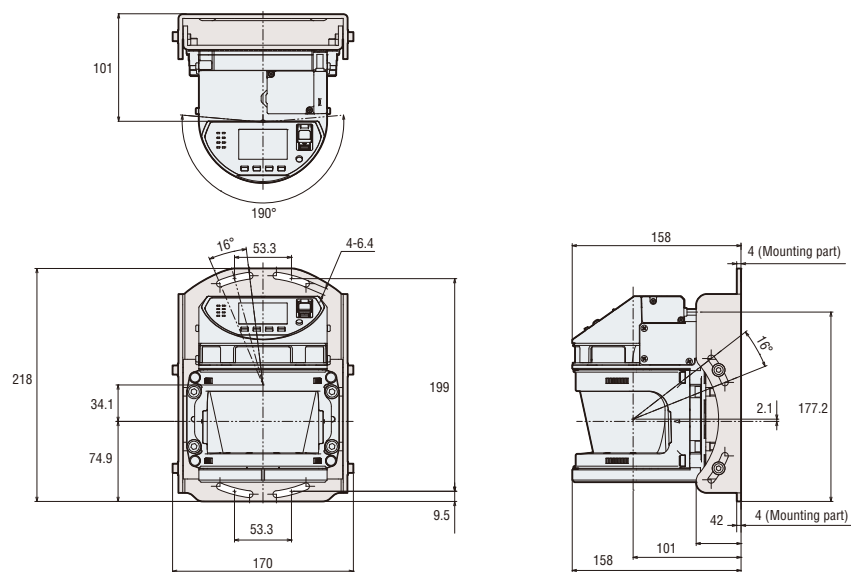
SZ-VH1(X) + SZ-VB21



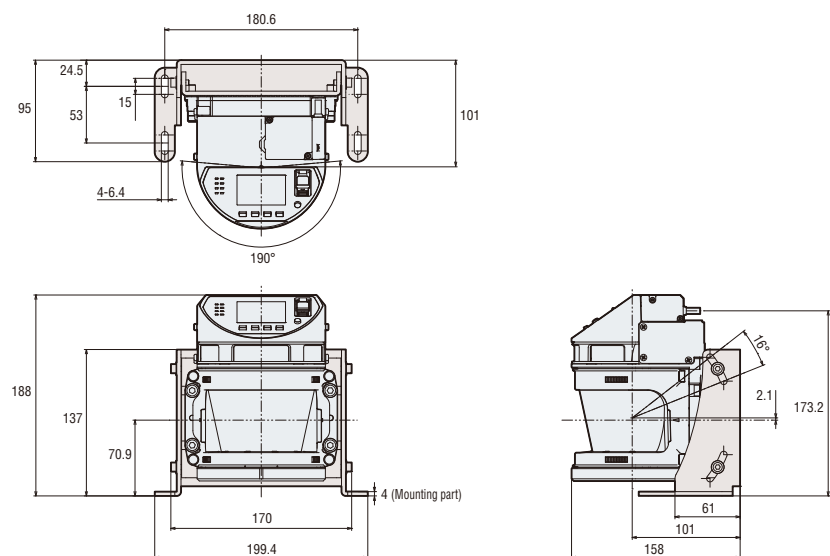
SZ-VB01 + SZ-V32(X)

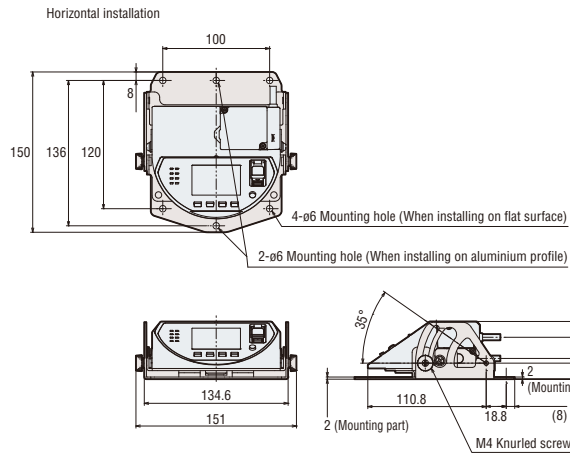


SZ-VB02 + SZ-V32(X)



SZ-VB03 + SZ-V32(X)



