

Quick Reference Guide

Safety Laser Scanner

SE2L-H05LP

IDEC CORPORATION

Manufacturer: IDEC CORP.
 2-6-64 Nishimiyahara Yodogawa-ku, Osaka 532-0004, Japan
 EU Authorized Representative: IDEC Elektrotechnik GmbH
 Heselstuecken 8, 22453, Hamburg, Germany

<http://www.idec.com>

2017.11

Confirm that the delivered product is what you have ordered. Read this quick reference guide to make sure of correct operation. Make sure that the quick reference guide is kept by the end user.

Notice for safety

Special markings and symbols are used in this document to alert the reader especially to safety-related issues. Follow strictly the instructions marked by these special markings and symbols to ensure safety during the operation.

| Mark | Meaning |
|------|--|
| | Danger |
| | Procedures that could lead to dangerous situation, critical injury or death if not carried out properly. |

Refer SE2L user's manual for details.

Read section 12 "Instruction for using SE2L for the first time afterpurchase" when using the device for the first time.

1. Safety precautions

Danger

Please read the following guidelines for correct use of the SE2L. Proper handling and usage ensure the SE2L to operate accordingly.

(1) General

Danger

- SE2L is an AOPDDR that detects obstacles within the configured protection zone by detecting diffused optical radiation. Optical radiations are generated and emitted into the configured protection zone. The optical radiations are then rotated by a rotating motor covering the protection zone. The optical radiations are diffused and reflected back towards the receiving unit 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 the electro magnetic radiation.
- Pre-operation tests must be performed in order to verify the functionality and the performance of the SE2L.
- Do not modify or disassemble SE2L. Such modifications will affect the detection capability leading to injuries or death.
- Do not modify or disassemble SE2L to maintain its housing rating. Such modifications will void the warranty.
- Operator is referred to a person who is responsible and qualified to operate the SE2L. Operator should have attended appropriate safety-related training and could operate the SE2L correctly.
- A person-in-charge must be assigned and have trained the operator about the correct use of SE2L.
- The person-in-charge is responsible to ensure the proper working environment for SE2L.
- The person-in-charge is responsible for the compliance with the local safety requirements, standards, rules and regulations, laws of respective nations, states or districts when the SE2L is used in a safety-related system.
- SE2L has been manufactured and shipped under the strict quality control. If you find any defect in the product contact the nearest distributor or sales representative.
- IDEC cannot be held responsible for the damages or failure due to misuse 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.

- User should prepare test pieces for detection capability verification. The test piece should emulate the smallest object that is intended to be detected during the operation.
- Maximum level of homogeneous pollution for SE2L is 30%. Warning signal will be displayed if the pollution exceeded the stated limit. However, operator should always keep the optical window in clean condition.
- Before resetting the interlock of the SE2L, operator must ensure the surrounding is safe especially in the protection zone.
- During decommission of the SE2L, protective measures must be taken to ensure safety on the protection zone. Protective materials such as guards or light curtain should be used to prevent any passage into the hazardous area.
- SE2L including its accessories are subject to change without prior notice for the improvement.
- SE2L should be disposed as industrial waste or in accordance with the local disposal directives.
- 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.

(2) Operating environment

Danger

- Make sure that SE2L's operating environment is within the stated specification (temperature, humidity, ambient light, etc.). Using SE2L in the out-of-spec environment may cause malfunction or decrease the detection capacity.
- Do not use or mount SE2L near devices that could generate strong electromagnetic waves as it could affect the operation of SE2L.
- Do not use or mount SE2L in dusty, smoky, or misty environments, or where corrosive substances are present. Operating under such environments may decrease the detection capacity of SE2L.
- This product is for indoor use only.

(3) Installation

Danger

- Install the SE2L on a firm surface or structures to avoid displacement of the sensor.
- The SE2L should be firmly mounted using screws. Shock and vibration should not loosen the mounting. SE2L will not operate properly if the protection zone is different from the intended area due to the displacement. Recommended torque for screws is 3 N·m.
- Safety distance must be determined before installing SE2L. User must ensure the functionality of the SE2L after installation by placing a test piece in all the protection zone.
- During the installation of the SE2L, protective materials such as guards or light curtain should be used to prevent any passage into the hazardous area.
- Reset switch used for interlock, muting and override function should be mounted at a location away from the protection zone. Also the whole protection zone must be visible from the switch location.
- Mutual interference could occur when identical SE2Ls are mounted at the same detection plane.
- SE2L should be mounted at a location which has sufficient space for maintenance.
- Do not add any protective materials such as glass, transparent cover etc in front of the optical window. This would lead to loss of detection capability of the SE2L.
- Minimum detectable width varies with the distance.

(4) Wiring

Danger

- Switch OFF all the power supply during wiring.
- If the source of the power supply is taken from a converter, please ensure the power supply fulfills the following requirements:
 - a) A rated output voltage of 24VDC \pm 10%(SELV circuit, Overvoltage Category II)
 - b) Reinforced insulation or double insulation for the primary and secondary circuit
 - c) Holding time of the output should be above 20ms
 - d) The power supply must comply with the requirements of electrical safety and electromagnetic compatibility (EMC) regulations of the respective country, states and district.
- All the input/output signal cables should be installed away from machines power lines and high-voltage cables.
- Use OSSD of the SE2L to control safety-related machine/system. Do not use Warning signals to control safety-related machine as these are non-safety signals.
- Both the OSSD1 and OSSD2 outputs should be connected to the safety-related machines or control system. If OSSD3 and OSSD4 are used they must be connected in the same manner.
- Use shield cable for the connection between OSSD signals and safety-related machines or systems.

(5) Configuration

Danger

- Configuration of safety functions are password protected. Only authorized personnel or operator with password are allowed for configuration.
- SE2L will not operate without an initial configuration.
- Pre-operation test must be performed to verify the configurations before operating the SE2L.
- Increasing the response time of OSSD will increase the stability of SE2L. However, this will reduce the detection capability towards moving objects. User must perform risk assessment before using this function.
- Changes made during the configuration must be recorded. Operator can use the report generating function in the SE2L Project Designer.

