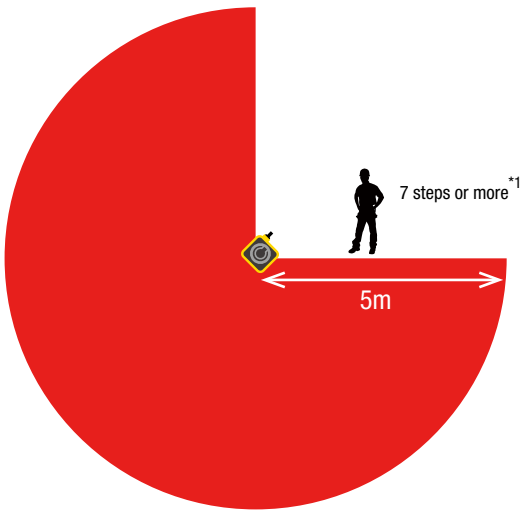# SAFETY LASER SCANNER

Ensures safety with
long distance detection

IDEC CORPORATION

Area Protection

Ensures the safety of humans in a hazardous area, or those approaching the machine.
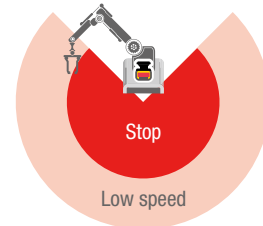
Distance 5m, sensing angle 270º

7 steps or more [1]

5m

One SE2L protects a wide area (270º and 5m) and can be used in a variety of applications such as large sized systems or long conveyor lines.
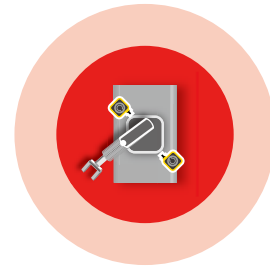
[1]: average stride length (70 cm) of a 170 cm tall person

Ensures productivity and safety

Stop

Low speed

The SE2L is a safety sensor that can detect approach. Stop area can be made smaller by detecting approach at the additional protection zone to start slowdown.
(Conventional configuration of one protection zone + two warning zones is possible)
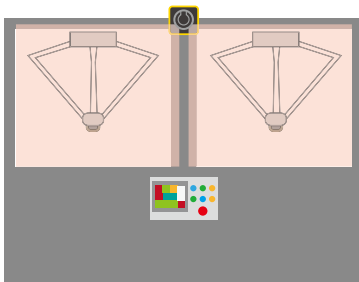
Master slave function

A maximum of four SE2Ls can be interconnected using RS-485 for master/slave operation.
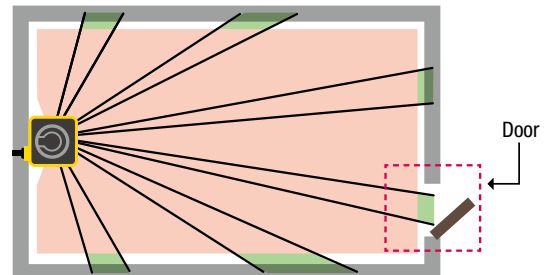
Dual protection function

An SE2L can monitor two separate hazardous areas to stop machines when detecting the access of humans. No reflective sensor is necessary, thus eliminating the need of optical axis alignment. Can replace two light curtains.

Ensures safety at positional change

Door

Reference monitoring function ensures safety by detecting the positional change of SE2L or reference boundary, such as a door's opening/closing status.

Ensures safety at entrance of works. Override function enables restart from unintended stop.
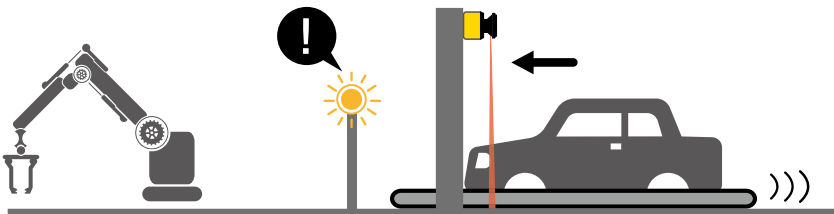
By disabling some areas of protection zone, muting function allows objects to enter the hazardous area without stopping the machine.
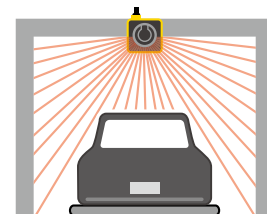
With override function, when stopped by errors at muting status, the work can be moved easily.

Collision Avoidance

Protects humans from colliding. Also prevents loads on from falling.

A maximum of 128* area patterns
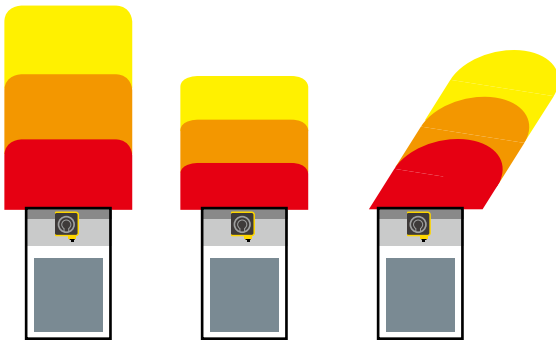
A maximum of 128* area patterns can be configured/switched according to the mobile application such as AGV, ensuring the optimum protection in various applications.

*Maximum 32 sets of area can be configured by parallel input when switching the area by encoder input.

Utilize distance measurement data
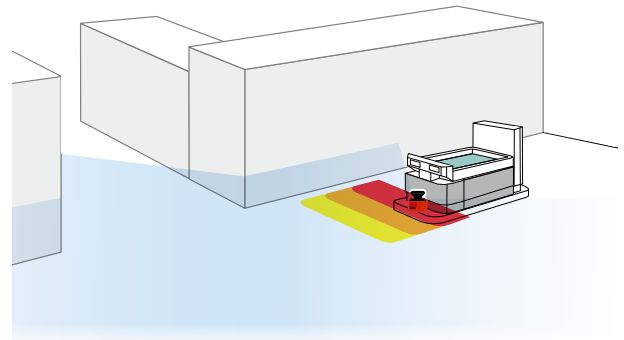
During safety protection, the SE2L can send out distance measurement data through the Ethernet port, in order to obtain the data of the obstacles.

Monitors external output equipment

Force-guided relay

EDM function monitors the status of external devices, such as enabling monitoring of welded contacts.

Encoder inputs
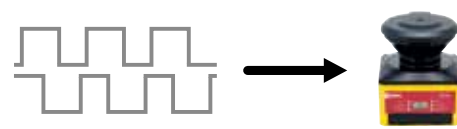
Pulse signals from an incremental encoder can be sent to the SE2L directly without a controller, enabling to switch areas easily depending on the speed.

Supports area configuration
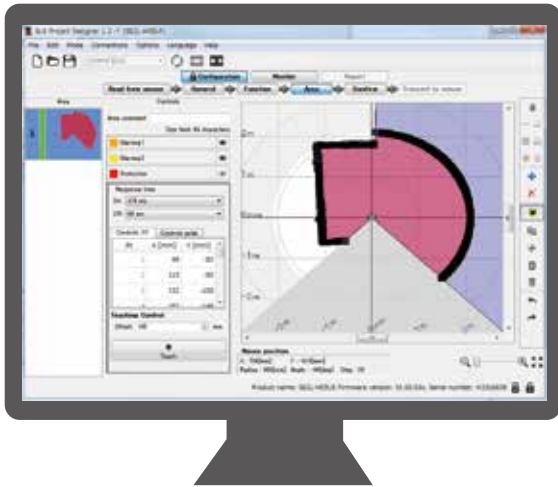
Teaching function enables automatic area configuration by referring to obstacles such as walls and columns. Area can be configured easily even with complicated background.

Detection log report reduces maintenance

Operational status is displayed on the SE2L. It can also be displayed on PC to monitor errors and data log for easy trouble shooting.
Also, the detection log can be displayed not only by numerical values but can be displayed intuitively by mapping.

Application example

By using the SE2L's Ethernet distance measurement data output function, peripheral monitoring of multiple SE2L units using the HG series operator interface is possible.

*Switching is done by designating the IP address.
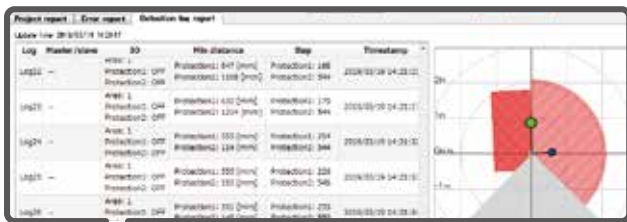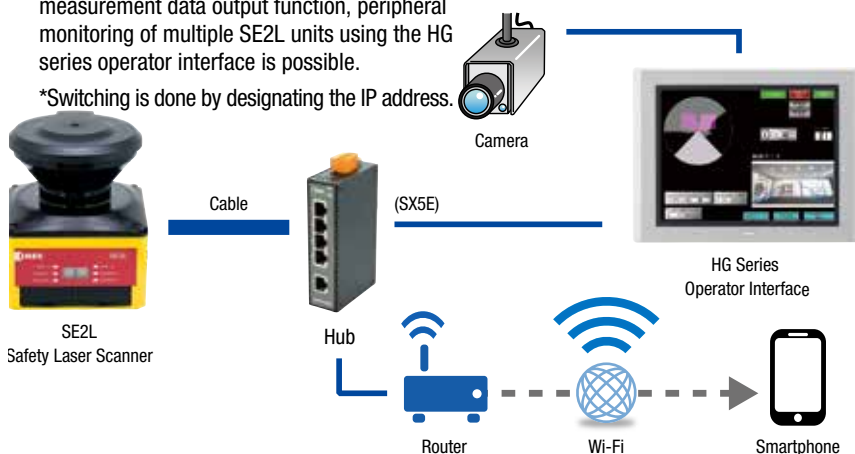

Camera

SE2L
Safety Laser Scanner

Cable   (SX5E)

Hub

Router   Wi-Fi   Smartphone

HG Series
Operator Interface

Check detection status with video
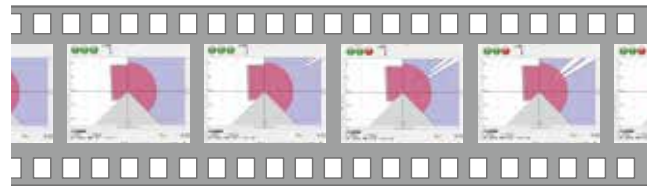
No human in the protection zone

Human approaching the protection zone

Human inside the protection zone

Area data and distance measurement data can be recorded while monitoring on PC. Video of detection status can be replayed with the file.
The measured data can be recorded few seconds (arbitrary) before or after detection.

