

SIN/COS Encoder Option board

SV-iV5



- Be sure to read “Safety Instructions” before using for the proper use.
- Keep this manual within easy reach for quick reference.

Before using the product, thank you for purchasing SV-iV5 SIN/COS Encoder option board.

SAFETY PRECAUTIONS

- Always follow safety instructions to prevent accidents and potential hazards from occurring.
- Safety precautions are classified into “WARNING” and “CAUTION” and their meanings are as follows:



WARNING

Improper operation may result in serious personal injury or death.



CAUTION

Improper operation may result in slight to medium personal injury or property damage.

- The indicated illustrations on the product and in the manual have the following meanings.



Danger may be present. Read the message and follow the instructions carefully.



Particular attention should be paid because danger of an electric shock may be present.

- Keep operating instructions handy for quick reference.
- Read the operating instructions carefully to fully understand the functions of the SV-iV5 series SIN/COS Encoder option board and to use it properly.



CAUTION

- **Be cautious, when handling the CMOS components of the Option Board.**
Static may lead to malfunctioning of the product.
- **Turn off the inverter power, when changing the encoder signal line.**
Otherwise, you may damage the board or an error may occur.
- **Make sure to insert the option board encoder output to the SIO encoder signal input precisely.**
Otherwise, you may damage the board or an error may occur.
- **Check the motor encoder specification and option board encoder pulse multiplication setting before setting up the parameter.**
Otherwise, an error may occur.

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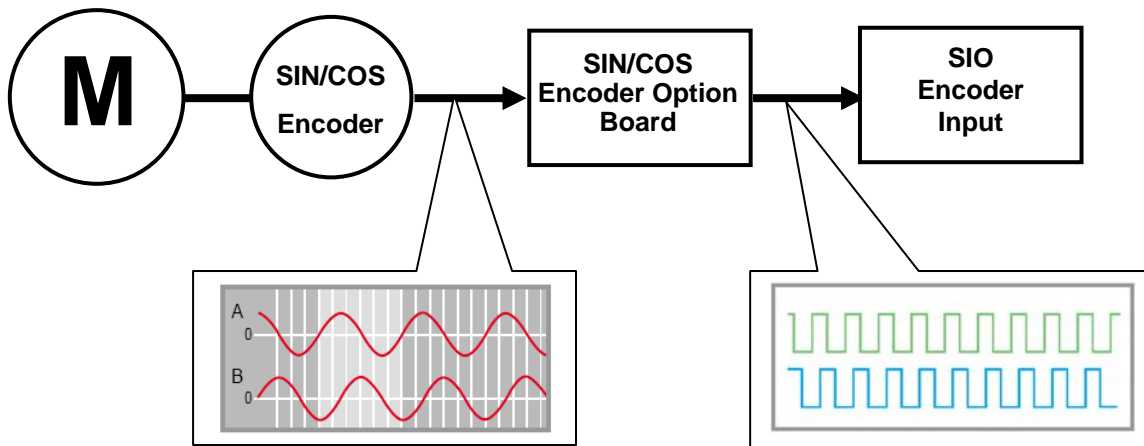
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This instruction manual describes about how to set up an encoder pulse count (PAR_10) and multiplication numbers (PAR_33) for LS SV-iV5 and SV-MRL (Machine Roomless Elevator) inverters. For more details, please refer to the manual of SV-MRL and SV-iV5 series.

1. Introduction and Specification of SIN/COS Encoder Option Board

1.1 Introduction

This option board is to convert the output signals of a SIN/COS encoder into output pulse and then feed the output signal into the SIO board as an input signal. SIN/COS encoder option board allows the more precise control of the inverters than incremental encoder