(6) Test and maintenance

Danger

- User must perform the following tests and maintenance by referring to the checklists in this manual.
 - a) Pre-operation inspection
 - b) Operation inspection
 - c) Daily inspection
 - d) Periodical inspection
- *The checklists in this document are provided as basic guidelines while performing the test and maintenance. User must perform additional inspection and maintenance tasks deemed necessary for the respective application.
- Stop the machine and stop using the SE2L if faults are detected during these tests.
- Clean the optical window when it gets contaminated. If the optical window is damaged it should be replaced by a new one.

2. Specification

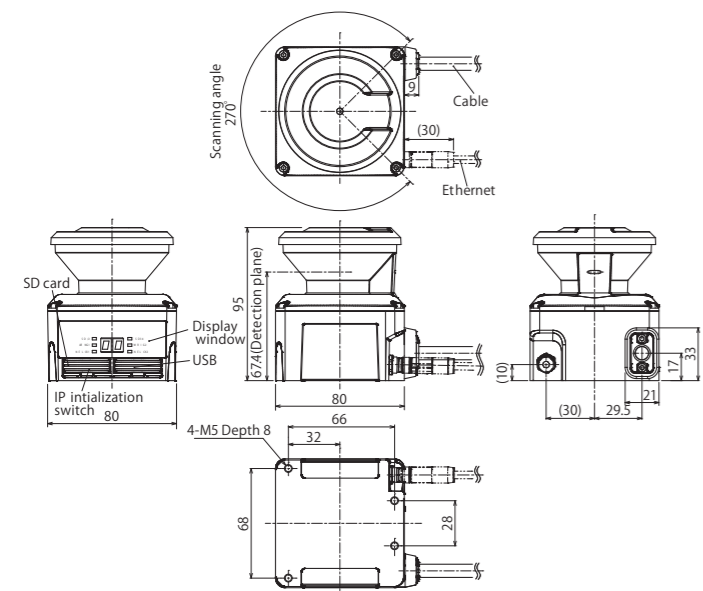
| Subject | Specifications | |
|--------------------|--------------------------|--|
| Model | SE2L-H05LP | |
| Detection property | Protection Range | Max.5.0m |
| | Warning Range | Max.20.0m (Non-safety) ※1 |
| | Distance tolerance ※2 | +100mm |
| | Detection capability | From Black-Reflector Sheet (1.8%) to Retro-Reflector Sheet |
| | Detection angle | 270° |
| | Minimum Detectable Width | φ30mm (Max. 1.8m) φ40mm (Max. 2.5m) φ50mm (Max. 3.0m) φ70mm/150mm (Max. 5.0m) |

| Subject | Specifications | |
|-------------------------------|--|---|
| Detection property | Scan Frequency | 30ms (Rotational Speed 2,000rpm) |
| | Scan area | Max.32 patterns |
| | Response time | OFF (ON -> OFF) 60~510ms ON (OFF -> ON) 270~510ms |
| Optics | Element | Pulsed Laser Diode |
| | Wavelength | 905nm |
| | Safety Class | Laser Class1 (IEC60825-1) |
| Type | Type 3 (IEC61496-1, IEC61496-3) | |
| Functional Safety | SIL 2 (Type B, HFT=1) (IEC61508) | |
| PFHd | 7.8×10 ⁻⁸ (T1=20 year) : When master slave function is not in use. 1.6×10 ⁻⁷ (T1=20 year) : When master slave function is in use. | |
| Housing | Size | 80.0mm(W), 80.0 mm(D), 95.0mm(H) |
| | Weight | 0.8kg |
| | Protection | IP65 |
| | Case Material | Body: Aliminum Optical Window: Polycarbonate |
| Connection Cable | Flying lead cable length: 3m | |
| Power Supply | 24VDC \pm 10% : when operation using converter power supply 24VDC -30%/+20% : when operation using battery | |
| Supply current | Normal (Without load) | 6W |
| | Max. (with load) | 50W |
| Output types | OSSD1/2 (Safety-related) | Output type (High side SW) Output current (Max. : 500mA) ※3 Leak current (Max. : 1mA) Cable (AWG 26) Load (L/R=25ms, C=1μF) |
| | OSSD3/4 (Safety-related) WARNING1/2 (Non-safety) | Output type (High side SW) Output current (Max. : 250mA) ※3 Leak current (Max. : 1mA) Cable (AWG 28) Load (L/R=25ms, C=1μF) |
| | RES_REQ1 RES_REQ2 MUT_OUT1 MUT_OUT2 | Output type (PNP Transistor) Output current (Max. : 200mA) Leak current (Max. : 1mA) Cable (AWG 28) |
| Input Signal (Safety-related) | 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 Impedance 4.7kΩ Cable (AWG 28) |
| Interface | Configuration | USB2.0 (USB micro type-B connector) RS-485 Ethernet 100BASE-TX (Water proof connector) |
| | Temperature | -10 ~ +50°C (No freezing) |
| | Storage Temperature | -25 ~ +70°C (No freezing) |
| Environmental resistance | Humidity | 95% RH (No condensation) |
| | Storage Humidity | 95% RH (No condensation) |
| | Surrounding Intensity ※4 | Less than 1,500lx |
| | Vibration | Frequency range : 10~55 Hz Sweep rate : 1 octave/min Amplitude : 0.35mm \pm 0.05mm |

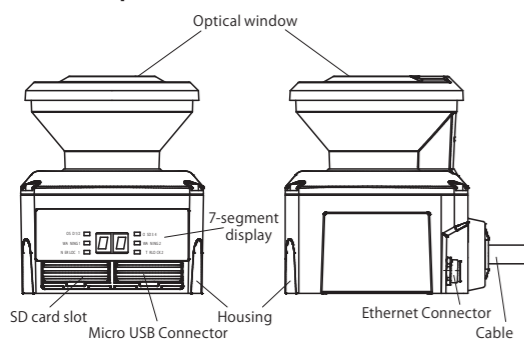
| Subject | Specifications | |
|--------------------------|-------------------|--|
| Environmental resistance | Bump | Acceleration : 98m/s ² (10G) Pulse duration : 16ms |
| | Outdoor Operation | Not permitted |
| | Altitude | Below 2,000m |

- ※1. Distance when reflectance of the object is 90% or above.
- ※2. Additional distance of 200 mm is needed when the SE2L is working under high reflective background.
- ※3. Total current supply of OSSD output and Warning output should be below 1.0A.
- ※4. When the light sources located at $\geq 5^\circ$ from the detection plane of SE2L.