Reduce maintenance and start-up time

Area data and function settings created on PC can be transferred to the SE2L using not only by USB cable but also micro SD card.

Stable operation even in dusty environment

Checks dust in air with signals and reduces unintended detection. Safety function is not impaired.
Also, the alarm will function before the OSSD turns OFF due to error caused by dust or dirt build-up on the optical window.

Optical window can be replaced on-site

Cover Bracket

Optical Window

Optical window can be replaced by the user, reducing downtime and cost. A cover bracket to protect the SE2L for damage by collision is also available.

Optical window contamination countermeasure
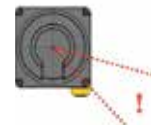
When an error occurs, I/O output can be set to turn on.
Especially when an optical window is contaminated, it is possible to output a warning alert before stopping due to contamination.
Also, the PC monitor displays the position of the contamination when the optical window is contaminated, making maintenance and countermeasures easier.

Robot controller connection terminal (accessory)

Safety input to the robot controller

The connection terminal allows the safety signal from the safety laser scanner to be easily input to the robot controller. The safety signal is converted and output as a dry contact output of a force-guided relay. Two sets of dual signals can be output.

For FANUC controllers, the connection terminal inverts one of the two high signals to low signal using a force guided relay.
Two sets of diversity signals can be output.

SE9Z-RT2D	SE9Z-RT2SV	SE9Z-T

Master-slave connection

Master-slave connection is supported.
The SE2L can be connected to each other with an M12 connector cable.

SE2L Master (*1)

Safety output ⇒
SE9Z-C8F∗F

Robot controller

Power supply, reset signal, etc.
SE9Z-C8F∗F

SE9Z-C5∗

SE2L Slave 1 (*1)

SE9Z-C5∗

SE2L Slave 2 (*1)

SE9Z-C5∗

SE2L Slave 3 (*1)

RF2 2-pole force-guided relay
(For details, see the RF series force-guided relays catalog)

Push-in terminal blocks

No.	Signal name
1	OSSD1

Connector J3

No.	Wire color	Signal name
8	BN	RY1-1
2	YE	RY1-2

RY1
24V
0V

No.	Signal name
2	EDM1
3	OSSD2

RY2

No.	Wire color	Signal name
3	GN	RY2-1
4	WH	RY2-2

0V

No.	Signal name
4	OSSD3

RY3
24V

No.	Wire color	Signal name
5	GY	RY3-1
6	PK	RY3-2

0V

No.	Signal name
5	EDM2
6	OSSD4

RY4

No.	Wire color	Signal name
7	BU	RY4-1
1	RD	RY4-2

RF2V-1A1B-D24
0V

Safety signal conversion part of SE9Z-RT2D internal wiring

*1) When SE2L-H05LP is used
● ∗(Cable length): 002 (2m), 005 (5m), 010 (10m), 020 (20m)

SE2L Safety Laser Scanner

SE2L Safety Laser Scanner

FUNCTIONAL SAFETY

Main Unit

Package Quantity: 1

Name & Shape	Cable Length	Part No.	Remarks
Cable Model	3m	SE2L-H05LP	• Attachment: SLS Project Designer CD (includes: User's Manual, SLS_Optical Window Adjuster) • Applicable OS: Windows XP, 32 bit (SP3 or higher) Windows 7, 32/64 bit (SP1 or higher) Windows 8, 32/64 bit Windows 8.1, 32/64 bit Windows 10, 32/64 bit
Connector Model	0.3m	SE2L-H05LPC	

Accessories (optional)

Package Quantity: 1

Part No.	Cable Length	Part No.	Remarks
Connector Cable	2m	SE9Z-HS2-C002	• Degree of protection: IP65 • Used with connector model SE2L-H05LPC only.
	5m	SE9Z-HS2-C005	
	10m	SE9Z-HS2-C010	
	20m	SE9Z-HS2-C020	
Micro USB Cable	1m	SE9Z-HS2-XCM11	• Used to connect the SE2L and PC.
Ethernet Cable	3m	SE9Z-HS2-XCD13	• Degree of protection: IP65 • Waterproof LAN cable
Extension Cable	10m	SE9Z-HS2-XCE010	• Used to extend the cable length of the SE2L.
	20m	SE9Z-HS2-XCE020	
Base Mounting Bracket		SE9Z-HS2-BK01	• Used to change the vertical angle alignment of the SE2L. • Adjustable by 15 degrees total (7.5 degrees each direction) • Material: iron • Attachment: Four bolts (M5×12)
Rear Mounting Bracket		SE9Z-HS2-BK02	• Used to change the vertical/horizontal angle adjustment of the SE2L. • Adjustable by 15 degrees total (7.5 degrees each direction) • Material: iron • Attachment: Four bolts (M5×12)
Simple Base Mounting Bracket		SE9Z-HS2-BK03	• Attachment: Four bolts (M5×10)
Rear Mounting Bracket (long type)		SE9Z-HS2-BK04L	• Attachment: Four bolts (M5×10)
Cover Bracket		SE9Z-HS2-CM01	• Used to protect the optical window in combination with base mounting bracket or rear mounting bracket. • Material: iron • Attachment: Four bolts (M5×12)
Optical Window		SE9Z-HS2-WD01	• Material: polycarbonate • Attachment: Four bolts (M3×8)
Robot controller Connection terminal		SE9Z-RT2D	• Dry contact output x 4 • Push-in terminal block 23-pin, M12 connector 8-pin x 3, M12 connector 5-pin x 1 • Maximum current: Power line 2A, others 500mA (except RS485 line)
Robot controller Connection terminal		SE9Z-RT2SV	• (Direct output + inverted output) x 2 (for FANUC controllers) • Push-in terminal block 23-pin, M12 connector 8-pin x 3, M12 connector 5-pin x 1 • Maximum current: Power line 2A, others 500mA (except RS485 line)
Robot controller Connection terminal		SE9Z-T	• For slave connection (without built-in relay) • Push-in terminal block 23-pin, M12 connector 8-pin x 2, M12 connector 5-pin x 2 • Maximum current: Power line 2A, others 500mA (except RS485 line)
Connector cable	2m	SE9Z-C5002	• M12 connector cable 5-pole (connectors on both sides) • Degree of protection: IP65 • For robot controller connection terminal
	5m	SE9Z-C5005	
	10m	SE9Z-C5010	
	20m	SE9Z-C5020	
Connector cable	2m	SE9Z-C8002F	• M12 connector cable 8-pole (connector on one side) • Degree of protection: IP65 • For robot controller connection terminal
	5m	SE9Z-C8005F	
	10m	SE9Z-C8010F	
	20m	SE9Z-C8020F	

Performance Specifications

Part No.		SE2L-H05LP/SE2L-H05LPC
Sensing Characteristics	Protection Zone	5.0m maximum
	Warning Zone (Note 1)	20m maximum (non-safety)
	Additional Safety Distance (Note 2)	+100 mm
	Sensing Characteristics	Black reflector sheet (1.8%) to retro-reflector sheet
	Sensing Angle	270°
	Minimum Sensing Width	ø30 mm (maximum distance: 1.8m) ø40 mm (maximum distance: 2.5m) ø50 mm (maximum distance: 3.0m) ø70 mm/ø150 mm (maximum distance: 5.0m)
	Scan Cycle	30 ms (rotating speed 2,000 rpm)
	Scan Area	32 patterns maximum (128 area sets when encoder input function is used)
	Response Time	ON→OFF: 60 to 2010 ms OFF→ON: 270 to 2010 ms
Light Source	Element	Pulse laser diode
	Wavelength	905nm
	Laser Class	Laser class 1 (IEC 60825-1)
Type		Type 3 (IEC 61946-1, IEC 61496-3)
Functional Safety		SIL 2 (Type B, HFT=1) (IEC 61508)
PFHd		7.8×10^{-8} (T1=20 years): when master slave function is disabled 1.6×10^{-7} (T1=20 years): when master slave function is enabled
Master Slave Connection		4 maximum
Enclosure	Dimensions	80W × 80D × 95H (mm) (cable not included)
	Weight (approx.)	Cable model: 0.8 kg (incl. 3 m cable)/Connector model 0.5 kg
	Degree of Protection	IP65 (IEC 60529)
	Material	Body: aluminum diecast / Optical window: polycarbonate
	Cable	Cable model: 3 m/Connector model 0.3 m
Power Voltage		24V DC ±10%: power from converter 24V DC −30%/+20%: power from battery
Power Consumption	Without Output Load	6W
	Maximum (without output load)	50W
Output	OSSD1/2 (safety)	Output type (high side SW)
		Output current (maximum: 500 mA) (Note 4)
		Leakage current (maximum: 1 mA)
		Cable (AWG 26)
		Allowable load (L/R=25 ms, C=1µF)
	OSSD3 (safety) OSSD4 (safety) WARNING1 (non-safety) WARNING2 (non-safety)	Output type (high side SW)
		Output current (maximum: 250 mA) (Note 4)
		Leakage current (maximum: 1 mA)
		Cable (AWG 28)
		Allowable load (L/R=25 ms, C=1µF)
	RES_REQ1, RES_REQ2, MUT_OUT1, MUT_OUT2 AUX_OUT1, AUX_OUT2 (Note 3)	Output type (PNP transistor output)
		Output current (maximum: 200 mA)
		Leakage current (maximum: 1 mA)
		Cable (AWG 28)
Input	Area Switching (5 inputs × 2 channels) EDM1/EDM2/MUTING1/MUTING2/MUTING3/ MUTING4/OVERRIDE1/OVERRIDE2/RESET1/ RESET2/ENC1_A/ENC1_B/ENC2_A/ENC2_B	Input Resistance: 4.7kΩ Cable: AWG 28
Interface	PC	USB2.0 (USB micro type-B connector)
	Master Slave	RS-485 (cable)
	Distance Measurement Data Output	Ethernet 100BASE-TX (water proof connector)
Environmental Resistance	Operating Temperature	−10 to +50˚C (no freezing)
	Storage Temperature	−25 to +70˚C (no freezing)
	Operating Humidity	95% RH (no condensation)
	Storage Humidity	95% RH (no condensation)
	Surrounding Light Intensity (Note 5)	1500 lx maximum
	Vibration Resistance	Frequency: 10 to 55 Hz Sweep: 1 octave/minute Amplitude: 0.35 mm ±0.05 mm
	Shock Resistance	Acceleration: 98 m/s² (10G) Pulse duration: 16 ms
	Outdoor Operation	Not permitted
	Altitude	Below 2,000m