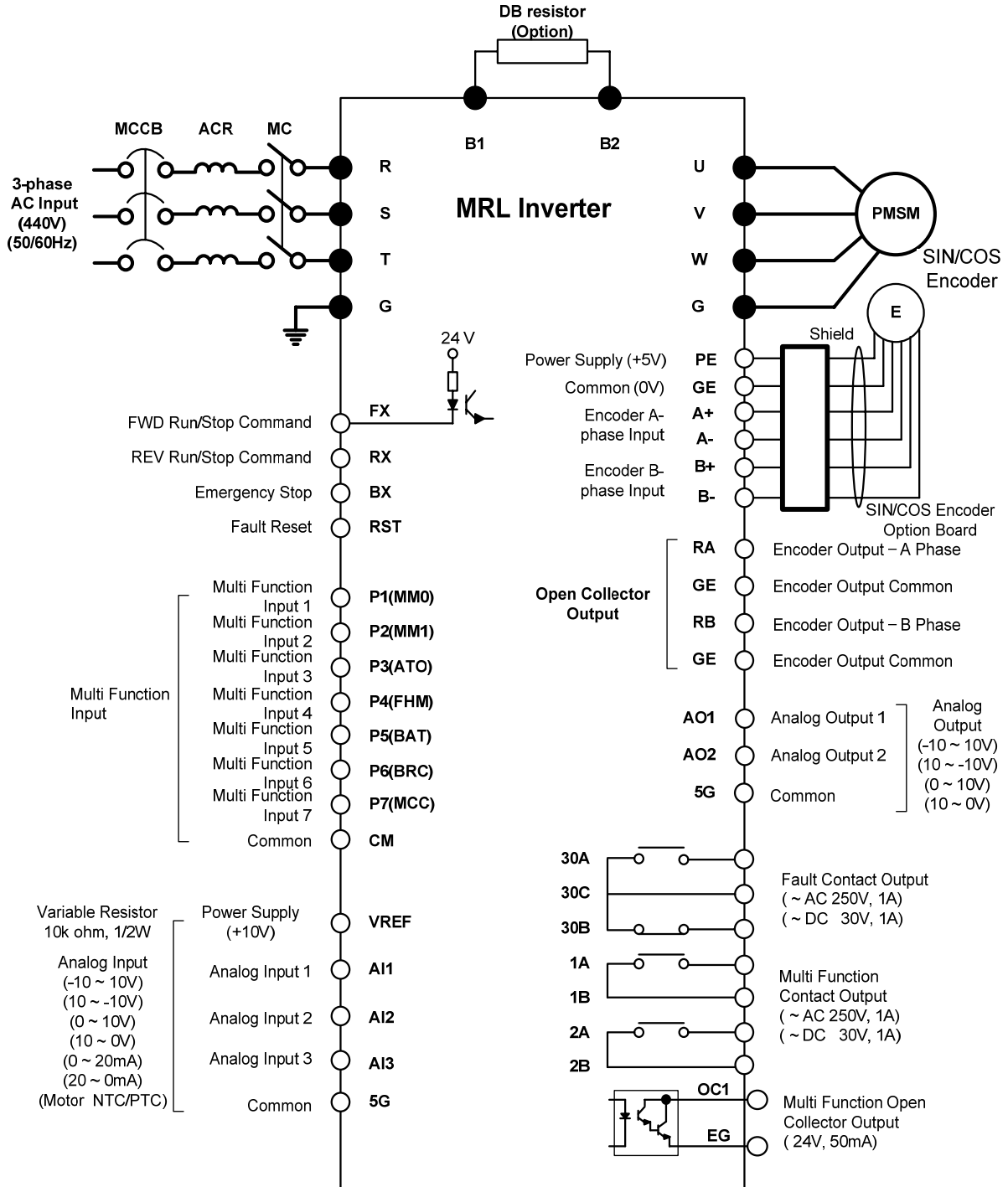
1.2 Hardware Specification

| Items | Specification |
|---|--|
| Mounting Type | Fixed by brass stick to the inverter control board |
| Power Supply | 24 V External power supply |
| Encoder Power Supply | 5V |
| Input Signal | 5V Line Drive SIN/COS encoder signal |
| Encoder Input Pulse Count | 512 ~ 2048 |
| The Multiplication Number of the Encoder Output Pulse | 16, 32 or 64 |
| Encoder Output Signal | 5V Line Drive |

