MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

KEYENCE

SZ-01S

SINGLE FUNCTION SAFETY SCANNER

Used with the applicable KEYENCE SZ series configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: KEYENCE SZ Series catalog KA1-0049, exact SZ-01S specifications and wiring; current KEYENCE SZ-01S online specification

KEYENCE

NEW **Safety Laser Scanner**
SZ Series

Maximum safety standard for scanners

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

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)

See P.4

Area Protection

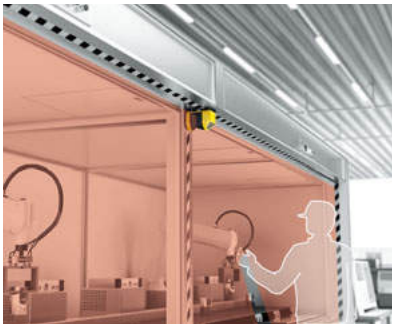
A safety laser scanner allows users to configure protection zones anywhere, even in complex-shaped zones.



See P.6

Access Protection

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



See P.8

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.





NEW

Safety Laser Scanner

SZ Series

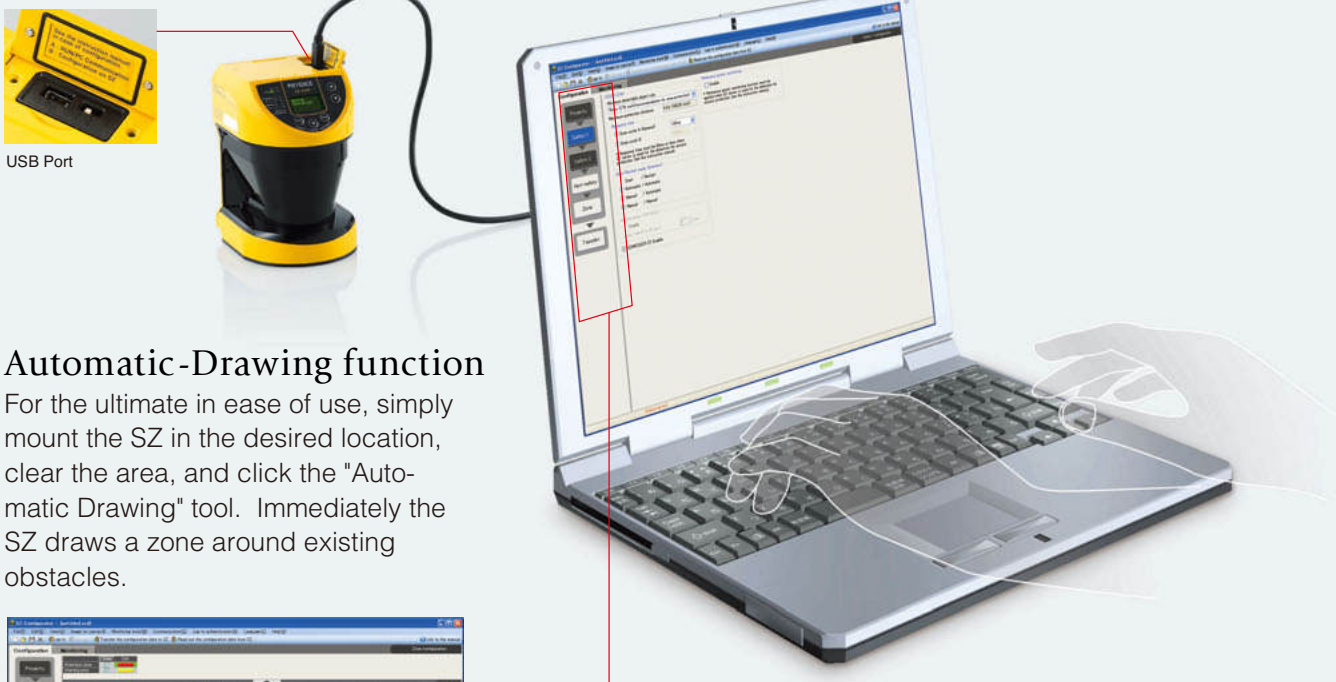
3 models available according to the application