Note 1: When the reflectance of object is 90% or above.
Note 2: Additional distance of 200 mm is needed when the SE2L operates under high reflective background.
Note:3 Error output, optical window contamination error output, optical window contamination warning, and synchronous output can each be allotted.
Note 4: Total current supply of OSSD output and warning output should be below 1.0A.
Note 5: The angle between the sensing plane and the light source should be more than 5 degrees.

Dimensions

Safety Laser Scanner
SE2L-H05LP□
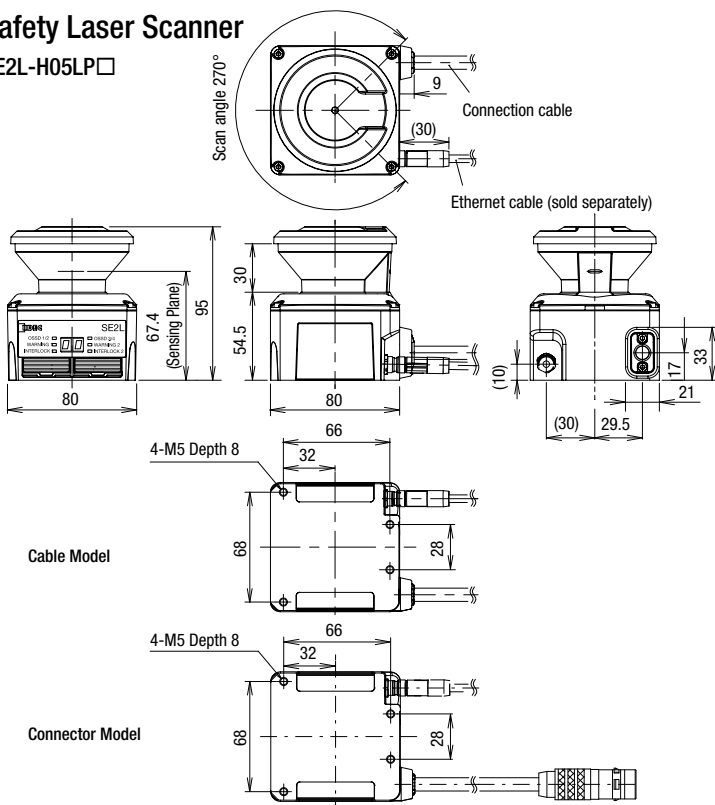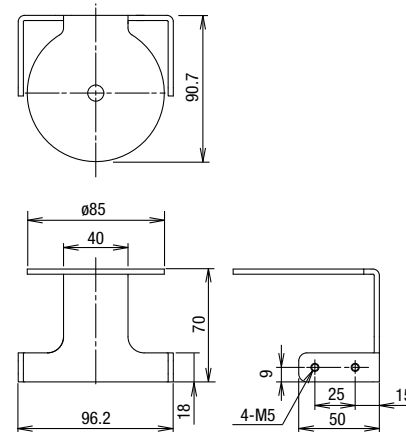
All dimensions in mm.

Scan angle 270°

Connection cable

Ethernet cable (sold separately)

Cable Model

4-M5 Depth 8

Connector Model

4-M5 Depth 8

Cover Bracket
SE9Z-HS2-CM01

ø85

4-M5

• Used to protect the optical window in combination with base mounting bracket or rear mounting bracket. Cannot be used with simple base mounting bracket or rear mounting bracket.

Base Mounting Bracket
SE9Z-HS2-BK01

4-ø5.3 SE2L Mounting Holes

3-ø5.3

4-ø5.3 Cover Bracket Mounting Holes

Rear Mounting Bracket
SE9Z-HS2-BK02

4-ø5.3 SE2L Mounting Holes

4-ø5.3 Cover Bracket Mounting Holes
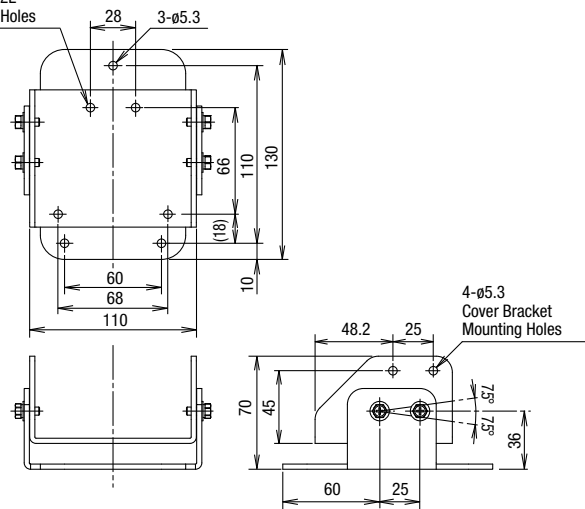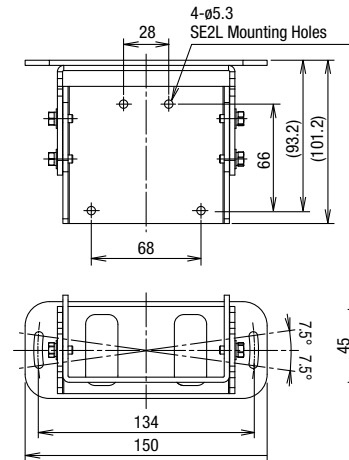
Simple Base Mounting Bracket
SE9Z-HS2-BK03 (Note 1)

(1) Position A: M5 screws

4-M5 screws

A

(2) Position B, C, or D: M6 screws

2-M6 screws

B
C
D
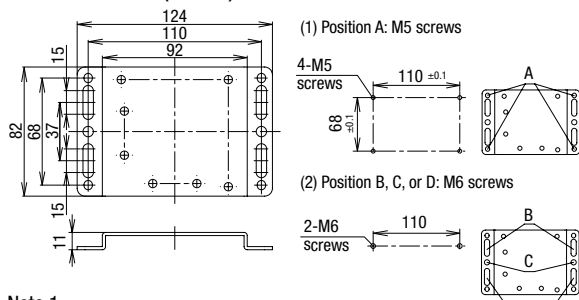
Note 1:
• Use washers when fastening screws.
• Use two M6 screws when installing on an aluminum frame.

Rear Mounting Bracket
SE9Z-HS2-BK04L (Note 1)

(1) Position A: M5 screws

4-M5 screws

A

(2) Position B: M6 screws

2-M6 screws

B

R53

4-ø6
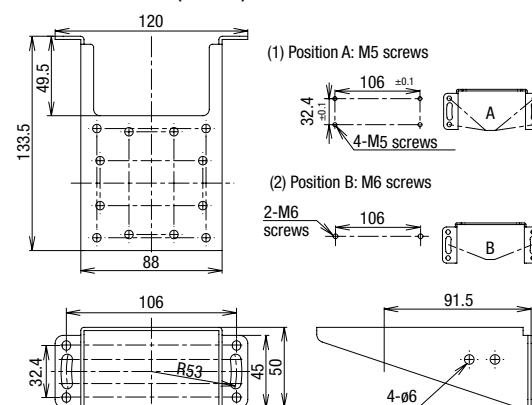
Wiring Examples

a) When using 32 scanning areas (e.g. AGV)
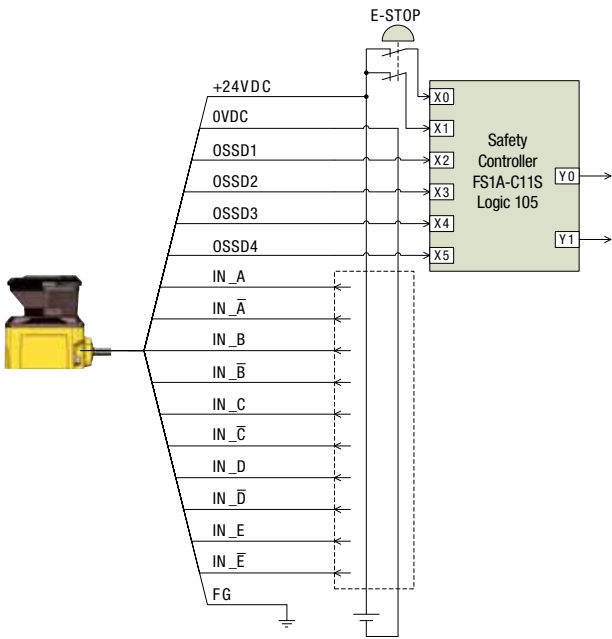
IDEC safety products
Safety Controller: FS1A
E-STOP: X series