2. Installation and Wiring

2.1 Terminal Connection Diagram

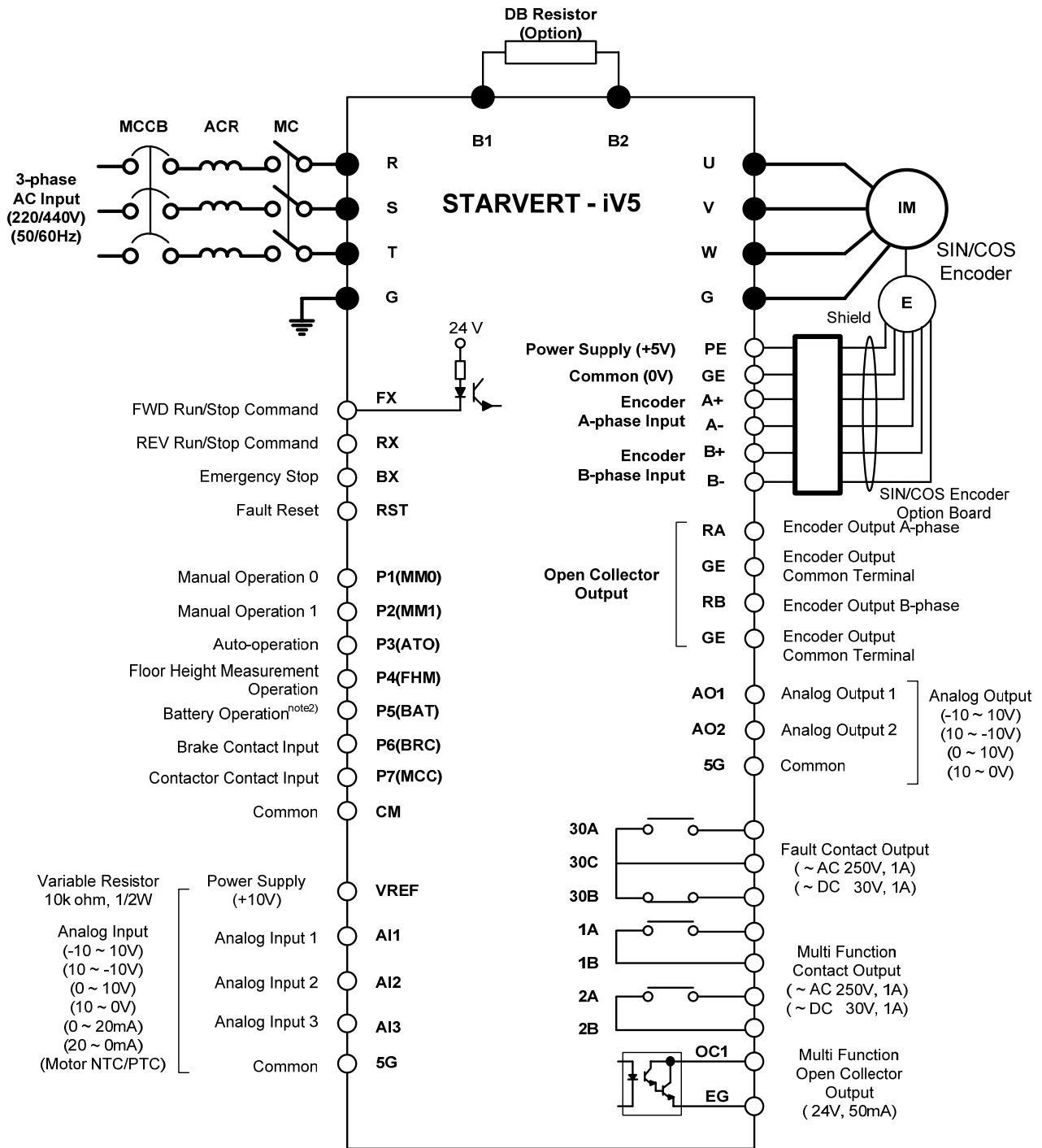
- SV 075, 110, 150, 220iV5-4 (MRL)



Note) ● : Power terminal block, ○ : Control terminal block

SV-iV5 SIN/COS Encoder Option

- SV022, 037, 055, 075, 110, 150, 185, 220iV5-2 (DB)
- SV022, 037, 055, 075, 110, 150, 185, 220iV5-4 (DB)