Simple function type	SZ-01S
Multi-function type	SZ-04M
Multi-zone sets (banks) type	SZ-16V

The easiest, most intuitive, step-by-step scanner configuration software you will ever use

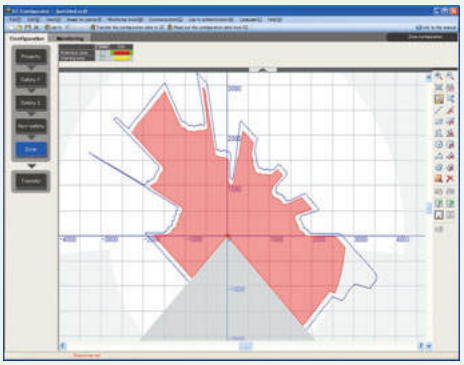
SZ-H1S configuration software is fast, easy, and loaded with useful, time-saving tools

SZ-01S SZ-04M SZ-16V



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

Industry first

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.

Industry first

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.

Industry first

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.

Main Unit * Cables and brackets are not included. Select separately.

Appearance	Type	# of zone sets (# of banks)	Model	Weight
	Simple function type 	1	**SZ-01S**	Approx. 1.6 kg
	Multi-function type 	4	**SZ-04M**	
	Multi-zone sets (banks) type 	16	**SZ-16V**	

Cable

Appearance	Compatible With	Length	Output	Model	Weight
	SZ-01S	5m 16.4'	PNP	**SZ-P5PS**	Approx. 280g
			NPN	**SZ-P5NS**	
		10m 32.81'	PNP	**SZ-P10PS**	Approx. 530g
			NPN	**SZ-P10NS**	
		20m 65.62'	PNP	**SZ-P20PS**	Approx. 1,040g
			NPN	**SZ-P20NS**	
	SZ-04M SZ-16V	5m 16.4'	PNP	**SZ-P5PM**	Approx. 360g
			NPN	**SZ-P5NM**	
		10m 32.81'	PNP	**SZ-P10PM**	Approx. 720g
			NPN	**SZ-P10NM**	
		20m 65.62'	PNP	**SZ-P20PM**	Approx. 1,400g
			NPN	**SZ-P20NM**	

* Connector colors; PNP:Black, NPN:Gray

USB Cable (Optional)

Appearance	Name	Length	Model	Weight
	USB cable 5m 16.4'	5m 16.4'	**OP-86941**	Approx. 200g

PC Software (Standard accessory)

Name	Model	Weight
SZ Series Configuration Software	**SZ-H1S**	Approx. 80g

Brackets (Appearance when mounted)

Standard mounting bracket



OP-86935 Horizontal mount



OP-86936 Vertical mount

Mounting bracket with angle alignment



OP-86937 Horizontal mount



OP-86938 Vertical mount



OP-86939 L-shaped mount

Mounting bracket (Optional)