b) When using muting/override/EDM
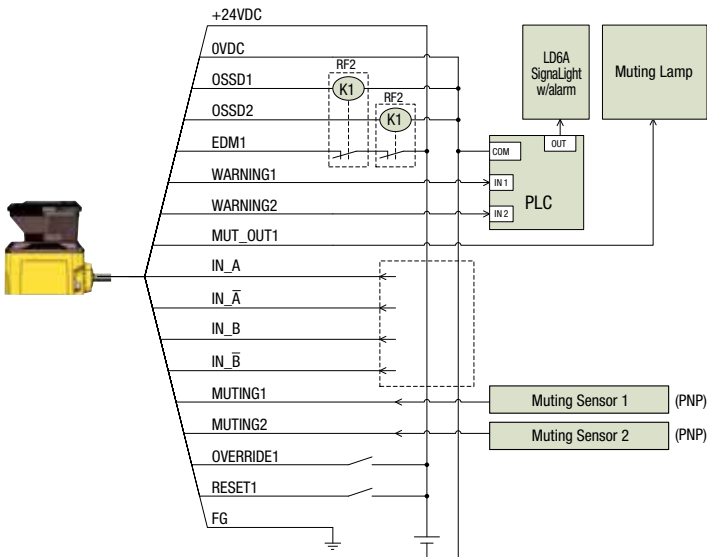
IDEC safety products
SignaLight w/alarm: LD6A
PLC: FC6A
Muting sensor: SA1E
Muting sensor lamp: HW1P-5
Force-guided relay: RF2

c) When switching 32 scanning areas using an encoder

IDEC safety products
SignaLight w/alarm: LD6A
PLC: FC6A
LED pilot light: AP22
Force-guided relay: RF2

d) When using the master slave function to guard an AGV or robot
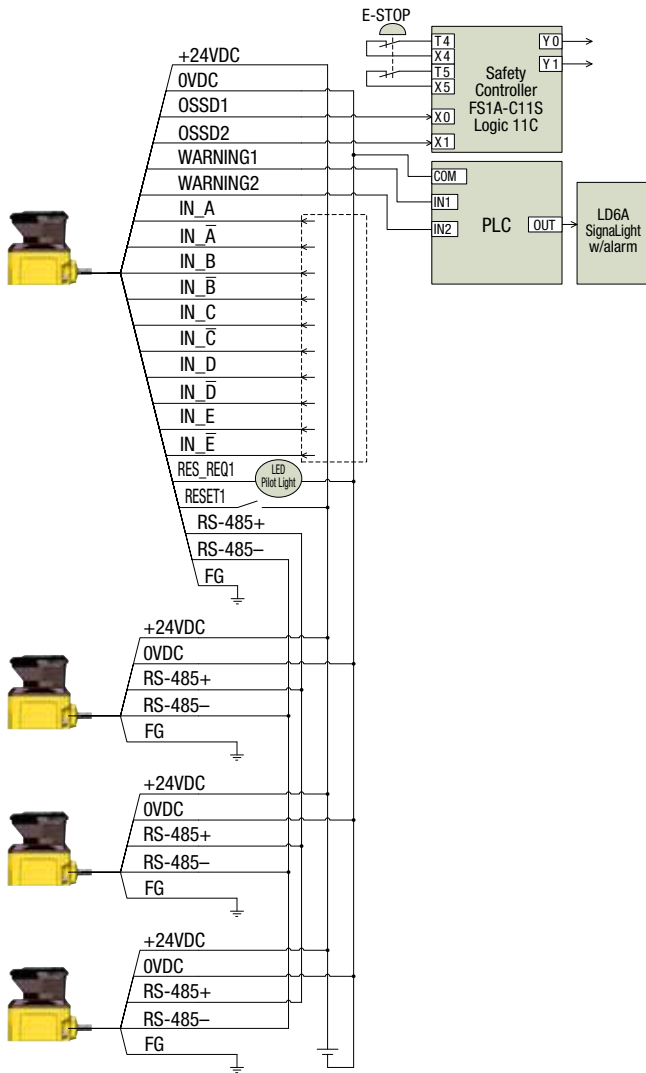
E-STOP

| Safety Controller FS1A-C11S Logic 11C |
| T4 / X4 / T5 / X5 / X0 / X1 |
| Y0 / Y1 |

+24VDC
0VDC
OSSD1
OSSD2
WARNING1
WARNING2
IN_A
IN_Ā
IN_B
IN_B̄
IN_C
IN_C̄
IN_D
IN_D̄
IN_E
IN_Ē
RES_REQ1
RESET1
RS-485+
RS-485–
FG

COM / IN1 / IN2 — PLC — OUT — LD6A SignaLight w/alarm

LED Pilot Light

+24VDC
0VDC
RS-485+
RS-485–
FG

+24VDC
0VDC
RS-485+
RS-485–
FG

+24VDC
0VDC
RS-485+
RS-485–
FG

IDEC safety products
SignaLight w/alarm: LD6A
PLC: FC6A
LED pilot light: AP22
Safety Controller: FS1A
E-STOP: X series

e) When using the master slave function to guard multiple hazards and perform partial stops

E-STOP

| Safety Controller FS1A-C11S Logic 105 |
| X0 / X1 / X2 / X3 / X4 / X5 / X6 / X7 / X10 / X11 |
| Y0 / Y1 / Y2 / Y3 |

+24VDC
0VDC
OSSD1
OSSD2
WARNING1
WARNING2
IN_A
IN_Ā
IN_B
IN_B̄
IN_C
IN_C̄
IN_D
IN_D̄
IN_E
IN_Ē
RES_REQ1
RESET1
RS-485+
RS-485–
FG

COM / IN1 / IN2 / IN3 / IN4 / IN5 / IN6 / IN7 / IN8 — PLC — OUT1 / OUT2 / OUT3 / OUT4

OUT1 — LD6A SignaLight w/alarm
OUT2 — LD6A SignaLight w/alarm
OUT3 — LD6A SignaLight w/alarm
OUT4 — LD6A SignaLight w/alarm

LED Pilot Light

+24VDC
0VDC
OSSD1
OSSD2
WARNING1
WANING2
RES_REQ1
RESET1
RS-485+
RS-485–
FG
LED Pilot Light

+24VDC
0VDC
OSSD1
OSSD2
WARNING1
WANING2
RES_REQ1
RESET1
RS-485+
RS-485–
FG
LED Pilot Light

+24VDC
0VDC
OSSD1
OSSD2
WARNING1
WANING2
RES_REQ1
RESET1
RS-485+
RS-485–
FG
LED Pilot Light

IDEC safety products
SignaLight w/alarm: LD6A
PLC: FC6A
LED pilot light: AP22
Safety Controller: FS1A
E-STOP: X series

Input/Output Circuit

OSSD/WARNING Output Circuit

OSSD/WARNING outputs are N channel MOSFET outputs.

+24V
OSSD1
OSSD2
OSSD3 / WARNING1
OSSD4 / WARNING2
Control Circuit
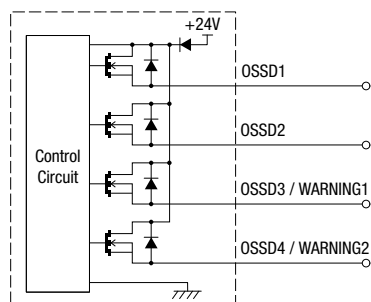
Other Output Circuit

RES_REQ1, RES_REQ2, MUT_OUT1, MUT_OUT2, AUX_OUT1, AUX_OUT2 outputs are PNP outputs.

+24V
RES_REQ1/MUT_OUT1/AUX_OUT1
RES_REQ1/MUT_OUT1/AUX_OUT1
Control Circuit
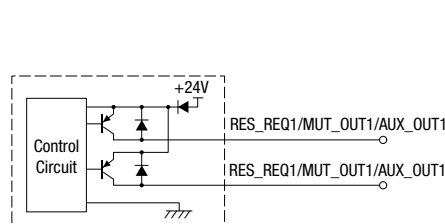
Input Circuit

Available for are input, EDM1, EDM2, RESET1, RESET2, MUTING1, MUTING2, MUTING3, MUTING4, OVERRIDE1, and OVERRIDE2.

Input
0V
Control Circuit

Robot controller connection terminal (accessory)

Dimensions

SE9Z-RT☐

SE9Z-T

All dimensions in mm.

3-M4 screw

Panel Cut-out

3 or 4-M4 screw

Panel Cut-out

Internal circuit

SE9Z-RT2D

Relay area

Connector J1   Connector J3

Push-in terminal block
Pin No.14～23

Push-in terminal block
Pin No. 1～13

Connector J2   Connector J4

Push-in terminal block

No.	Signal name (*1)
1	OSSD1
2	EDM1
3	OSSD2
4	OSSD3
5	EDM2
6	OSSD4
7	RESET1
8	RESET2
9	0V
10	24V
11	RS485-
12	RS485+
13	IN_A
14	IN_B
15	IN_C
16	IN_D
17	IN_A‾
18	IN_B‾
19	IN_C‾
20	IN_D‾
21	RES_REQ1
22	RES_REQ2
23	FG

Relay area / Others

Connector J1

No.	Wire color	Signal name (*1)
3	BU	0V
4	WH/BU	24V
1	YE	RS485-
5	WH/YE	RS485+
2	Shield	FG

Connector J2

No.	Wire color	Signal name (*1)
1	RD	RESET1
7	BU	RESET2
3	GN	0V
4	WH	24V
5	GY	RES_REQ1
6	PK	RES_REQ2
Shield		FG

Connector J3

No.	Wire color	Signal name (*1)
8	BN	RY1-1
2	YE	RY1-2
3	GN	RY2-1
4	WH	RY2-2
5	GY	RY3-1
6	PK	RY3-2
7	BU	RY4-1
1	RD	RY4-2

Connector J4

No.	Wire color	Signal name (*1)
1	RD	IN_A
2	YE	IN_B
3	GN	IN_C
4	WH	IN_D
5	GY	IN_A‾
6	PK	IN_B‾
7	BU	IN_C‾
8	BN	IN_D‾
Shield		FG

RY1, RY2, RY3, RY4

RF2V-1A1B-D24

*1) Signal name: when connected to SE2L
• For performance specifications of the SE9Z series, see the SE9Z series instruction manual.