Note1) ● : Power Terminal Block, ○ : Control Terminal Block

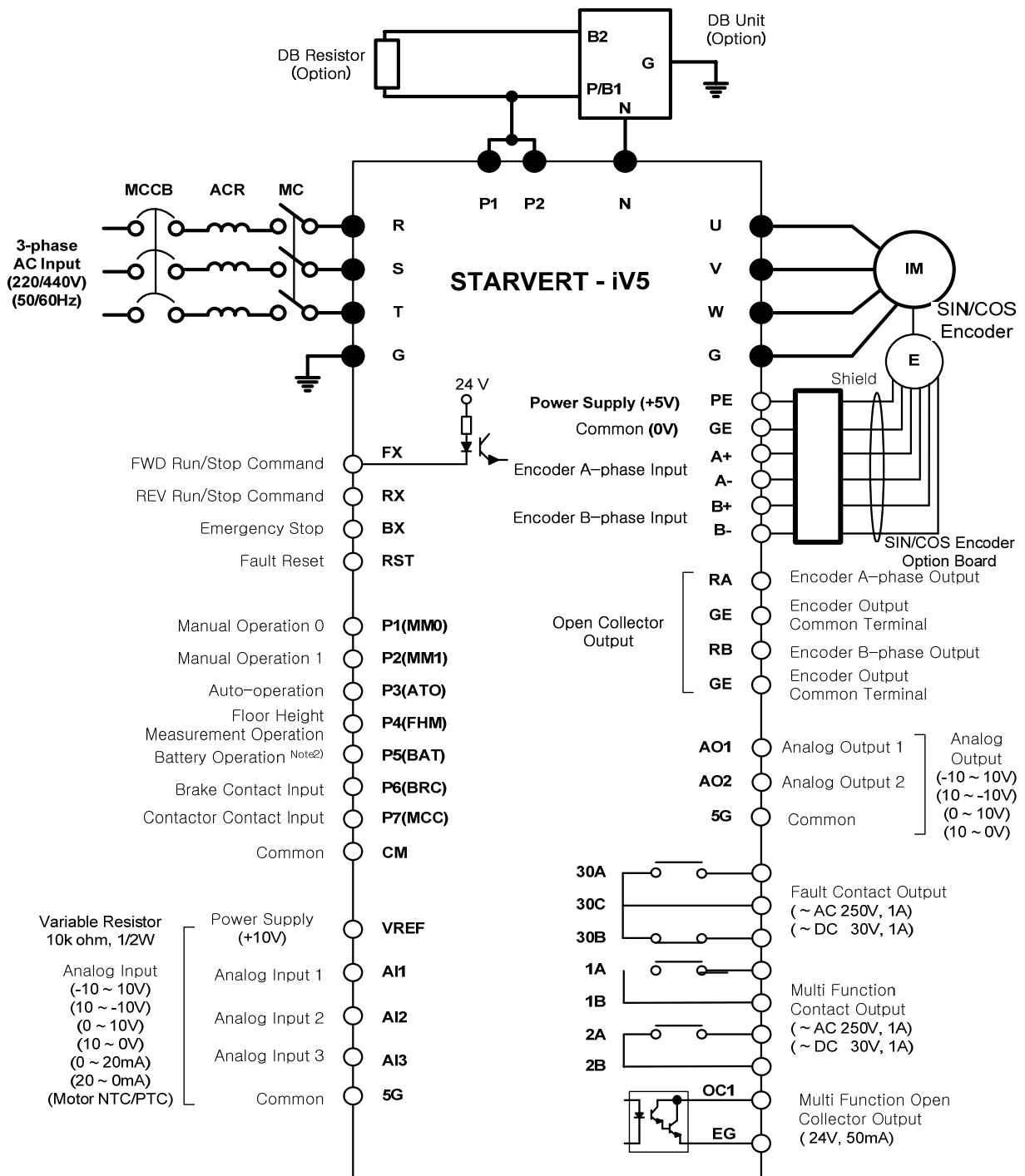
Note2) Multi input terminal block p1 ~ p7: factory default