SZ-VB11 + SZ-VU32

Vertical installation

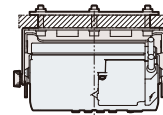
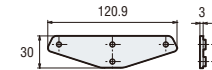
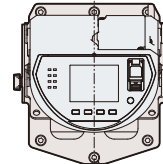


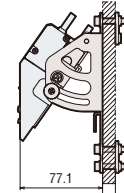
Plate nut (2 pieces included with SZ-VB11)



*Screw included: M5 × L25, 6 pieces



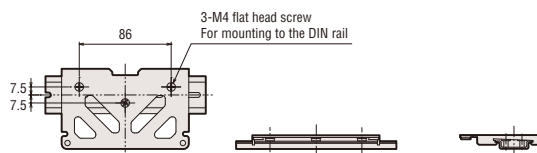
6-ø6 Mounting hole (When using plate nut)



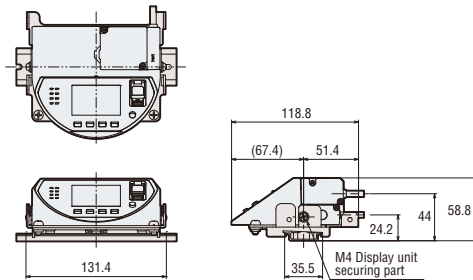
Thickness attachable with screws included: 12 mm max. (When using plate nut)

SZ-VB12 + SZ-VU32

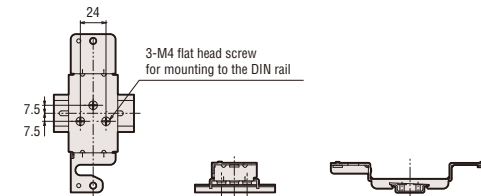
When installing DIN attachment



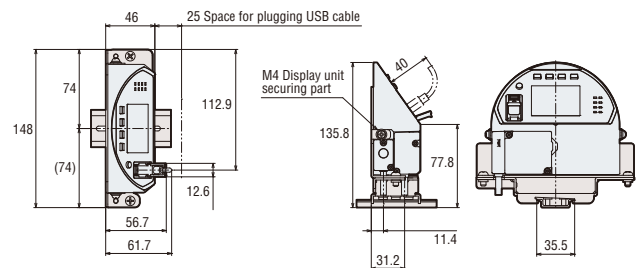
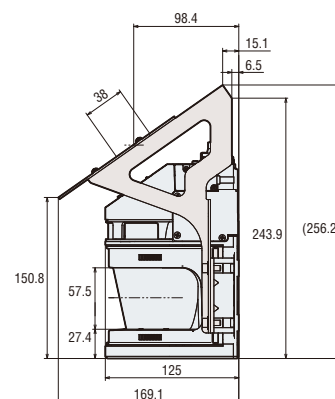
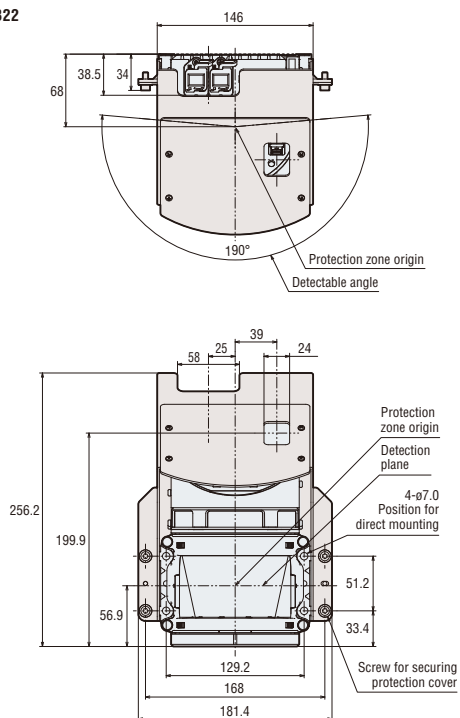
When installing display unit