Robot controller connection terminal (accessory)

SE9Z-RT2SV

Push-in terminal block

No.	Signal name (*1)
1	OSSD1
2	EDM1
3	OSSD2
4	OSSD3
5	EDM2
6	OSSD4
7	RESET1
8	RESET2
9	0V
10	24V
11	RS485-
12	RS485+
13	IN_A
14	IN_B
15	IN_C
16	IN_D
17	$\overline{\text{IN\_A}}$
18	$\overline{\text{IN\_B}}$
19	$\overline{\text{IN\_C}}$
20	$\overline{\text{IN\_D}}$
21	RES_REQ1
22	RES_REQ2
23	FG

(Rows 1–6: Relay area; Rows 7–23: Others)

Connector J1

No.	Wire color	Signal name (*1)
3	BU	0V
4	WH/BU	24V
1	YE	RS485-
5	WH/YE	RS485+
2	Shield	FG

Connector J2

No.	Wire color	Signal name (*1)
1	RD	RESET1
7	BU	RESET2
3	GN	0V
4	WH	24V
5	GY	RES_REQ1
6	PK	RES_REQ2
Shield		FG

Connector J3

No.	Wire color	Signal name (*1)
8	BN	Safety input 1
2	YE	Safety input 2
3	GN	Safety input 3
4	WH	Safety input 4
5	GY	RESET1
6	PK	RESET2
7	BU	0V
1	RD	24V

Connector J4

No.	Wire color	Signal name (*1)
1	RD	IN_A
2	YE	IN_B
3	GN	IN_C
4	WH	IN_D
5	GY	$\overline{\text{IN\_A}}$
6	PK	$\overline{\text{IN\_B}}$
7	BU	$\overline{\text{IN\_C}}$
8	BN	$\overline{\text{IN\_D}}$
Shield		FG

Relay: RY1, RY2 — RF2V-1A1B-D24

*1) Signal name: when connected to SE2L

SE9Z-T

Push-in terminal block

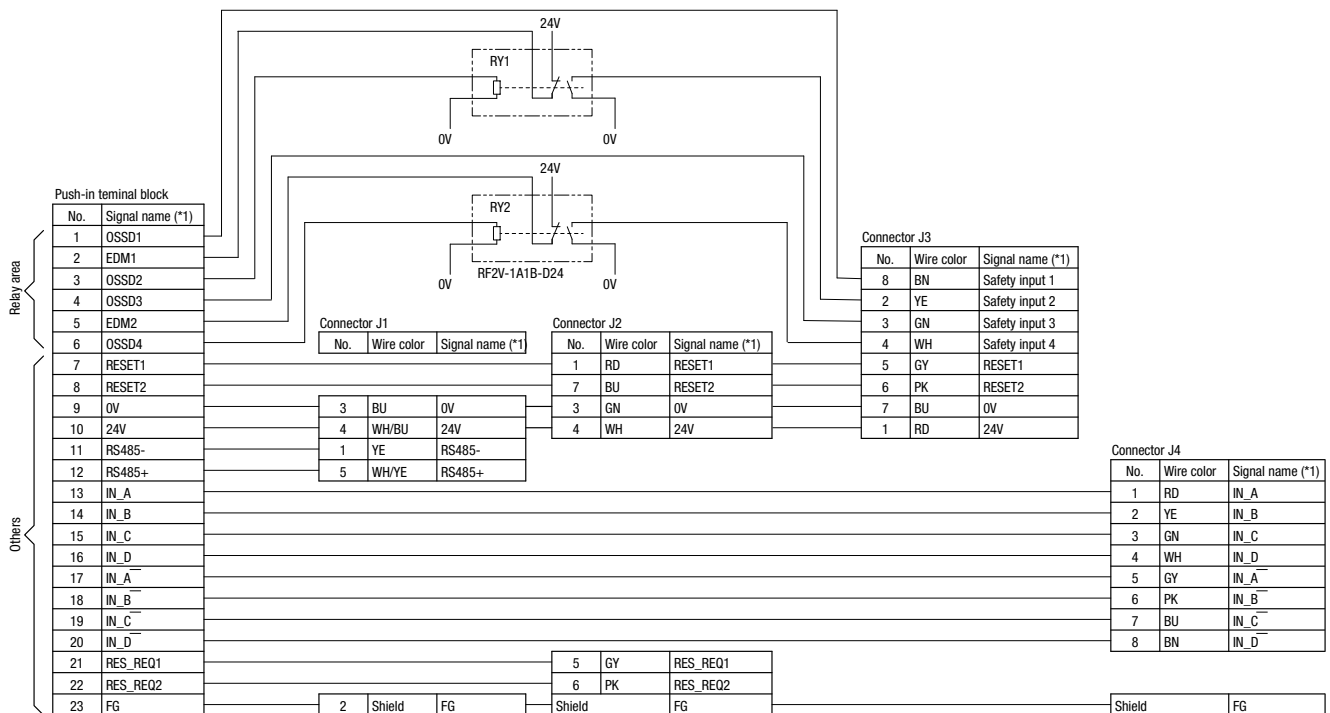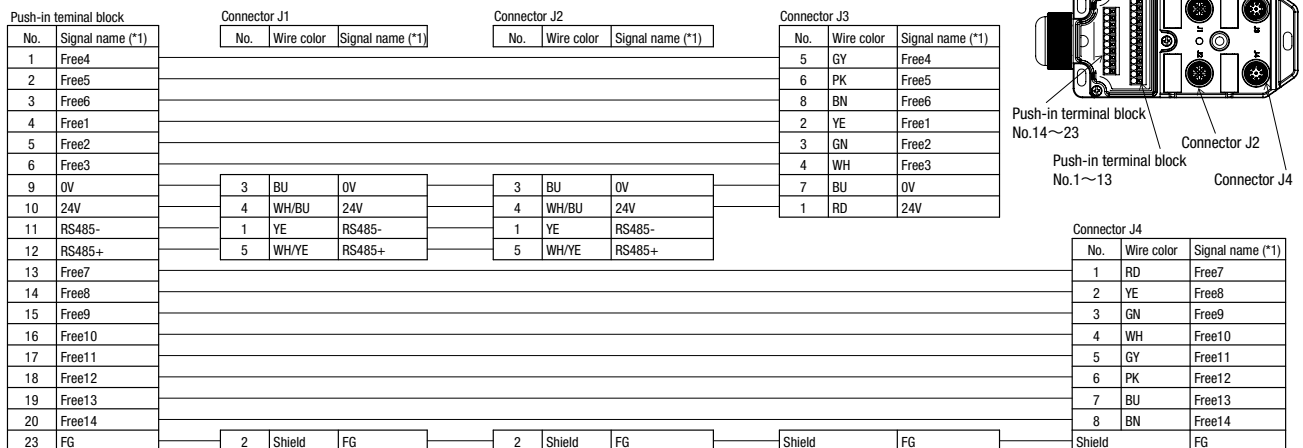| No.	Signal name (*1)
1	Free4
2	Free5
3	Free6
4	Free1
5	Free2
6	Free3
9	0V
10	24V
11	RS485-
12	RS485+
13	Free7
14	Free8
15	Free9
16	Free10
17	Free11
18	Free12
19	Free13
20	Free14
23	FG

Connector J1

No.	Wire color	Signal name (*1)
3	BU	0V
4	WH/BU	24V
1	YE	RS485-
5	WH/YE	RS485+
2	Shield	FG

Connector J2

No.	Wire color	Signal name (*1)
3	BU	0V
4	WH/BU	24V
1	YE	RS485-
5	WH/YE	RS485+
2	Shield	FG

Connector J3

No.	Wire color	Signal name (*1)
5	GY	Free4
6	PK	Free5
8	BN	Free6
2	YE	Free1
3	GN	Free2
4	WH	Free3
7	BU	0V
1	RD	24V
Shield		FG

Connector J4

No.	Wire color	Signal name (*1)
1	RD	Free7
2	YE	Free8
3	GN	Free9
4	WH	Free10
5	GY	Free11
6	PK	Free12
7	BU	Free13
8	BN	Free14
Shield		FG

Connector J1, Connector J3, Connector J2, Connector J4

Push-in terminal block No.14～23
Push-in terminal block No.1～13

*1) Signal name: when connected to SE2L

SE2L (safety laser scanner main unit) + robot controller connection terminal (accessory) kit

SE2L (safety laser scanner main unit) and the robot controller connection terminal (accessory) are available as a kit.
We offer the kit at a resonable price compared to purchasing them separately.
Also, this kit can be used instead of the connector model for the purpose of reducing costs.

2)When connecting the SE2L-H05LPC to the robot controller connection terminal, connector cable SE9Z-C5 (sold separately) is required.
*See page 7 for details.