Battery operation: available in the near future

SV-iV5 SIN/COS Encoder Option

- SV300, 370iV5-2

SV300, 370, 450, 550, 750, 900, 1100, 1320, 1600, 2200iV5-4



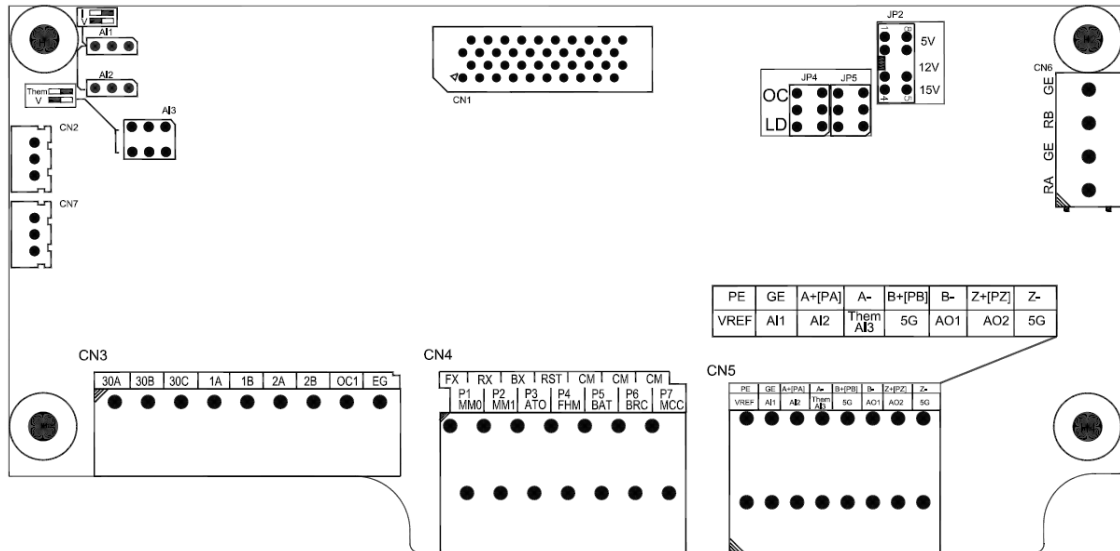
Note) ● : Power Terminal Block, ○ : Control Terminal Block

Note2) Multi input terminal block p1 ~ p7: factory default

Battery operation: available in the near future

2.2 Control Terminal Block – SIO Board and SIN/COS Encoder Option Board

1) Arrangement of SIO board terminal block



2) Functions of SIO board terminal block

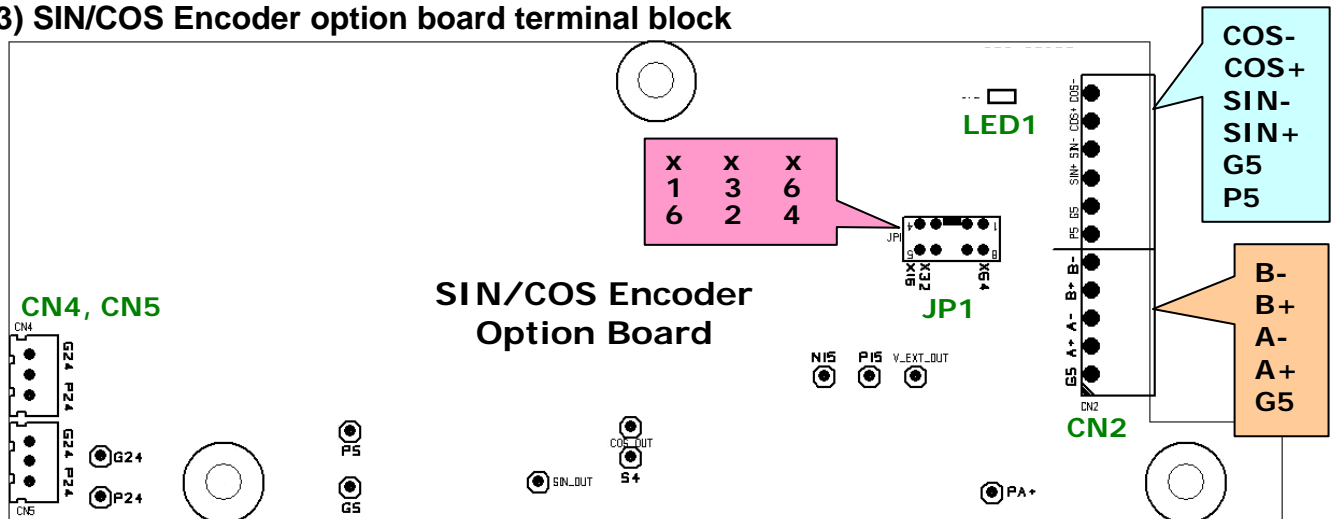
| Item | Name | Function | Description |
|---------------|---------|---|---|
| Contact Input | FX | Forward Run/Stop command | <ul style="list-style-type: none"> Turned On when it is connected to CM terminal. |
| | RX | Reverse Run/Stop command | <ul style="list-style-type: none"> Motor stops when Both FX and RX are On or Off at the same time. |
| | BX | Emergency stop | <ul style="list-style-type: none"> Turned On when it is connected to CM, Free-run Stop and Deceleration stop. It does not trigger fault alarm signal. |
| | RST | Fault stop | <ul style="list-style-type: none"> After problem is cleared, restarting the system will reset the fault condition. |
| | P1(MM0) | Multi functional input terminal | <ul style="list-style-type: none"> List of E/F IO Card usages listed below Select one of the 7 functions listed below, including the Elevator function / Common Vector mode. <p>Manual Operation mode 0,1 (MM0,MM1), Auto-operation command (ATO), Floor Height Measurement operation command (FHM), Battery operation command (BAT)⁽¹⁾, Brake Contact Input (BRC), Contactor Contact Input (MCC)</p> <p>⁽¹⁾Battery Operation command (BAT) function will be provided later.</p> |
| | P2(MM1) | | |
| | P3(AT0) | | |
| | P4(FHM) | | |
| | P5(BAT) | | |
| P6(BRC) | | | |
| P7(MCC) | | | |
| CM | COMMON | <ul style="list-style-type: none"> Turned On when each contact input is connected to CM. | |