3. Dimensions (mm)



4. SE2L components



5. Functions

SE2L's function can be configured using the SLS Project Designer.

(1) Scanning area

Scanning area of SE2L consists of protection zone and warning zones. Maximum 32 sets of area can be configured. Further, two combinations for protection and warning zones can be selected for the operation.

a) Protection zone, Warning zone 1 and Warning zone 2

b) 2 Protection zones (Dual Protection)

In dual protection mode, two protection areas can be configured therefore two machines can be protected by one unit of SE2L. Protection and warning zones can be configured by using SLS Project Designer.

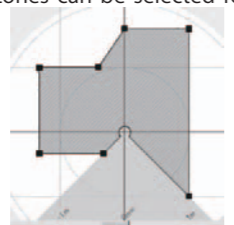


Fig-1. Protection zone configured using manual mode

● Protection zone

Protection zone is safety-critical and directly connected to the OSSD signal. When an obstacle is detected in the protection zone, SE2L will switch the OSSD from ON-state to OFF-state (which should trigger a switch to stop a machine or AGV). For mobile applications,

the OSSD signal can be used as the emergency stop signal. Figure 1 shows the examples of protection zone configured using manual mode and teaching mode respectively. User must configure these zones accordingly to ensure hazardous area is completely protected.

● Warning zone

Warning zones are non-safety zones and are connected to Warning1 and Warning2 outputs. When the obstacle is detected in the warning zones, SE2L will switch the respective warning signal from ON-state to OFF-state. Warning signals can be used as an alert signal to avoid human beings or objects from approaching near the protection zone. For mobile applications, warning signals can be used for reducing the speed of automatic guided vehicle (AGV) to avoid collision.

(2) OSSD

OSSD is safety-related signal. When humans or objects are detected in the protection zone, the OSSD signal will switch to OFF state from ON-state. OSSD signal has the self-diagnostic function which tests the signal periodically. Signal is continuously switched to OFF-state when an error is detected during the diagnostic. Output states of OSSD1 and OSSD2 signal are identical. Both signals should be connected to the safety related machines or control system to fulfill the required safety level. If OSSD3 and OSSD4 are used they must be connected in the same manner.

(3) Interlock function

Interlock is a function to prevent automatic restart of the OSSD signal switching from OFF-state to ON-state. OSSD1/2, RES_REQ1 and RESET1 are for protection zone 1; OSSD3/4, RES_REQ2 and RESET2 are for protection zone 2 when setting the sensor by SLS Project Designer. We use OSSD, RES_REQ and RESET in the rest of this document as representative terms.

● Automatic restart

SE2L will restart automatically when interlock function is disabled or the restart interlock function is set "auto" when interlock is enabled. When obstacle from the protection zone is removed, OSSD signals switch from OFF-state to ON-state automatically. However, if SE2L is in the lockout state due to error, OSSDs will remain in OFF-state even if the interlock function is disabled.

● Manual restart

When interlock function is set to manual restart mode, even if the detected obstacles or system error is removed, OSSD signals will remain in OFF-state. An external reset input signal is required to release the interlock which allows the SE2L to switch to normal operation. RES_REQ signal will be switched to ON state when obstacles disappear from protection zone. SE2L will resume normal operation only after confirming the reset signal (RESET). The duration of the reset signal should be more than 500ms. After RES_REQ signal becomes ON and reset signal is confirmed, the OSSD signal will switch to ON-state after the lapse of the configured delay time. If OSSD's OFF-state is due to an internal fault, it will remain in OFF-state even when reset signal is provided. Reset delay is configurable in the range of 1s to 6s.

● Manual start

Start interlock is a function which keeps the OSSD in OFF-state during the start-up until an external reset input is applied. Start interlock setting has only manual mode. The RES_REQ signal switches to ON-state after the SE2L completes initial routines and ready to accept the RESET input. When RESET input is applied, OSSD will switch to ON state if no object is detected in the protection zone. The duration of the reset input should be more than 500ms. Delay can be configured in the range of 1s to 6s.

(4) External device monitoring (EDM) function

EDM is a function that monitors the state of the input signal from the controlled machine or automated guided vehicle (AGV). EDM is configured using the SLS project designer. When EDM function is enabled, any fault detected in EDM signal will switch the OSSD signal to OFF-state. Logic of EDM signal should be always inverse of the OSSD signal. EDM input signal ON/OFF delay is configurable to match the user's system. Please do not connect EDM input when this function is not needed.

(5) Muting function

Muting function temporarily suspends the safety function in the configured zone of SE2L when the specified conditions are fulfilled. In the muting state OSSD remains in the ON-state even when an object is detected in the configured muting zone. Two independent hard wired input signals are provided to start and end the muting function. Muting zone is configured using the SLS project designer. When muting inputs fulfill the muting start conditions, SE2L will suspend the safety function for the muting zone within 60ms.

● Muting start condition

Muting function will start when the following conditions are fulfilled:

- a) There are no objects in the protection zone and the OSSD is in ON-state.
- b) The two independent hard wired muting input signals are switched to ON state in the predefined sequence within the pre-set time interval. However, the switching interval between two input signals should not be 0.

● Muting stop condition

Muting function will stop when any one of the condition below is fulfilled:

- a) One of the muting inputs switches to OFF-state.
- b) When the muting state exceeds the predefined maximum muting time.
- c) Objects are detected in the protection zone which is not covered by the muting zone.
- d) Error is detected by the self-diagnostics function.
- e) During muting state when the area is switched to another area.