**SZ-VB13 + SZ-VU32**

When installing DIN attachment



When installing display unit

**SZ-V32N(X) + SZ-VB22**

SAFETY LASER SCANNER **SZ Series**



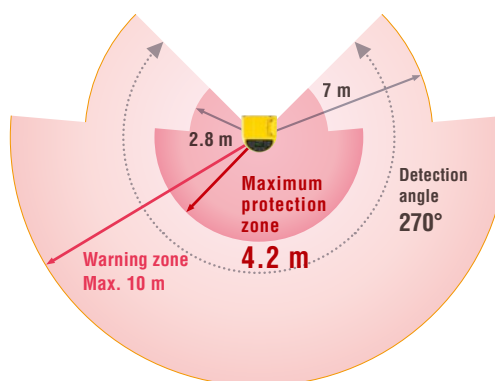
Protection zone **4.2 m**
Detectable angle **270°**

Maximum
48 zones

Simple zone configuration
using PC

Protection zone **4.2 m** Detectable angle **270°**

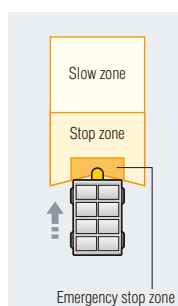
The compact SZ has a maximum protection zone of 4.2 m and a maximum warning zone of 10 m.



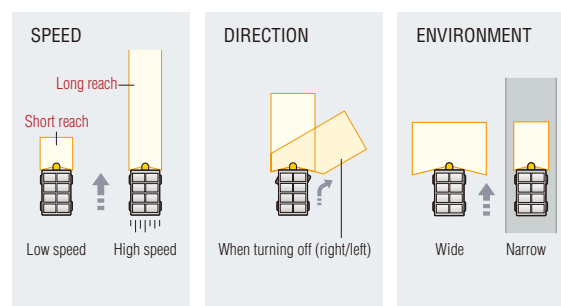
Maximum **48 configurable zones**

External inputs enable simple switching between the 16 zone sets (banks) according to the speed, direction, and environment. One protection zone and two warning zones can be configured per zone set.

3 zones for 1 bank



Example of bank switching pattern




PRODUCT LINEUP

Main unit

Appearance	Type	Number of banks	Model	Weight
	Simple function type	1	SZ-01S	Approx. 1.6 kg
	Multi-bank type	16	SZ-16V	



*Cables and brackets are not included. Select separately.

Cables (Optional)

Appearance	Main unit model	Length	Output	Model	Weight
	For SZ-01S	5 m	PNP	SZ-P5PS	Approx. 280 g
			NPN	SZ-P5NS	
		10 m	PNP	SZ-P10PS	Approx. 530 g
			NPN	SZ-P10NS	
		20 m	PNP	SZ-P20PS	Approx. 1040 g
			NPN	SZ-P20NS	
		30 m	PNP	SZ-P30PS	Approx. 1550 g
			NPN	SZ-P30NS	
	For SZ-16V	5 m	PNP	SZ-P5PM	Approx. 360 g
			NPN	SZ-P5NM	
		10 m	PNP	SZ-P10PM	Approx. 720 g
			NPN	SZ-P10NM	
		20 m	PNP	SZ-P20PM	Approx. 1400 g
			NPN	SZ-P20NM	
		30 m	PNP	SZ-P30PM	Approx. 2080 g
			NPN	SZ-P30NM	

*Connector colours; PNP: Black, NPN: Grey




Mounting brackets (Optional) Standard mounting bracket

Appearance	Type	Model	Weight
	Horizontal mounting bracket	OP-86935	Approx. 250 g
	Vertical mounting bracket	OP-86936	Approx. 180 g

Configuration software

The configuration software "Safety Device Configurator" can be downloaded for free from the KEYENCE website.

Mounting brackets (Optional) Mounting brackets with angle alignment

Appearance	Type	Model	Weight
	Horizontal mounting bracket with angle alignment	OP-86937	Approx. 690 g
	Vertical mounting bracket with angle alignment	OP-86938	Approx. 850 g
	L-shaped mounting bracket with angle alignment	OP-86939	Approx. 960 g