SV-iV5 SIN/COS Encoder Option

| Item | Name | Function | Description |
|----------------|--------|--|--|
| Analog Input | VREF | Power supply for analog setting | <ul style="list-style-type: none"> Reference voltage by variable resistance (+10V) : 10kΩ |
| | AI1 | Voltage/Current input | <ul style="list-style-type: none"> Voltage Input (-10 ~ 10V), Current Input (0 ~ 20mA), Motor NTC or PTC input type available. Jumper setting in Voltage Input (※ Jumper set as factory default) → AI1, AI2: Put in the jumper on the left side. AI3: Set on the left side of switch. Jumper setting in Current Input → AI1, AI2: Put in the jumper on the right side. Switch-direction setting when Motor NTC (LG-OTIS Motor) input. → AI3: Set on the right side of switch. Select one of the 15 functions listed below. (Speed command, Torque command, Magnetic flux command, Torque bias, Torque limit, Process PI controller command, Process PI controller feedback, Draw command, Motor NTC/PTC input etc.) |
| | AI2 | | |
| | AI3 | Voltage input Motor NTC/PTC input | |
| 5G | COMMON | <ul style="list-style-type: none"> Common terminal for analog input | |
| Encoder Input | PE | Encoder power supply | +5V Line Drive power supply |
| | 5G | | 0V |
| | A+ | Encoder A-phase signal | <ul style="list-style-type: none"> A, B signal for Line Drive type When using Line Drive type encoder, switch JP2 to P5, and JP4 to LD. |
| | A- | | |
| | B+ | Encoder B-phase signal | <ul style="list-style-type: none"> ※ Jumper set as Factory Default |
| | B- | | |
| | PE | Encoder power supply | +15V Open Collector power supply |
| | 5G | | 0V |
| | PA | Encoder A-phase signal | <ul style="list-style-type: none"> A, B signal for Complementary and Open Collector type Switch JP2 of I/O PCB to P15 and JP4 to OC. |
| | PB | Encoder B-phase signal | |
| Encoder Output | RA | Encoder output – A phase | Encoder A, B phase output signal – Open Collector type |
| | GE | Encoder output common | |
| | RB | Encoder output – B phase | |
| | GE | Encoder output common | |
| Analog Output | AO1 | Analog Output 1 | <ul style="list-style-type: none"> -10 → 10V, 10 → -10V, 0 → 10V, 10 → 0V output Select one of the 34 functions. (Motor speed, Speed command 1~2, Torque command 1~2, Magnetic flux command, Magnetic flux current, Inverter output current, Inverter output voltage, Motor temperature, DV voltage etc.) |
| | AO2 | Analog Output 2 | |
| | 5G | COMMON | <ul style="list-style-type: none"> COMMON terminal for analog output |

| Item | Name | Function | Description | |
|----------------|------|---|---|---|
| Contact Output | 1A | Multi functional contact output 1 (A contact) | <ul style="list-style-type: none"> Select one of the 21 functions listed below. (Zero speed detect, Speed detect (Bi-directional), Speed detect (Uni-directional), Speed reach, Speed deviation, Torque detect, On torque limit status, Motor overheat, Inverter overheat, On low voltage status, Inverter run signal, Inverter regenerating signal, Inverter ready, Timer output, Highest/Lowest floor operation mode status ⁽¹⁾ , Highest/Lowest floor operation finish ⁽¹⁾ , Fault signal related elevator ⁽¹⁾) | |
| | 1B | | | |
| | 2A | Multi function contact output 2 (A contact) | | |
| | 2B | | | |
| | OC1 | Multi function Open Collector output | | |
| | EG | | | |
| | 30A | Fault signal A-phase | | <ul style="list-style-type: none"> Outputs when failure occurs. Deactivated in Emergency Stop (BX). |
| | 30B | Fault signal B-phase | | |
| | 30C | COMMON | | |