Standard mounting bracket

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

Mounting bracket with angle alignment

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

Specifications

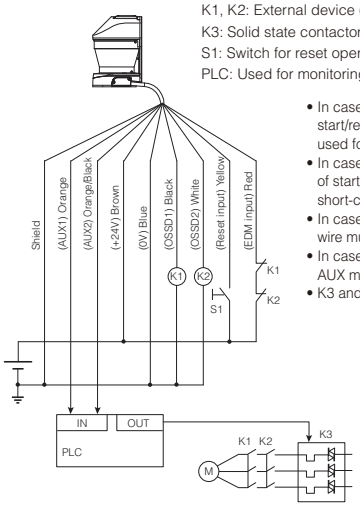
Type3 **SIL2** **Category3** **PLd**

Model			SZ-01S	SZ-04M	SZ-16V
Type			Simple function type	Multi-function type	Multi-zone sets (banks) type
Detection capability	Minimum detectable object size		Diameter 1.18" 30 mm/1.58" 40 mm, 1.97" 50 mm, 2.56" 70 mm, 5.91" 150 mm (depends on the setting) Reflectance 1.8% min., Speed 5.25 ft/s 1.6 m/s max.		
	Detectable angle		270° (-45° to 225°)		
	Response time (ON to OFF)	General scan cycle (Scan cycle A)	60 ms (2 scanning) to 480 ms (16 scanning)		
		Specific scan cycle (Scan cycle B)	66 ms (2 scanning) to 528 ms (16 scanning)		
	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)			
	Max. protection zone	Minimum detectable object size: 2.76" 70 mm/5.91" 150 mm	13.78' 4.2 m (-5° to 185°), 9.19' 2.8 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.97" 50 mm	9.84' 3.0 m (-5° to 185°), 6.56' 2.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.58" 40 mm	7.87' 2.4 m (-5° to 185°), 5.25' 1.6 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.18" 30 mm	5.91' 1.8 m (-5° to 185°), 3.94' 1.2 m (-45° to -5°, 185° to 225°)		
	Max. warning zone (non safety related)*1	Minimum detectable object size: 2.76" 70 mm/5.91" 150 mm	32.18' 10.0 m (-5° to 185°), 22.97' 7.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.97" 50 mm	24.61' 7.5 m (-45° to -5°, 185° to 225°), 16.4' 5.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.58" 40 mm	19.69' 6.0 m (-45° to -5°, 185° to 225°), 13.12' 4.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.18" 30 mm	14.76' 4.5 m (-45° to -5°, 185° to 225°), 9.84' 3.0 m (-45° to -5°, 185° to 225°)		
	Additional safety distance		3.94" 100 mm *2		
Light source	Type, wavelength		Infrared laser diode, 905 nm		
	Laser class		Class 1 IEC / EN 60825-1: 2007 Class 1 CFR 21 1040.10, 1040.11 (Laser Notice No.50) Class 1 JIS C6802: 2005		
Rating	Power voltage		24 V DC ±10% (Ripple P-P 10% or less): When using a converter power supply 24 V DC +20%/-30%: When using a battery		
	Power consumption		Max. 9.5 W (without load) Max. 39W (with load)	Max. 9.5 W (without load) Max. 50W (with load)	Max. 10.5 W (without load) Max. 43W (with load)
OSSD output	Output		PNP or NPN (Selectable according to the connector cable)		
			2 outputs	4 outputs	2 outputs
	Max. load current		500mA*3		
	Residual voltage (during ON)		Max. 2.5 V (with a cable length of 16.4' 5 m)		
	OFF-state voltage		Max. 2.0 V (with a cable length of 16.4' 5 m)		
	Leakage current		Max. 1 mA *4		
	Max. capacitive load		2.2 µF (with a load resistance of 100Ω)		
	Load wiring resistance		Max. 2.5Ω *5		
Input (safety-related)	Input resistance		4.4 kΩ (for Input 1) 2.2 kΩ (for Input 2)	4.4 kΩ (for Input 1,3, 4, and 5) 2.2 kΩ (for Input 2 and 6)	4.4 kΩ (for Input 1 and 3 to 10) 2.2 kΩ (for Input 2)
Non safety-related output (AUX output)	Output		PNP/NPN totem pole output		
			2 outputs	6 outputs	4 outputs
	Max. load current		50mA		
	Residual voltage (during ON)		Max. 2.5 V (with a cable length of 16.4' 5 m)		
Muting lamp output	(AUX6 output can be assigned for the muting lamp output)			Can be connected to the incandescent lamp (24V DC, 1 to 5.5W) and LED lamp (load current 10 to 230 mA)	
Environmental resistance	Enclosure protection		IP65 (IEC60529)		
	Operating ambient temperature		–10 to +55°C (No freezing) 14 to 131°F		
	Storage ambient temperature		–25 to +60°C (No freezing) –13 to 140°F		
	Operating relative humidity		35 to 85% RH (No condensation)		
	Storage relative humidity		35 to 95% RH		
	Surrounding light		Incandescent lamp: 1500 lx or less *6		
	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	Main unit case		Aluminum die casting, SPHC (Bottom)		
	Window		Polycarbonate		
Cable length			65.62' 20 m or less *7		
Approved standards	EMC	EMS	IEC61496-1, EN61496-1, UL 61496-1		
		EMI	EN55011 Class A, FCC Part15B Class A		
	Safety		IEC61496-1, EN61496-1, UL 61496-1 (Type 3 ESPE) IEC61496-3, EN61496-3 (Type 3 AOPDDR) IEC61508, EN61508, IEC62061, EN62061 (SIL2) EN ISO13849-1:2006 (PL d, Category 3) UL508, UL1998		