Kit		Part No.
SE2L-H05LP (Cable model)	SE9Z-RT2D (with built-in relay)	SE2L-RT2D
	SE9Z-RT2SV (with built-in relay)	SE2L-RT2SV
	SE9Z-T (with built-in relay)	SE2L-T
SE2L-H05LPC (Connector model) (*2)	SE9Z-RT2D (with built-in relay)	SE2L-CRT2D
	SE9Z-RT2SV (with built-in relay)	SE2L-CRT2SV
	SE9Z-T (without relay)	SE2L-CT

Operating Principle

With the SE2L, the distance is measured by the Time of Flight (TOF) principle. The SE2L sends out very short pulses of infrared light. The mirror rotated by the motor sends the infrared light within the scanning range of 270º, and is reflected back from an object within the range.
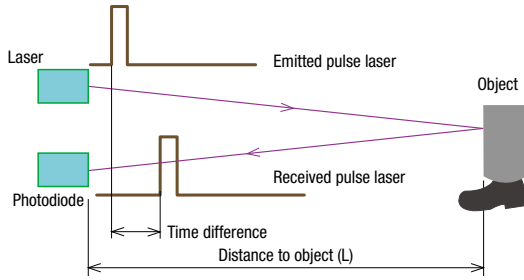
The distance can be calculated as follows:

$$L = \frac{1}{2} \times c \times T$$

L = Distance to the object
c = Speed of light
T = Time difference

Scanning Area

Scanning area of SE2L consists of protection zone and warning zones or only a protection zone. In both cases, maximum 32 sets of area can be configured (128 area sets when encoder input function is used). A software SLS Project Designer supplied with the SE2L is used to configure the protection and warning zones, providing excellent user interface. Automatic zone configuration by referring the boundary is also possible. See SE2L User's Manual "7. Function Configuration of SE2L" for details. The latest version of the software can be downloaded from IDEC website.

Protection zone: The area obtained by risk assessment and calculation of safety distance
Warning zone: The area to send alarms which can be set according to the application
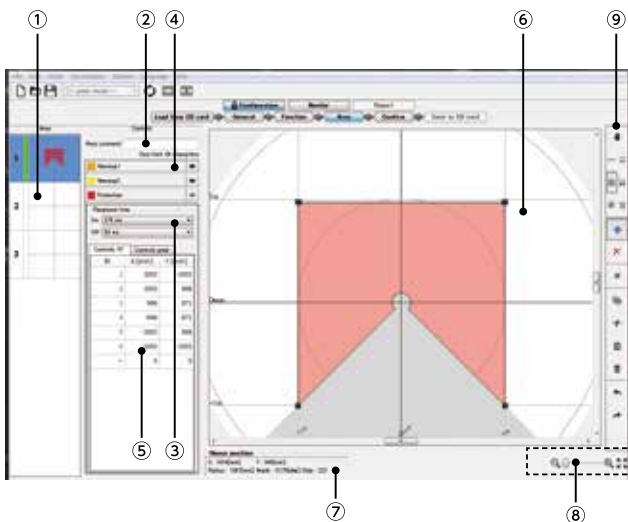
① Area preview
② Area comment
③ Response time (ON/OFF)
④ Area selection
⑤ Point coordinate
⑥ Area display
⑦ Mouse position
⑧ Zoom-in, zoom-out tool
⑨ Drawing tools bar

Area Switching

The SE2L can store up to 32 area patterns. The number of maximum configurable areas depends on selected functions such as scan area mode and muting.

Maximum number of patterns

Mode	Protection	Max. Internal Input	Max. Area	Max. Encoder Area
Standard	1	5	32	–
	2	5	32	–
EDN	1	4	16	–
	2	4	16	–
MUTING/EDM	1	2	4	–
	2	1	2	–
Encoder (Note 1)	1	3	7	128 (Note 2)
	2	3	7	128 (Note 2)

Note 1: Muting function modes cannot be used when encoder input mode is selected.
Note 2: Among the eight input patterns, at least one pattern must be used for encoder input. Other seven remaining patterns can be selected to be used as a static input or not in use. A pattern with encoder input mode has up to 128 sets of area.

Input combination for area switching
(ex. 5 inputs)

Area	IN_A	IN_B	IN_C	IN_D	IN_E	IN_$\overline{A}$	IN_$\overline{B}$	IN_$\overline{C}$	IN_$\overline{D}$	IN_$\overline{E}$
1	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF
3	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF
4	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF
5	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
6	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
7	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF
9	ON	ON	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
10	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF

• See User's Manual for more combinations (max. 32 areas)

Response Time

The OFF response time (default: 60ms) for the OSSD signal and ON response time (default: 270ms) can be configured by using the SLS Project Designer. The response time for WARNING 1, 2 is the same as the response time for OSSD. In dual protection mode, different response time can be set for protection zone 1 and 2 each. The stability of the SE2L can be increased by setting a long response time, but a long safety distance is required (see User's Manual 4. Application Examples of SE2L). Before setting the response time, the user must perform a risk assessment thoroughly. The configurable response time is shown in the table below. Be sure to add the time taken to switch areas (30 ms).

Time Chart
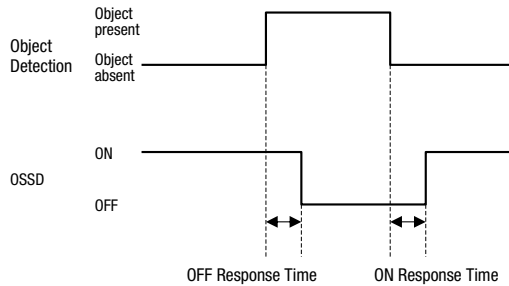
SE2L Response Time

	Response Time (ms)							
OFF (ON→OFF)	60	90	120	150	180	210	240	270
	300	330	360	390	420	450	480	510
	540	570	600	630	660	690	720	750
	780	810	840	870	900	930	960	990
	1020	1050	1080	1110	1140	1170	1200	1230
	1260	1290	1320	1350	1380	1410	1440	1470
	1500	1530	1560	1590	1620	1650	1680	1710
	1740	1770	1800	1830	1860	1890	1920	1950
	1980	2010						

|	Response Time (ms)							
ON (OFF→ON)								270
	300	330	360	390	420	450	480	510
	540	570	600	630	660	690	720	750
	780	810	840	870	900	930	960	990
	1020	1050	1080	1110	1140	1170	1200	1230
	1260	1290	1320	1350	1380	1410	1440	1470
	1500	1530	1560	1590	1620	1650	1680	1710
	1740	1770	1800	1830	1860	1890	1920	1950
	1980	2010						

• Minimum configurable response time in Master/Slave mode
  OFF: 60ms (when OSSD is used), ON: 300ms

Safety Distance

Access protection

In this application, the SE2L is horizontally installed to protect the hazardous area. The protection zone is set around the hazardous area to prevent humans or objects from entering the hazardous area. Warning zones 1 and 2 are configured to surround the protection zone.

Protection zone 1 application
### (horizontal, stationary installation)
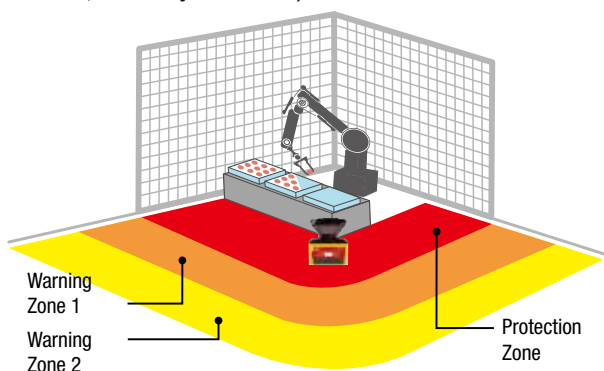
Warning zones 1 and 2 are set around the protection zone to send alarms to prevent humans or objects from entering the hazardous area and stopping the machine. By detecting humans or objects in the protection zone, the OSSD signal switches from ON to OFF. Also, when humans or objects are detected in the warning zone, WARNING signal switches from ON to OFF.

Upper view (stationary)
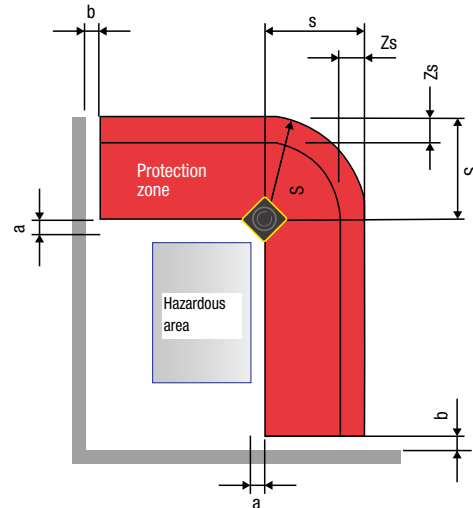
• Maintain the distance "a" shorter than the minimum detection width. To prevent unwanted detection, maintain the distance "b" 100mm.