● Muting override function

Muting override is a function to recover SE2L when the OSSD is switched to OFF state due to muting related errors by temporarily suspending the safety function. Override function is active when the override input (OVERRIDE 1/2) and the reset input (RESET1/2) are switched in a sequence.

(6) Reference monitoring function

Reference monitoring is a function to monitor the displacement of the SE2L or the structure used as reference boundary.

● Access protection

An example of reference monitor function used for access protection is shown in figure 1. Reference segments should be configured on each surface for displacement detection. Reference segments should be configured such that displacement can be easily detected. The OSSD will switch to OFF-state when access penetration is detected, and also if the distance between SE2L and the reference structure changes. This function is compulsory for vertical applications.

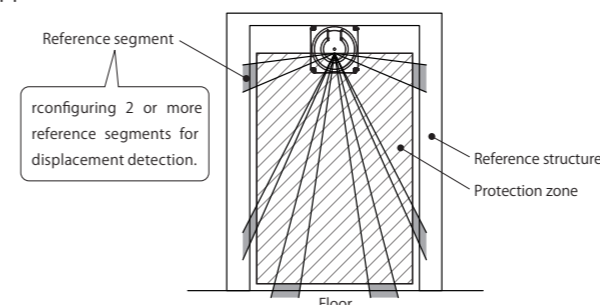


Fig-2. Front view of the access detection using reference monitor function

※ This function can be also used in area protection applications. Refer to User's Manual for the detail.

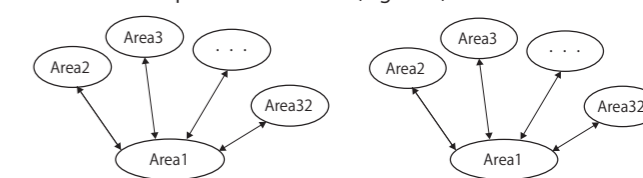
(7) Area sequence function

Area sequence is a function to monitor sequences of area switching. When this function is activated, OSSD signal will switch to OFF-state if the switching pattern is other than the configured sequence. This function prevents the machine to operate with random protection zone.

From each area, switching selection to maximum 31 other areas is possible when configuring the area sequence. And, it is necessary to specify 1 or more areas to avoid error.

< Area switching sequence >

When area sequence is disabled, SE2L can switch from an area to any other areas (Figure 3) whereas it can only switch to specified areas if area sequence is enabled. (Figure 4).



Area sequence function is recommended for control systems where switching area sequences can be configured.

Fig-3. Operation without area sequence Fig-4. Operation with area sequence

(8) Response time

Response times of OSSD signal, OFF response time (Default 60ms) and ON response time (Default 270ms) are configurable individually for each area using the SE2L project designer. Response time of the Warning 1 and Warning 2 will be same as the OSSD response time. Table 1 shows the possible configurable values. In the dual protection mode, it is possible to set a separate response time for each protection area.

When longer response time is configured, the stability of SE2L can be increased. However, longer response time requires longer safety distance. User must perform risk assessment before configuring the response time. Addition of maximum 1 cycle (30ms) has to be taken into account for the area switching.

Table-1. Response time of SE2L

| OFF (ON->OFF) | Response time (ms) | | | | | | | |
|---------------|--------------------|-----|-----|-----|-----|-----|-----|-----|
| | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 |
| | 300 | 330 | 360 | 390 | 420 | 450 | 480 | 510 |
| ON (OFF->ON) | Response time (ms) | | | | | | | |
| | | | | | | | | 270 |
| | 300 | 330 | 360 | 390 | 420 | 450 | 480 | 510 |

(9) Area switching

A maximum of 32 sets of area can be configured in SE2L. However the maximum configurable area number differs depending on the selected function such as, muting and dual protection. Table 2 shows the maximum configurable area number according to the used mode. External input signals are provided in SE2L for switching the area. Each signal has a pair of normal and inverted signal. For example, it is necessary to provide both input signal IN_A and inverse IN_A signal to switch the area. Error will occur if IN_A and inverse IN_A signals do not complement each other. Table 3-2 below shows the combination of input signal to switch the area. Area in use will be displayed in the 7 segment LED of SE2L. It is also possible to configure area input delay. Configure the necessary delay required for the system to provide stable input signals to SE2L. The default value is 30ms.

There are maximum 5 input pairs (a pair is a combination of normal and inverted signal) in SE2L therefore, it can operate with maximum 32 sets of area. Further, it is also possible to switch the area through the speed monitoring of increment encoder signal connected to SE2L.

Table-2. Input combination for area switching

| Mode | Protection | Max internal input | Max Area | Max encoder area |
|------------|------------|--------------------|----------|------------------|
| Standard | 1 | 5 | 32 | — |
| | 2 | 5 | 32 | — |
| EDM | 1 | 4 | 16 | — |
| | 2 | 4 | 16 | — |
| MUTING/EDM | 1 | 2 | 4 | — |
| | 2 | 1 | 2 | — |
| Encoder ※1 | 1 | 2 | 3 | 32 ※2 |

※1. Muting function and dual protection mode cannot be used if encoder input mode is selected.

※2. Among the 4 input patterns at least one pattern must be used for encoder input. Other remaining 3 patterns can be selected to be used as static input or not in use. A pattern with encoder input mode can have maximum 32 sets of area.