*1 20% or more reflectance is necessary for the minimum detectable object in the warning zone.
*2 If there is a high reflective background within 49.21' 1.5 m from the boundary of the protection zone, 7.87" 200 mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance.
*3 The total load current of the OSSD output and the AUX output must be 1.5 A or less in case of the converting equipment for power supply, while it must be 1.0 A (0.5 A with 16.4' 5m of cable length) or less in case of the battery.
*4 This also takes into account the situations when power is either off or disconnected.
*5 The wiring resistance between the OSSD output and the connected equipment (excluding the resistance of the cable) must be 2.5 Ω or less to ensure operation. However, it must be 1.0 Ω or less if the load current is 300 mA or more.
*6 The SZ should not be installed so as to have light interference within ±5° to the detection plane.
*7 It must be 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

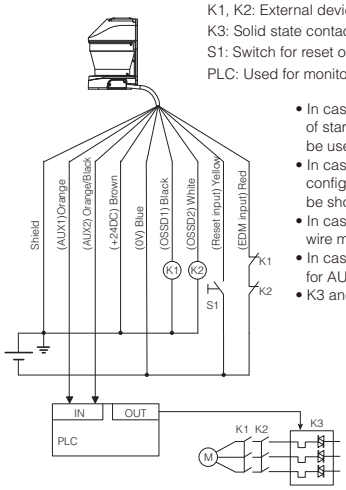
For the PNP output type cable



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

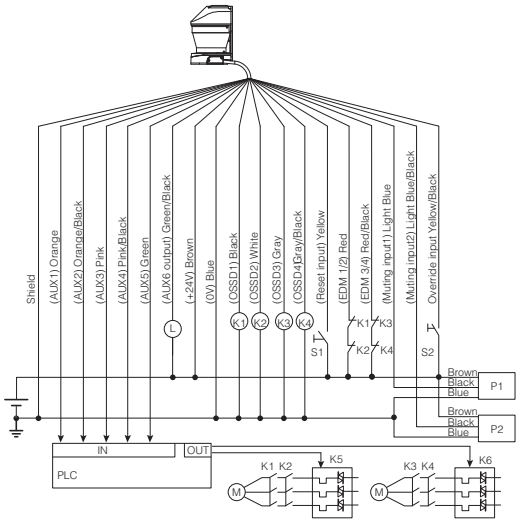


K1, K2: External device (Safety relay, magnet contactor, etc.)
K3: Solid state contactor
S1: Switch for reset operation (N.O.)
PLC: Used for monitoring, not for control systems related to safety.