Side view (stationary)
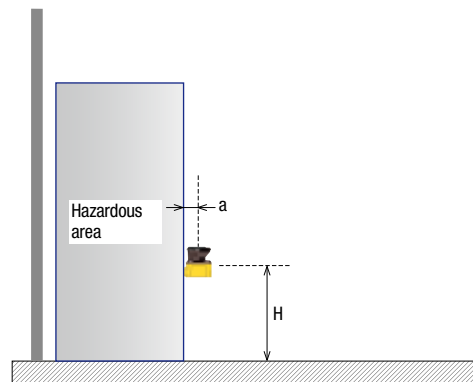
Calculation

$$S = (K \times (T_m + T_s) + C + Z_s$$

S = Safety distance (mm)
K = Human approach speed 1,600 (mm/s)
T_m = Maximum stop speed of machine or system (s)
T_s = Response time of SE2L (s)
C = $1200 - 0.4 \times H \geq 850$
  H = height from the floor to the sensing plane (mm)
  $1000 \geq H \geq 15 \times (d - 50)$
  d = Minimum sensing width of object (mm)
Z_s = Additional safety distance of SE2L (mm)

• See User's Manual for access protection and area protection (access detection, collision avoidance for mobiles)

Installation

Light Interference

SE2L is a sensor that transmits pulsed laser for obstacle detection. Interfering light sources may lead to false detection. Before using the SE2L, examine the surrounding environment. If the SE2L must be used under the environment shown below, install the SE2L so that the light source is located more than ±5 degrees from the sensing plane to prevent light interference.

a) Incandescent light
b) Florescent light
c) Strobe light
d) Flashing beacon
e) Sunlight
f) Infrared light source
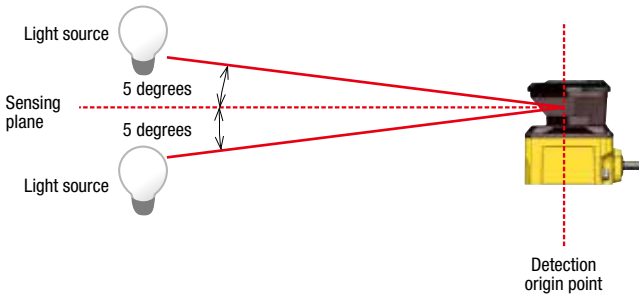
Mutual Interference

When using several safety laser scanners or scanning range finders of the same model, pulse laser signals from other sensors may be falsely detected. To prevent mutual interference, see the installation methods shown below. See User's Manual for more details.
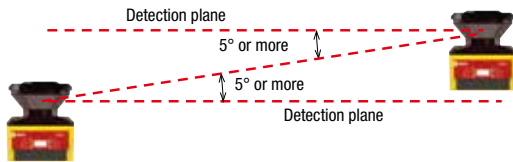
1) Changing the installation height

Install the SE2Ls at different heights to keep at least 5 degree distance between the detection planes.

①Face to face installation
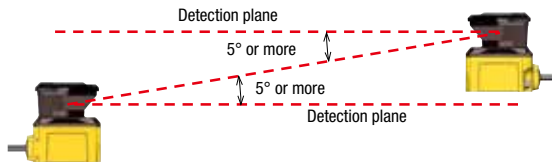
②Parallel installation

2) Changing the installation angle

Adjust the angle of SE2Ls to keep at least 5 degree distance between the detection planes.
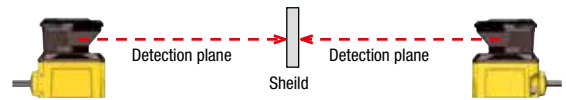
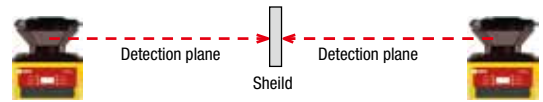①Face to face installation

②Parallel installation

3) Using shields

Install a shield between the SE2Ls to prevent prevent the laser beams from entering the other SE2L.
①Face to face installation

②Parallel installation

Highly Reflective Background

Highly reflective backgrounds may cause false detection causing the SE2L to detect a longer distance than the actual distance. If an operating environment with a highly reflective background cannot be avoided, an additional distance of 200 mm, in addition to the 100mm additional safety distance, is needed when configuring protection or warning zones.
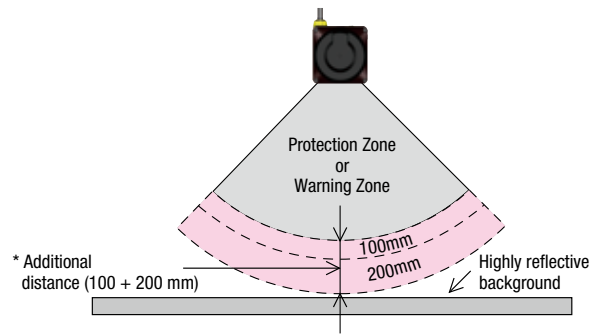
* Additional distance: the distance required to operate the SE2L under high reflective background

Limited Detection Capability Area

The limited detection capability area is the area between the optical window and the beginning of the detection zone. The area from the origin point of the SE2L to 90 mm from the origin point is the limited detection capability area. In this area, a low reflective object is difficult to detect.
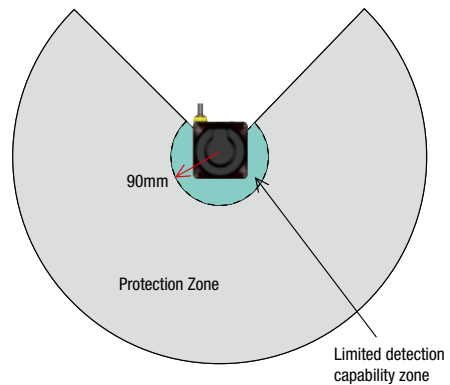
Wiring

The table below shows the functions of each wire. Use of a shielded wire is recommended.

Wire Color and Functions

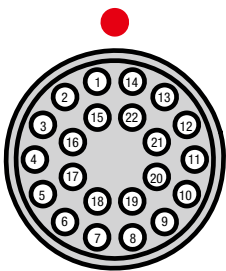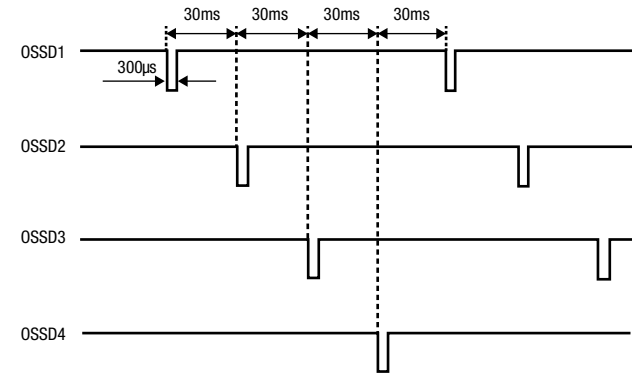| Color	Signal	Function	Description	AWG	Pin No.
Brown	+24V DC	Power	Power: 24V DC	22	1
Blue	0V DC		Power: 0V DC	22	2
Red	OSSD 1	Output	Protection zone output 1	26	3
Yellow	OSSD 2		Protection zone output 2	26	4
Red/Black	OSSD 3 WARNING1	Output	Protection zone output 3 Warning zone output 1	28	5
Yellow/Black	OSSD 4 WARNING2	Output	Protection zone output 4 Warning zone output 2	28	6
Purple	IN_A	Input	Area switching input A	28	7
Gray	IN_B MUTING3		Area switching input B Muting input 3	28	8
White	IN_C OVERRIDE1 ENC1_A		Area switching input C Override input 1 Encoder input 1_A	28	9
Pink	IN_D MUTING1 ENC1_B		Area switching input D Muting input 1 Encoder input 1_B	28	10
Green	IN_E EDM1		Area switching input E External device monitoring 1	28	11
Purple/Black	IN_$\overline{A}$		Area switching input $\overline{A}$ invert	28	12
Gray/Black	IN_$\overline{B}$ MUTING4		Area switching input $\overline{B}$ invert Muting input 4	28	13
White/Black	IN_$\overline{C}$ OVERRIDER2 ENC2_A		Area switching input $\overline{C}$ invert Override input 2 Encoder input 2_A	28	14
Pink/Black	IN_$\overline{D}$ MUTING2 ENC2_B		Area switching input $\overline{D}$ invert Muting input 2 Encoder input 2_B	28	15
Green/Black	IN_$\overline{E}$ EDM2		Area switching input $\overline{E}$ invert External device monitoring 2	28	16
Yellow/Green	RESET1		Reset input 1	28	17
Yellow/Blue	RESET2		Reset input 2	28	18
Orange	RES_REQ1 MUT_OUT1 AUX_OUT1	Output	RES_REQ1: request output 1 MUT_OUT1: muting state output 1 AUX_OUT1: Synchronous signal / Error / Window contamination error / Window contamination warning	28	19
Orange/Black	RES_REQ2 MUT_OUT2 AUX_OUT2		RES_REQ2: request output 2 MUT_OUT2: muting state output 2 AUX_OUT2: Synchronous signal / Error / Window contamination error / Window contamination warning	28	20
White/Blue	RS-485+	Commu-nication	Communication protocol RS-485 (twisted pair)	28	21
White/Red	RS-485−		Communication protocol RS-485 (twisted pair)	28	22
Shield	FG	−	Frame ground	−	Case

SE2L-H05LPC
Pin No.

SE9Z-HSC-C□□□
Socket No.

OSSD

In SE2Ls, the OSSD signal has a self-diagnosis function that tests the signal periodically to detect malfunction. The OSSD signal will turn OFF when a error is detected due to the self-diagnosis function. The self-diagnosis function of the OSSD detects abnormality by switching off OSSD 1 to OSSD 4 at intervals of 300 μs maximum. Be sure to use a force-guided relay, converter, or controller that does not respond to this self-diagnosis function.

Time chart
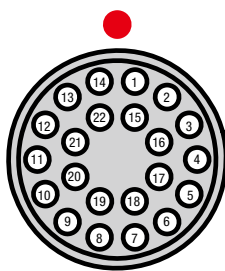
⚠ Safety Precautions

For correct use of the SE2L, take note of the following precautions.