Table-3. Input combination for area switching (In the case of 5 Input)

| Area | IN_A | IN_B | IN_C | IN_D | IN_E | IN_A | IN_B | IN_C | IN_D | IN_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 |
| 11 | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON | OFF |
| 12 | OFF | OFF | ON | OFF | ON | ON | ON | OFF | ON | OFF |
| 13 | ON | ON | OFF | OFF | ON | OFF | OFF | ON | ON | OFF |
| 14 | OFF | ON | OFF | OFF | ON | ON | OFF | ON | ON | OFF |
| 15 | ON | OFF | OFF | OFF | ON | OFF | ON | ON | ON | OFF |
| 16 | OFF | OFF | OFF | OFF | ON | ON | ON | ON | ON | OFF |
| 17 | ON | ON | ON | ON | OFF | OFF | OFF | OFF | OFF | ON |
| 18 | OFF | ON | ON | ON | OFF | ON | OFF | OFF | OFF | ON |
| 19 | ON | OFF | ON | ON | OFF | OFF | ON | OFF | OFF | ON |
| 20 | OFF | OFF | ON | ON | OFF | ON | ON | OFF | OFF | ON |
| 21 | ON | ON | OFF | ON | OFF | OFF | OFF | ON | OFF | ON |
| 22 | OFF | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON |
| 23 | ON | OFF | OFF | ON | OFF | OFF | ON | ON | OFF | ON |
| 24 | OFF | OFF | OFF | ON | OFF | ON | ON | ON | OFF | ON |
| 25 | ON | ON | ON | OFF | OFF | OFF | OFF | OFF | ON | ON |
| 26 | OFF | ON | ON | OFF | OFF | ON | OFF | OFF | ON | ON |
| 27 | ON | OFF | ON | OFF | OFF | ON | OFF | ON | ON | ON |
| 28 | OFF | OFF | ON | OFF | OFF | ON | ON | OFF | ON | ON |
| 29 | ON | ON | OFF | OFF | OFF | OFF | ON | ON | ON | ON |
| 30 | OFF | ON | OFF | OFF | OFF | ON | OFF | ON | ON | ON |
| 31 | ON | OFF | OFF | OFF | OFF | ON | ON | ON | ON | ON |
| 32 | OFF | OFF | OFF | OFF | OFF | ON | ON | ON | ON | ON |

(10) Increment encoder

In SE2L there are 2 pairs of encoder input terminals for connecting 2 units of dual channel incremental encoder signals. Area will be switched depending on the encoder speed. Direction of travel is detected by encoder's phase A and phase B signal that have the phase difference of 90°. Speed and rotating direction of both encoders are constantly monitored to detect abnormal travel and stop the AGV.

(11) Ethernet communication

Measurement data of SE2L can be obtained from the Ethernet communication. For the communication specification of SE2L, contact the nearest distributor or sales representative. Water proof Ethernet connector is located at the back of SE2L. To connect sensor with PC use an Optional Ethernet cable (SE9Z-HS2-XCD13).

● Ethernet Setting

- a) Default setting
Factory default value is shown below.
IP address : 192.168.0.10
Default gateway : 192.168.0.254
Subnet mask : 255.255.255.0
Port number : 10940

- b) Changing the IP address
IP address can be changed by using SLS project Designer. Refer to section 7.13 and 7.9.1 for details, refer to the user's manual.

(12) Function to configure SE2L by SD card

Configuration generated by SLS Project Designer can be saved in a SD card. It is possible to transfer the setting directly from the SD Card to SE2L without connecting to a PC. The type of SD card should

be Micro SD card when this function is used. Create a project file with set the serial number and password of the SE2L and save it on the SD card using SLS Project Designer. When the SD card is inserted to the specified SE2L, settings are automatically transferred. Setting will not be transferred to the unspecified SE2L.

(13) Master-Slave Function

Maximum 4 units of SE2L can be interconnected using RS-485 for Master/slave operation. One unit will function as a master unit communicating with up to 3 units that function as slaves via safety communication channel. Use the SLS Project Designer to configure the devices.

Area switching of the slave unit is linked with the master unit while the slave units transmit the object detection information to the master which controls the OSSD. It is also possible to use each slave unit's OSSD. Figure 5 shows the connection example.

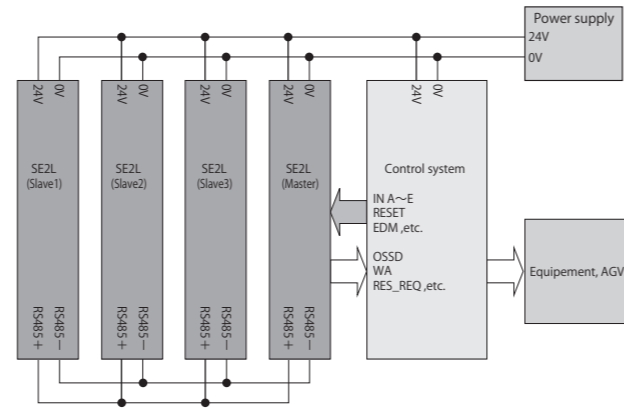


Fig-5. Connection example (When OSSD of slaves are not in use)

6. Light interference

SE2L uses pulsed laser for object detection. Light sources in the surrounding could interfere with its operation leading to false detection. User should examine the surroundings environments before installing the SE2L. Some of the light sources that could interfere with SE2L are as below.

- ① Incandescent light
- ② Fluorescent light
- ③ Stroboscopic light
- ④ Flashing beacon
- ⑤ Sunlight
- ⑥ Infrared light sources

In case the light source cannot be avoided during the operation, SE2L should be installed with the light source located at ±5 degrees or more from the detection plane to prevent the interference (Figure 6).



Fig-6. Protection zone origin

7. Mutual interference

Cautions are required while using two or more units of SE2L or identical products as pulsed laser signal from one another could lead to false detection. Figures below show the installation method for avoiding the mutual interference.

(1) Changing the height of installation

Install at different heights to separate the mutual detection plane by 5 degrees or more.

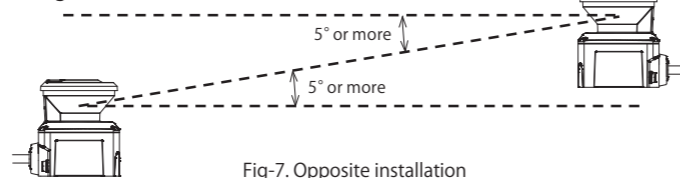


Fig-7. Opposite installation

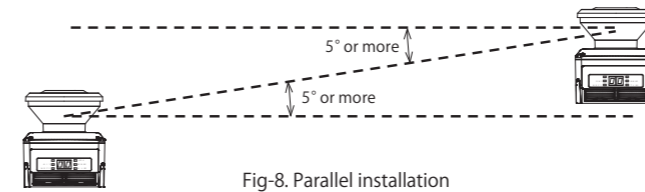


Fig-8. Parallel installation

(2) Changing the angle of installation

Change the installation angle of SE2L by 5 degrees or more from the mutual detection plane.