- 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

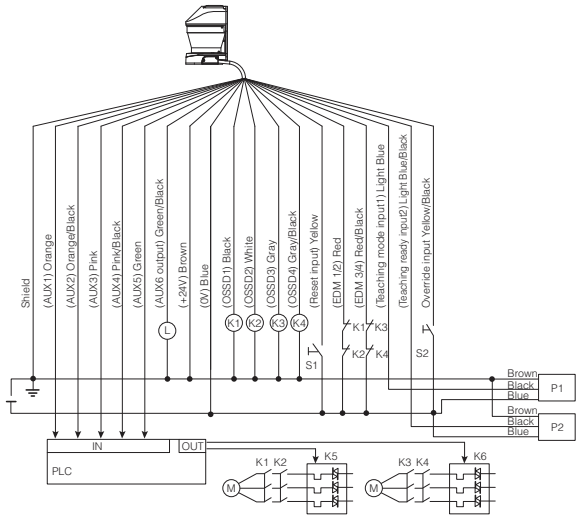
For the PNP output type cable



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.)
PLC: Used for monitoring, not for control systems related to safety.
P1, P2: Muting devices (ex. PZ series with PNP output, Keyence Corp.)
M: 3-phase motor
L: Muting lamp

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

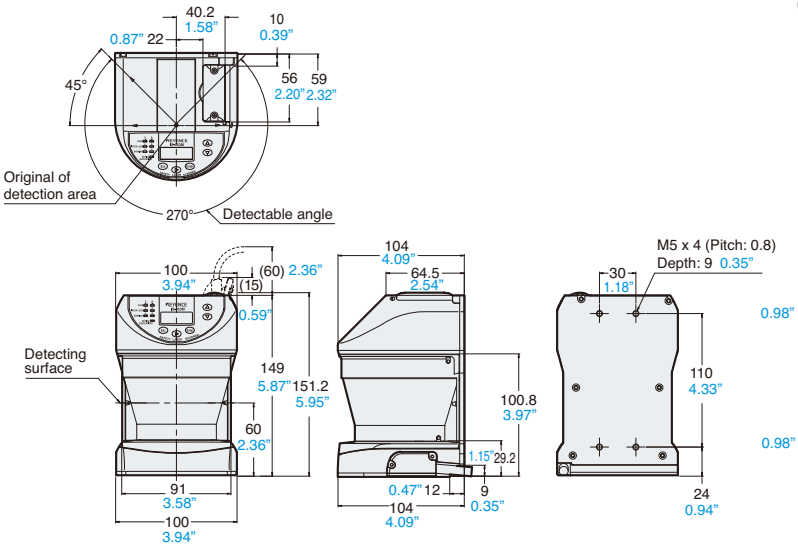
For the NPN output type cable



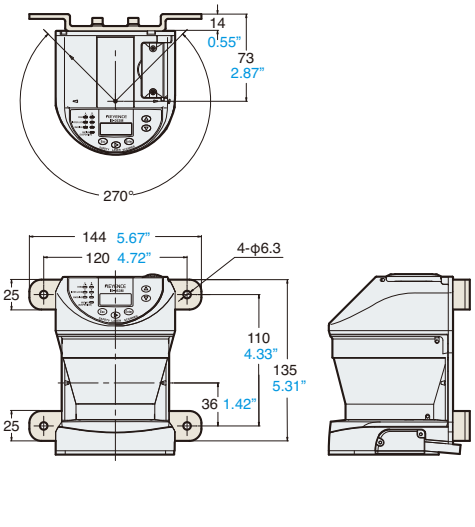
K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)
K5, K6: Solid state contactor
S1: Switch for reset operation (N.O.)
S2: Switch for override (N.O.)
PLC: Used for monitoring, not for control systems related to safety.
P1, P2: Muting devices (ex. PZ series with NPN output, Keyence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