General Instructions

- SE2L is a AOPDDR (Active Optoelectronic Protective Device responsive to Diffuse Reflection) that detects diffused emitted light within the protection zone.
- Perform tests before operation to check the function and performance of the SE2L.
- SE2L is designed to protect human beings or systems by monitoring the hazardous area. It is not designed for the protection from high speed objects or electromagnetic radiation.
- To maintain the degree of protection and to prevent injury or death, do not modify or disassemble the SE2L.
- IDEC does not warrant any problems that were caused by modification or disassembly of the SE2L.
- The operator must be a person qualified to operate the SE2L. The operator must be trained and be able to operate the SE2L correctly.
- The administrator must provide continuous training to the operator for correct use of the SE2L.
- The administrator must understand the user's manual and be responsible for ensuring appropriate operating conditions for SE2L.
- SE2L has been manufactured and shipped under strict quality control. If you find any defect in the product, contact distributor or sales representative.
- IDEC does not take responsibility for damage caused by improper use of the product by customers or third parties. IDEC cannot take responsibilities for any loss from the misuse except for the responsibilities governed by law.
- To examine the object detecting performance, use a test piece the size equivalent to the minimum detectable object.
- Error occurs when detection capability is below 30% due to homogenous dirt on the optical window. The operator must keep the windows clean.
- When the interlock function is active, make sure that the surrounding environment, especially within the protection zone, is safe before resetting the interlock.
- While SE2L is removed, a protective measure must be taken to ensure safety within the protection zone. To prevent entry into the danger zone, use protective materials such as a safety guard or light curtain.
- SE2L and its accessories are subject to change for improvement without prior notice.
- Dispose the SE2L as industrial waste or in accordance with the local regulations.
- Do not drop the product. Otherwise, the product may be damaged, lead to failure, and the performance will be degraded. Injury may also be caused.
- Take measures on the network system side to prevent unauthorized access to SE2L from external devices. Under no circumstances shall IDEC Corporation be held liable or responsible for any indirect or consequential damages and expenses resulting from unauthorized access.

Operating Environment

- Make sure that the operating environment is within the range of the specifications (temperature, humidity, light interference) described in User's Manual, otherwise malfunction or degradation of detection performance may result.
- Do not use the SE2L near a machine that may generate strong radio waves. It may interfere with the operation of the SE2L.
- Do not use or install the SE2L where dust, smoke, or corrosive chemical substances exist. Using the SE2L under these environments may lead to degradation of detection performance.
- The SE2L is for indoor use only.

Installation

- Install the SE2L on a stable surface or structure to prevent displacement of the sensor.
- Install the SE2L securely so that screws do not loosen due to shock or vibration. (Recommended tightening torque 3 N·m). Displacement may degrade protection performance.
- Determine the safety distance before installing the SE2L. After installing the SE2L, use a test piece for all protection zones to check the sensing functions.
- After installing the SE2L, use protective materials such as safety guards and light curtains to prevent entry into the protective zone.
- The following switches must be installed far from the protection zone, so that the operator can operate the switches while overseeing the entire protection zone.
  * Switch to reset the interlock function
  * Switch to start muting function
  * Switch to start override function
- If several SE2Ls are installed on the same sensing plane, mutual interference may occur.
- Provide enough space for installation and maintenance of the SE2L.
- Do not cover the front of the optical window with glass or transparent cover, otherwise detection characteristics of the SE2L may be impaired.
- Minimum sensing width differs according to the distance.

Wiring

- Be sure to turn off all power before wiring.
- When using converter power, make sure to use power that satisfies the following requirements.
  1) The rated output voltage is within 24V DC±10% (SELV circuit, overvoltage category II)
  2) The circuit between primary circuit and secondary circuit is reinforced insulation or double insulation.
  3) The output holding time is 20 ms.
  4) The power supply must comply with electrical safety and electromagnetic compatibility (EMC) regulations requirements of each country, state, and district.
- All input/output cables must be located away from power cables and high voltage cables.
- To control safety-related machine or system, use OSSD output. Because warning zone output (warning signal) is a non-safety signal, do not use for safety purposes.
- Both the OSSD1 and OSSD2 outputs should be connected to safety-related machines or control system. When OSSD3 and OSSD4 are used, connect the outputs in the same manner.
- Use shielded cable for the connection between OSSD signals and safety-related machines or systems.

⚠ Safety Precautions

Settings

- A password is used for configuring the safety function. Only an administrator or operator should be able to set safety functions.
- SE2L will not operate without initial configuration.
- Perform test operation and check the configuration before using the SE2L.
- The stability of the SE2L increases by delaying the response time of the OSSD signal but the sensing performance decreases for moving objects. Before using this function, be sure to carry out risk assessment.
- The operator must record the changes made in the configuration. SLS Configurator report function is available. For details, see the User's Manual.
- User must check the operations of this user configurable product on user's responsibility.
  Under no circumstances shall IDEC Corporation be held liable or responsible for the operations of the functions configurated by users, and any damages or losses due to the user's configurations.

Testing and Maintenance

- The operator should perform the following tests or maintenance based on the checklist described in the User's Manual.
  1) Pre-operation inspection
  2) Operation inspection
  3) Daily inspection
  4) Periodic inspection
  The checklist in the User's Manual is a basic guideline for performing tests and maintenance. The operator should perform additional tests and maintenance if necessary.
- Stop the machine if failure occurs during tests.
- Clean the optical window if any dirt is found, and ask for repair if damaged. Refer to the User's Manual for details.

Ordering Terms and Conditions

Thank you for using IDEC Products.

By purchasing products listed in our catalogs, datasheets, and the like (hereinafter referred to as "Catalogs") you agree to be bound by these terms and conditions. Please read and agree to the terms and conditions before placing your order.

1. Notes on contents of Catalogs

(1) Rated values, performance values, and specification values of IDEC products listed in this Catalog are values acquired under respective conditions in independent testing, and do not guarantee values gained in combined conditions.
Also, durability varies depending on the usage environment and usage conditions.

(2) Reference data and reference values listed in Catalogs are for reference purposes only, and do not guarantee that the product will always operate appropriately in that range.

(3) The specifications / appearance and accessories of IDEC products listed in Catalogs are subject to change or termination of sales without notice, for improvement or other reasons.

(4) The content of Catalogs is subject to change without notice.

2. Note on applications

(1) If using IDEC products in combination with other products, confirm the applicable laws / regulations and standards.
Also, confirm that IDEC products are compatible with your systems, machines, devices, and the like by using under the actual conditions. IDEC shall bear no liability whatsoever regarding the compatibility with IDEC products.

(2) The usage examples and application examples listed in Catalogs are for reference purposes only. Therefore, when introducing a product, confirm the performance and safety of the instruments, devices, and the like before use. Furthermore, regarding these examples, IDEC does not grant license to use IDEC products to you, and IDEC offers no warranties regarding the ownership of intellectual property rights or non-infringement upon the intellectual property rights of third parties.

(3) When using IDEC products, be cautious when implementing the following.
 i. Use of IDEC products with sufficient allowance for rating and performance
 ii. Safety design, including redundant design and malfunction prevention design that prevents other danger and damage even in the event that an IDEC product fails
 iii. Wiring and installation that ensures the IDEC product used in your system, machine, device, or the like can perform and function according to its specifications

(4) Continuing to use an IDEC product even after the performance has deteriorated can result in abnormal heat, smoke, fires, and the like due to insulation deterioration or the like. Perform periodic maintenance for IDEC products and the systems, machines, devices, and the like in which they are used.

(5) IDEC products are developed and manufactured as general-purpose products for general industrial products. They are not intended for use in the following applications, and in the event that you use an IDEC product for these applications, unless otherwise agreed upon between you and IDEC, IDEC shall provide no guarantees whatsoever regarding IDEC products.
 i. Use in applications that require a high degree of safety, including nuclear power control equipment, transportation equipment (railroads / airplanes / ships / vehicles / vehicle instruments, etc.), equipment for use in outer space, elevating equipment, medical instruments, safety devices, or any other equipment, instruments, or the like that could endanger life or human health
 ii. Use in applications that require a high degree of reliability, such as provision systems for gas / waterworks / electricity, etc., systems that operate continuously for 24 hours, and settlement systems
 iii. Use in applications where the product may be handled or used deviating from the specifications or conditions / environment listed in the Catalogs, such as equipment used outdoors or applications in environments subject to chemical pollution or electromagnetic interference
If you would like to use IDEC products in the above applications, be sure to consult with an IDEC sales representative.

3. Inspections

We ask that you implement inspections for IDEC products you purchase without delay, as well as thoroughly keep in mind management/maintenance regarding handling of the product before and during the inspection.

4. Warranty

(1) Warranty period
The warranty period for IDEC products shall be one (1) year after purchase or delivery to the specified location. However, this shall not apply in cases where there is a different specification in the Catalogs or there is another agreement in place between you and IDEC.

(2) Warranty scope
Should a failure occur in an IDEC product during the above warranty period for reasons attributable to IDEC, then IDEC shall replace or repair that product, free of charge, at the purchase location / delivery location of the product, or an IDEC service base. However, failures caused by the following reasons shall be deemed outside the scope of this warranty.
 i. The product was handled or used deviating from the conditions / environment listed in the Catalogs
 ii. The failure was caused by reasons other than an IDEC product
 iii. Modification or repair was performed by a party other than IDEC
 iv. The failure was caused by a software program of a party other than IDEC
 v. The product was used outside of its original purpose
 vi. Replacement of maintenance parts, installation of accessories, or the like was not performed properly in accordance with the user's manual and Catalogs
 vii. The failure could not have been predicted with the scientific and technical standards at the time when the product was shipped from IDEC
 viii. The failure was due to other causes not attributable to IDEC (including cases of force majeure such as natural disasters and other disasters)
Furthermore, the warranty described here refers to a warranty on the IDEC product as a unit, and damages induced by the failure of an IDEC product are excluded from this warranty.

5. Limitation of liability

The warranty listed in this Agreement is the full and complete warranty for IDEC products, and IDEC shall bear no liability whatsoever regarding special damages, indirect damages, incidental damages, or passive damages that occurred due to an IDEC product.

6. Service scope

The prices of IDEC products do not include the cost of services, such as dispatching technicians. Therefore, separate fees are required in the following cases.

(1) Instructions for installation / adjustment and accompaniment at test operation (including creating application software and testing operation, etc.)
(2) Maintenance inspections, adjustments, and repairs
(3) Technical instructions and technical training
(4) Product tests or inspections specified by you

The above content assumes transactions and usage within your region. Please consult with an IDEC sales representative regarding transactions and usage outside of your region. Also, IDEC provides no guarantees whatsoever regarding IDEC products sold outside your region.

IDEC CORPORATION

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