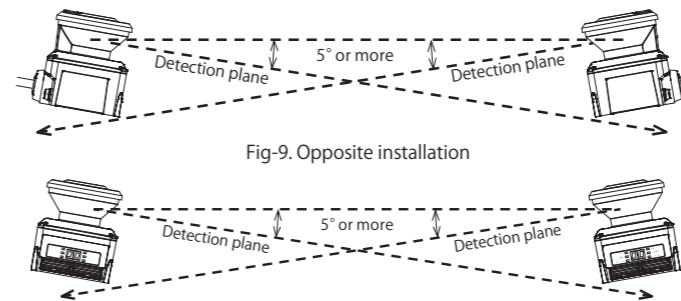


Fig-9. Opposite installation

(3) Adding a shield between SE2Ls

Add a shield between SE2Ls such that laser beam of one unit cannot reach the other to avoid the possible mutual interference.

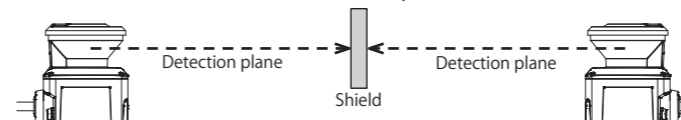


Fig-11. Opposite installation

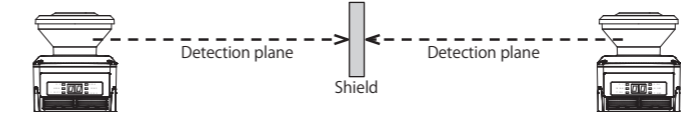


Fig-12. Parallel installation

8. High reflective background

Measured value will be longer than the actual distance of the object due to high reflective background leading to wrong detection. When high reflective background cannot be avoided in the working environment, additional distance of 200mm is necessary while configuring the protection and warning zones (Figure 13).

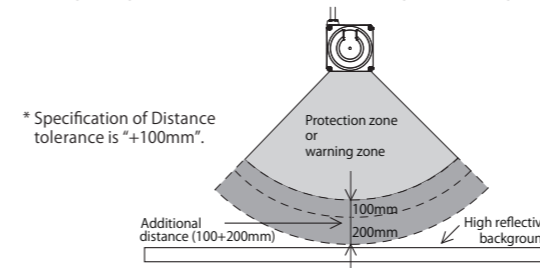


Fig-13. Additional distance under high reflective background

9. Limited detection capability zone

The limited detection capability zone is defined as a region between the optical window and start of the detection zone. The limited detection capability zone of the SE2L is 90mm from the origin of SE2L (Figure 14). Presence of object with low reflectance may not be detected in this zone.

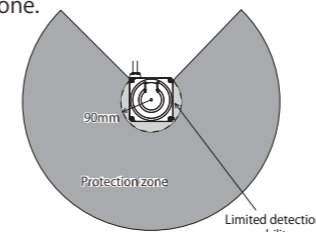


Fig-14. Limited detection capability zone

10. Wiring

Wiring example and cautions are shown below.

(1) Precautions

- a) During electric wiring make sure that all devices are disconnected from power supply. Switch off all the power supply during wiring. Confirm that power supply is OFF.
- b) Do not exceed cable length stated in the specification of SE2L.

(2) Power supply

Make sure that power supply is within the range of 24VDC ± 10%. For battery operation, power supply should be within the range of 24VDC -30% / +20%. SE2L could be damaged if rated output voltage exceeds this range.

(3) Wiring example

Standard (With maximum 32 sets of area)

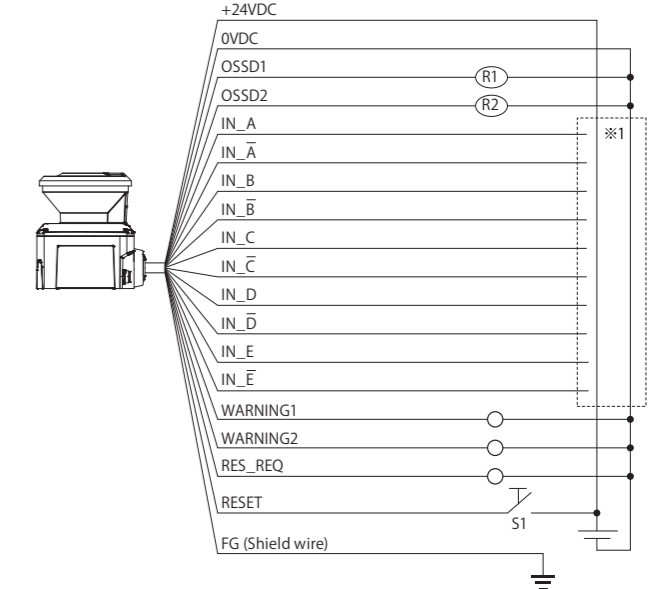


Fig-15. Wiring Example

R1 and R2 : External equipment (Safety relay, Electromagnetic contactor)

S1 : Interlock reset switch

※ 1. Refer to section 5. (9) for the detail on area switching.