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

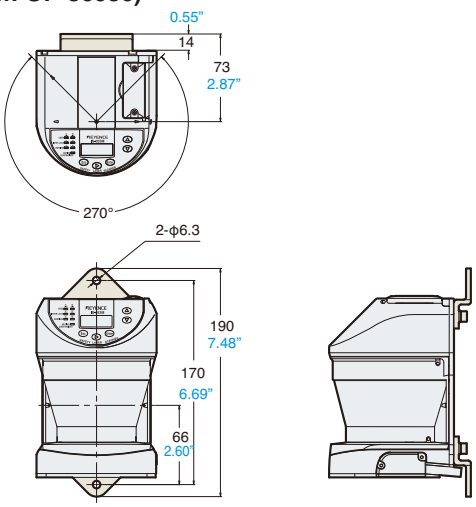
SZ Main unit



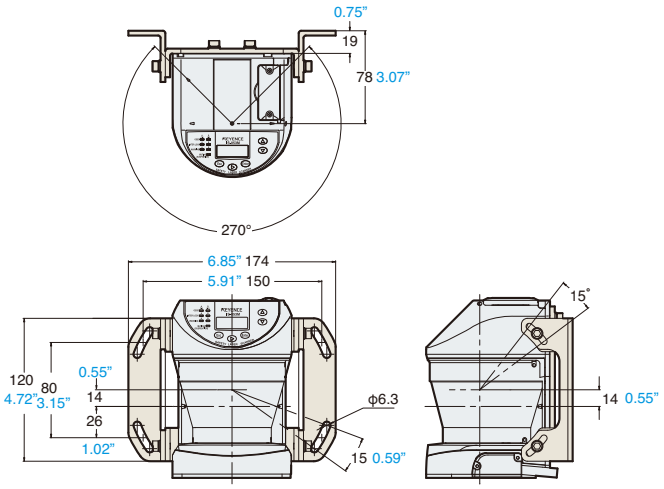
Horizontal mounting bracket (Model: OP-86935)



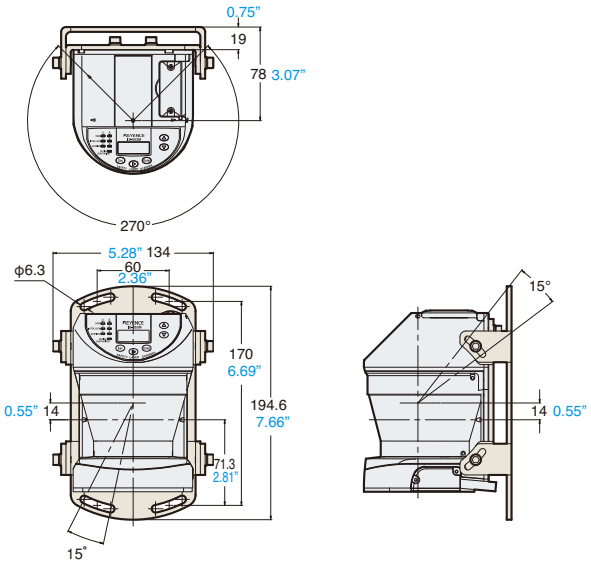
Vertical mounting bracket (Model: OP-86936)



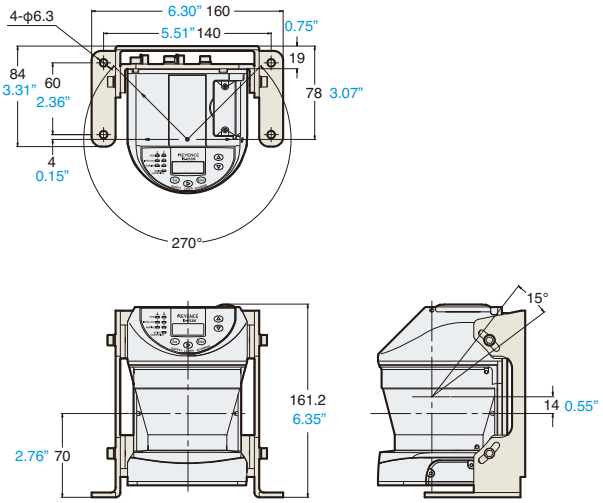
Horizontal mounting bracket with angle alignment



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



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



Unit: mm inch