DETECTION CAPABILITY SPECIFICATIONS

Detection capability	Minimum detectable object size	Diameter: 30 mm, 40 mm, 50 mm, 70 mm, 150 mm (depends on the setting); Reflectance: 1.8% min.; Speed: 1.6 m/s max.
	Detectable angle	270° (-45° to 225°)
	Response time (ON to OFF)	General scan cycle (Scan cycle A) 60 ms (2scans) to 480 ms (16scans) Specific scan cycle (Scan cycle B) 66 ms (2scans) to 528 ms (16scans)
	Response time (OFF to ON)	General scan cycle (Scan cycle A) Response time of ON to OFF +125 ms Specific scan cycle (Scan cycle B)
	Maximum protection zone	Minimum detectable object size 70 mm / 150 mm 4.2 m (-5° to 185°), 2.8 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 50 mm 3.0 m (-5° to 185°), 2.0 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 40 mm 2.4 m (-5° to 185°), 1.6 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 30 mm 1.8 m (-5° to 185°), 1.2 m (-45° to -5°, 185° to 225°)
	Maximum warning zone*1 (non safety related)	Minimum detectable object size 70 mm / 150 mm 10.0 m (-5° to 185°), 7.0 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 50 mm 7.5 m (-5° to 185°), 5.0 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 40 mm 6.0 m (-5° to 185°), 4.0 m (-45° to -5°, 185° to 225°)
		Minimum detectable object size 30 mm 4.5 m (-5° to 185°), 3.0 m (-45° to -5°, 185° to 225°)
	Additional safety distance	100 mm*2

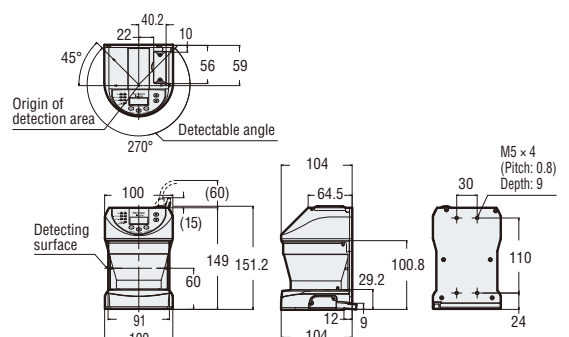
*1 20% or more reflectance is necessary for the minimum detectable object in the warning zone.

*2 If there is a highly reflective background within 1.5 m of the protection zone boundary, 200 mm must be added to the protection zone for the minimum safety distance.

DIMENSIONS

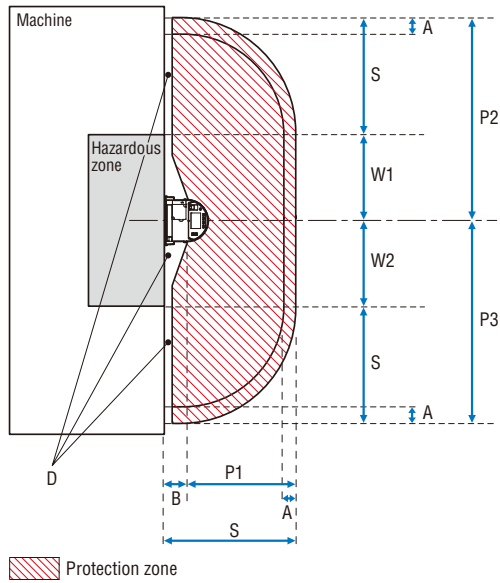
SZ main unit

Unit: mm

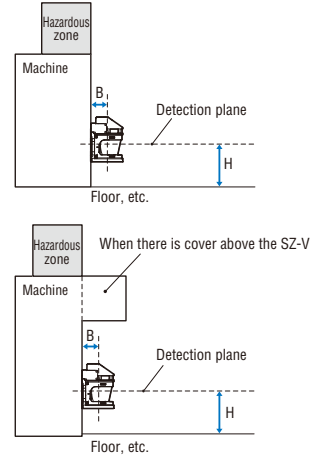


Example of area protection [Direction of approach parallel to the protection zone]

Top view of the machine



Side view of the machine



$$S = K \times T + C + A \text{ <According to ISO13855 and IEC61496-3>}$$

- S: Safety distance (mm)
 K: Approach speed of the body or parts of the body (mm/s)
 T: Overall Response time in second ($t_1 + t_2$) (s)
 t_1 : SZ-V response time (s)
 t_2 : Max. time required to stop the machine after receiving the OSSD signal from SZ-V (s)*
 C: Distance that parts of the body approach the hazardous zone before penetrating the protection zone of the SZ (mm)
 $1200 - 0.4 \times H$ (but at least 850 mm)
 H: Height of detection plane (protection zone) above the reference plane, for example the floor.(mm)
 $1000 \geq H \geq 15 \times (d - 50)$
 d: SZ-V minimum detectable object size (mm)
 A: Additional safety distance (mm)