(4) Wire color and function

| Color | Signal | Function | Description | AWG |
|--------------|---------------------------|----------|--|-----|
| Brown | +24V DC | Power | Power Supply : 24VDC | 22 |
| Blue | 0V DC | Power | Power Supply : 0VDC | 22 |
| Red | OSSD1 | Output | Protection zone output 1 | 26 |
| Yellow | OSSD2 | Output | Protection zone output 2 | 26 |
| Red/Black | OSSD3 / WARNING1 | Output | Protection zone output 3 / Warning zone output 1 | 28 |
| Yellow/Black | OSSD4 / WARNING2 | Output | Protection zone output 4 / Warning zone output 2 | 28 |
| Purple | IN_A | Input | Area Switching Input A | 28 |
| Gray | IN_B / MUTING3 | Input | Area Switching Input B / Muting input 3 | 28 |
| White | IN_C / OVERRIDE1 / ENC1_A | Input | Area Switching Input C / Override input 1 / Encoder input 1_A | 28 |
| Pink | IN_D / MUTING1 / ENC1_B | Input | Area Switching Input D / Muting input 1 / Encoder input 1_B | 28 |
| Green | IN_E / EDM1 | Input | Area Switching Input E / External device monitoring 1 | 28 |
| Purple/Black | IN_A-bar | Input | Area Switching Input A invert | 28 |
| Gray/Black | IN_B / MUTING4 | Input | Area Switching Input B invert / Muting input 4 | 28 |
| White/Black | IN_C / OVERRIDE2 / ENC2_A | Input | Area Switching Input C invert / Override input 2 / Encoder input 2_A | 28 |
| Pink/Black | IN_D / MUTING2 / ENC2_B | Input | Area Switching Input D invert / Muting input 2 / Encoder input 2_B | 28 |
| Green/Black | IN_E / EDM2 | Input | Area Switching Input E invert / External device monitoring 2 | 28 |

| Color | Signal | Function | Description | AWG |
|-----------------|-----------------------|---------------|---|-----|
| Yellow/Green | RESET 1 | Input | Reset input 1 | 28 |
| Yellow/Blue | RESET 2 | Input | Reset input 2 | 28 |
| Orange | RES_REQ1/ MUT_OUT1 | Output | RES_REQ1 : Request output 1 MUT_OUT1 : Muting state output 1 | 28 |
| Orange/Black | RES_REQ1/ MUT_OUT2 | Output | RES_REQ2 : Request output 2 MUT_OUT2 : Muting state output 2 | 28 |
| White/Blue (TP) | RS-485 + | Communication | Communication protocol RS-485 | 28 |
| White/Red (TP) | RS-485 - | Communication | Communication protocol RS-485 | 28 |
| Shield wire | FG | — | Frame ground | — |

(5)Input/ Output circuit

● OSSD/ Warning Output circuit

OSSD/Warning outputs are N channel MOSFET type.

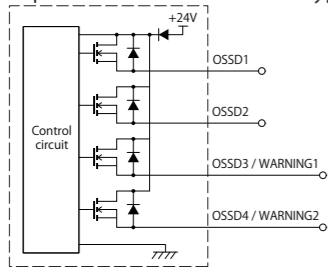


Fig-16. OSSD/WARNING Output circuit

● Other output circuits

RES_REQ1, RES_REQ2, MUT_OUT1, MUT_OUT2 outputs are PNP type.

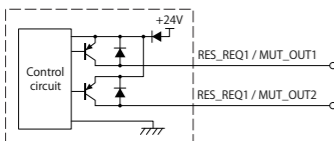


Fig-17. Output circuit

● Input circuit

Figure 18 shows input circuit for Area input, EDM1, EDM2, RESET1, RESET2, MUTING 1, MUTING 2, MUTING 3, MUTING4, OVERRIDE 1, and OVERRIDE 2 signals.

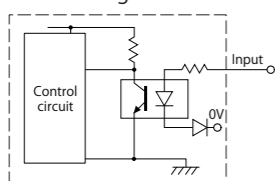


Fig-18. Input circuit

11.Troubleshooting

(1)Troubleshooting

| Situation | Possible reason | Solution suggestion |
|---|---|---|
| SE2L is not operating | Power supply is OFF/Over voltage | Make sure power supply is ON |
| | Under voltage | Check the supply voltage |
| | Cable is damaged | Check the condition of the power supply cable |
| | Configuration is incomplete | Replace with a new cable |
| SE2L is not connected with the SLS Project Designer | Configuration is incomplete | Reconfigure SE2L |
| | PC trouble | Check the PC's specification. Make sure the specification is compatible |
| | | Close the other unrelated applications and reconnect |
| | Power supply is OFF | Make sure the power supply is ON |
| | | Check the supply voltage |
| | Check the condition of the power supply cable | |
| | USB cable is not connected to USB port | Make sure the USB is connected to both PC and SE2L |

| Situation | Possible reason | Solution suggestion |
|---|---|---|
| Measurement data is not displayed | Power supply is OFF | Make sure the power supply is ON |
| | SE2L is in error/ lockout state | Check the supply voltage |
| | | Check the condition of the power supply cable |
| OSSD remain OFF even though the protection zone is free from obstacle | Light interference | Check the error number in the 7-segment table Restart SE2L if it is blinking |
| | Mutual interference | Mount SE2L at a location free from light interference Refer to section 6 for light interference counter measures |
| | Contaminated optical window | Refer to section 7 for mutual interference counter measures |
| | Floor is detected | Check for any contamination or damage on the optical window |
| | Background is detected | Make sure floor is not detected Reconfigure the detection area |
| | Lockout state due to self-diagnostic function | Make sure that the background is not inside the detection area. Reconfigure the detection area |
| | SE2L is interlocked | Check the description of the error number and perform the possible solution as suggested |

(2)Error number list

Table 4 shows the error number of the SE2L. These error numbers' information is displayed on the 7-segment display of the SE2L. If the SE2L is unable to resume normal operation, please contact the nearest distributor or sales representative for support.

Table-4. Error number list

| Error number | Details | Possible reason | Solution suggestion |
|---------------------------|--|---|--|
| 45 | Setting error/ Incomplete setting | Reconfigure SE2L | Automatic recovery or Input reset (During Interlock setting) |
| 56 | Invalid area error | Confirm the input status during area switching | Automatic recovery or Input reset (During Interlock setting) |
| 57 | Area Input Connection Error | Confirm the input status during area switching | Automatic recovery or Input reset (During Interlock setting) |
| 59 | Area sequence error | Confirm area switching sequence | Automatic recovery or Input reset (During Interlock setting) |
| 5B 5D 5F | Encoder speed error | Make sure the encoder speed is correctly configured | Automatic recovery or Input reset (During Interlock setting) |
| 5C | Encoder error | Confirm the encoder input status | Automatic recovery or Input reset (During Interlock setting) |
| 5E | Invalid area error (During Encoder is valid) | Confirm the input status during area switching | Automatic recovery or Input reset (During Interlock setting) |
| 60 ~63 | Motor error | Mount the sensor in a way that the vibration, bump stated in the specification does not exceed | Automatic recovery or Input reset (During Interlock setting) |
| 64 | Master/Slave communication error | Confirm the connection between master and slave | Automatic recovery or Input reset (During Interlock setting) |
| 70 | Optical interference/ High reflective background | Mount SE2L at a location free from light interference. Refer to section 6 for light interference counter measures | Automatic recovery or Input reset (During Interlock setting) |
| 72 | Operating temperature error | Make sure that operating temperature is within specification. | Restart the power supply |
| 74 ~79 | Power supply error | Make sure that voltage is within the specification | Restart the power supply |
| 7C | OSSD excess current error | Make sure the OSSD load is within the specification | Restart the power supply |
| 7D | Slave unit 1 error | Check the error code on slave unit 1 | Automatic recovery or Input reset (During Interlock setting) |
| 7E | Slave unit 2 error | Check the error code on slave unit 2 | Automatic recovery or Input reset (During Interlock setting) |
| 7F | Slave unit 3 error | Check the error code on slave unit 3 | Automatic recovery or Input reset (During Interlock setting) |
| Error other than (40 ~F5) | Device Error | <ul style="list-style-type: none"> Make sure that FG wire is correctly to the ground. Also check the surrounding disturbance of the operating environment. Mount the sensor within the stated vibration, bump in the specification. Replace SE2L if it does not recover even after restoring the power supply. Contact the nearest distributor or sales representative for the repair. | Restart the power supply |

| Error number | Details | Possible reason | Solution suggestion |
|---------------------------|---|---|--|
| 80 | Master unit error | Check the error code on master unit | Automatic recovery or Input reset (During Interlock setting) |
| 84 85 B1 ~C0 | Object in limited detection zone or contamination on the optical window | Clean the optical window (refer to chapter 8.5 of the manual). Further remove any objects present inside the zone with limited detection capability (refer to chapter 5.4) of SE2L. | Automatic recovery or Input reset (During Interlock setting) |
| 86 | Mutual interference error | Mount SE2L at a location free from mutual interference. Refer to section 7 mutual interference for counter measures | Automatic recovery or Input reset (During Interlock setting) |
| 8F | SD card detection error | Check SD card file or check the specification of the SD card | Automatic recovery or Input reset (During Interlock setting) |
| 95 ~9A A8, AC | OSSD diagnostic error | Check the OSSD output wire | Restart the power supply |
| A6 | EDM1 input connection error | Check the EDM1 input wire | Restart the power supply |
| A7 | EDM2 input connection error | Check the EDM2 input wire | Restart the power supply |
| A9 | Reset input error | Check the RESET input wire | Restart the power supply |
| AA | Reference monitor error | Check for the displacement of reference structure or SE2L position | Automatic recovery or Input reset (During Interlock setting) |
| C1 | Optical window is removed or contaminated | Replace or clean the optical window | Restart the power supply |
| CE | Adjustment of the optical window is incomplete after replacement | Adjust the optical window | Automatic recovery or Input reset (During Interlock setting) |
| CF | SE2L is not configured | Configure SE2L | Automatic recovery or Input reset (During Interlock setting) |
| D3 ~E6 | Configuration is incomplete | Reconfigure SE2L | Automatic recovery or Input reset (During Interlock setting) |
| F0 | SD card initialization error | Remove the card and try again | Automatic recovery or Input reset (During Interlock setting) |
| F1 | SD card file content error | Check the setting file in the SD card | Automatic recovery or Input reset (During Interlock setting) |
| Error other than (40 ~F5) | Device Error | <ul style="list-style-type: none"> Make sure that FG wire is correctly to the ground. Also check the surrounding disturbance of the operating environment. Mount the sensor within the stated vibration, bump in the specification. Replace SE2L if it does not recover even after restoring the power supply. Contact the nearest distributor or sales representative for the repair. | Restart the power supply |

※In 7 segment display B and D will display as b and d.

12. Instructions for using SE2L for the first time after purchase

SE2L does not operate without initial configuration. Install and use SLS Project Designer from CD provided with the product to configure SE2L.

(1)SLS USB driver installation

- Connect the SE2L to PC's USB port. PC will detect the new hardware and open the "Found New Hardware Wizard".
- Select "Install from a list or specific location (Advanced)", insert the CD then click [Next>].
- Select "Search for the best driver in these locations". Then select "Include this location in the search", and click [Browse].
- Select the "Driver" folder, then click [OK].
- Click [Next>]. The wizard starts searching for the driver and dialogue box is shown.
- Windows starts installing the SLS USB driver.
- After clicking [Finish], the dialogue appears indicating new hardware is successfully installed.

To confirm that the SLS USB driver was successfully installed, go to the computer's device manager and expand the "Ports (COM and LPT)" list, "SLS USB Device Driver" should be seen as one of the COM ports.

(2)SLS Project Designer installation

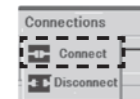
- Insert the CD into the CD-ROM drive.
- Click "SLS Project Designer_*. * _installer.exe".
- Follow the instructions of the installer and complete the installation.

(3)Configuration Procedure

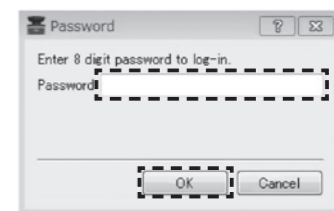
- Run the installed SLS Configurator software.
- Following application window will appear. Select [Create new configuration] and click [OK] button.



- Following configuration window will appear. Click [Connections] → [Connect] from the menu.



- Following password dialog box will appear. Enter default password [12345678] and click [OK].



- Following configuration window will appear. A message box [Device configuration is incomplete! Please reconfigure the device] will appear, refer to Chapter 7 of the user's manual and complete the function configuration, and write into the SE2L.



Configuration is completed.