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

- [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

Example of safety distance calculation

- K = 1600 mm/s Approach speed of the body or parts of the body (Constant)
 T = $t_1 + t_2 = 0.82$ s Overall response time
 $t_1 = 0.32$ s SZ-V response time (Changeable)
 $t_2 = 0.5$ s Max. time required to stop the machine after receiving the OSSD signal from SZ-V
 C = $1200 - 0.4 \times H = 1080$ mm
 H = 300 mm Lowest allowable height of detection plane(protection zone). This must be calculated using the following formula. $H \geq 15 (d - 50)$ mm).
 d = 70 mm Minimum detectable object size (Changeable)
 A = 100 mm 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 = 1000 mm Width of the hazardous area

Safety distance

$$S = K \times T + C + A = 1600 \times 0.82 + 1080 + 100 = 2492 \text{ mm}$$

Distance set as the protection zone

$$P1 = S - B = 2424 \text{ mm} \quad P2 = S + W1 = 3492 \text{ mm}$$

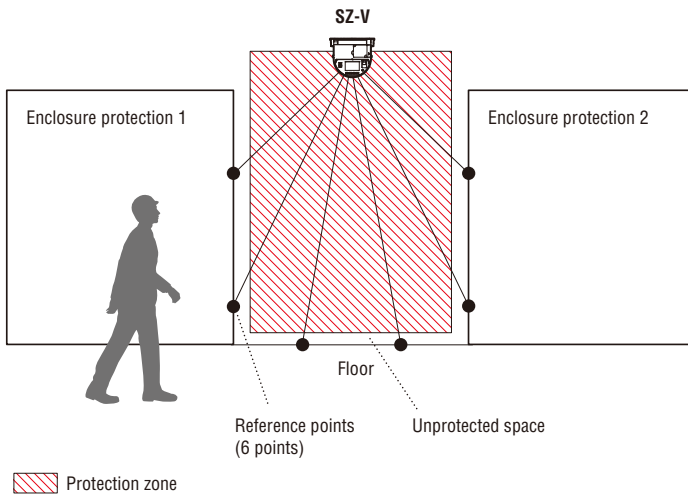
$$P3 = S + W2 = 3492 \text{ mm}$$

⚠ DANGER

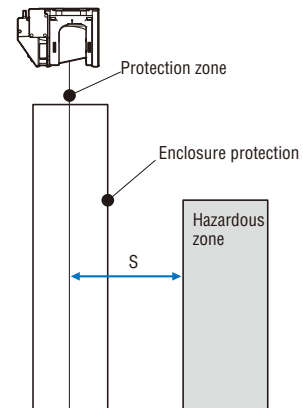
- The unprotected space (D) between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ-V is installed, in order to prevent the machine operators from approaching into the hazardous zone through this space. Additional countermeasures for protection must be provided if there is 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 1000 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.
- We recommend that you mark the floor in order to indicate the specified protection zone.

Example of access protection [Direction of approach normal to the protection zone]

Front view of the machine



Side view of the machine



$$S = K \times T + C \text{ <According to ISO13855 and IEC61496-3>}$$

S: Safety distance (mm)

K: Approach speed of the body or parts of the body (mm/s)

T: Overall response time ($t_1 + t_2$) (s)

t_1 : SZ-V response time (s)

t_2 : 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, please add communication and processing time required for the stop signal to reach the machine after 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 = $t_1 + t_2 = 0.58$ s Total response time

$t_1 = 0.08$ s SZ-V response time (Changeable)

$t_2 = 0.5$ 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)

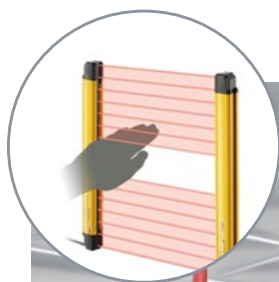
Safety distance

$$S = K \times T + C = 1600 \times 0.58 + 850 = 1778 \text{ mm}$$

⚠ 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 $\pm 30^\circ$ to the detection plane). In this case, the tolerance for reference points must be ± 100 mm or less and the response time must be 90 ms or less.
- The unprotected space between the protection zone and the protective structure must be less than the minimum detectable object size when the SZ-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.

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