3) SIN/COS Encoder option board terminal block



4) Description of SIN/COS Encoder option board function

Encoder pulse multiplication number (JP1)

| Indication | Name | Description |
|-------------|-------------------------------------|---|
| x16 x32 x64 | Encoder pulse multiplication number | <ul style="list-style-type: none"> Select one of the encoder pulse multiplication numbers. |

Error indication of encoder option board (LED1)

| Indication | Name | Description |
|------------|--|---|
| LED1 | Error indication LED of encoder option board | <ul style="list-style-type: none"> LED 1 is turned On when error occurs in SIN/COS encoder option board. LED 1 can be reset by turning inverter On or Off. |

※ If Error occurs repeatedly, it can leave some damages to the product. Please contact with the LSIS customer service center.

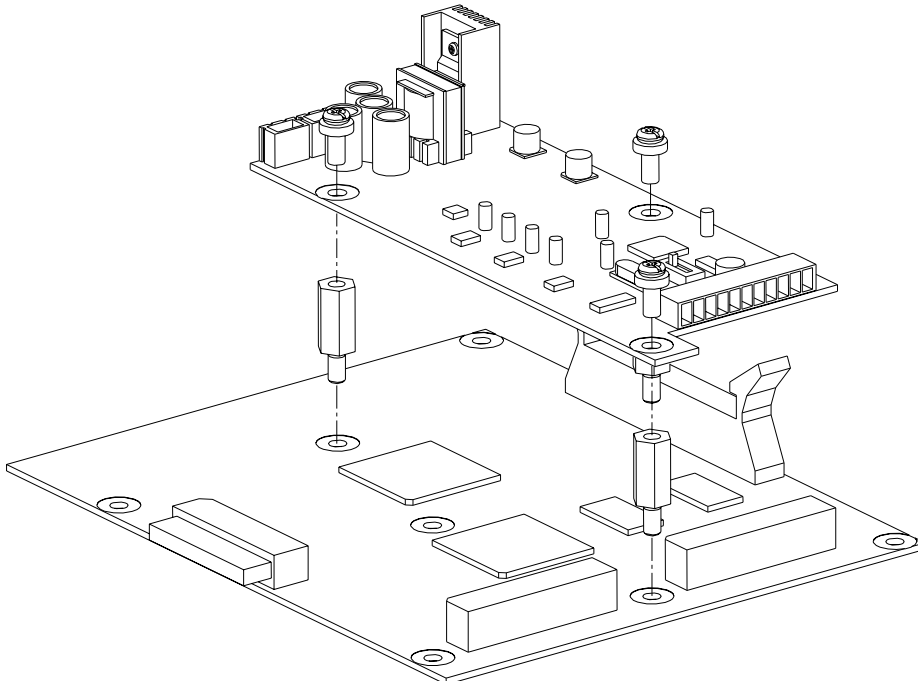
Input signal of SIN/COS encoder (CN2)

| Item | Indication | Name | Description |
|------------------------------|------------|-------------------------------------|--|
| SIN/COS Encoder Input Signal | P5 | SIN/COS | <ul style="list-style-type: none"> ● 5V Power Supply ● 0V |
| | G5 | encoder power supply | |
| | SIN+ | Encoder A-phase signal (SIN signal) | <ul style="list-style-type: none"> ● A, B signal of SIN/COS encoder ● PAR_10 (The pulse number of encoder) have to be changed according to encoder specification. (Refer to 3. Operation Ready.) |
| | SIN- | | |
| | COS+ | Encoder B-phase signal (COS signal) | |
| COS- | | | |

Connection signal of SIO board (CN2)

| Item | Indication | Function | Description |
|-----------------------------|------------|---|--|
| SIO Board Connection Signal | G5 | Encoder power supply | <ul style="list-style-type: none"> ● 0V ● A, B signal of Line Drive type encoder. ● Connects to SIO board with cable. |
| | A+ | Encoder A-phase signal (Incremental type) | |
| | A- | | |
| | B+ | Encoder B-phase signal (Incremental type) | |
| | B- | | |

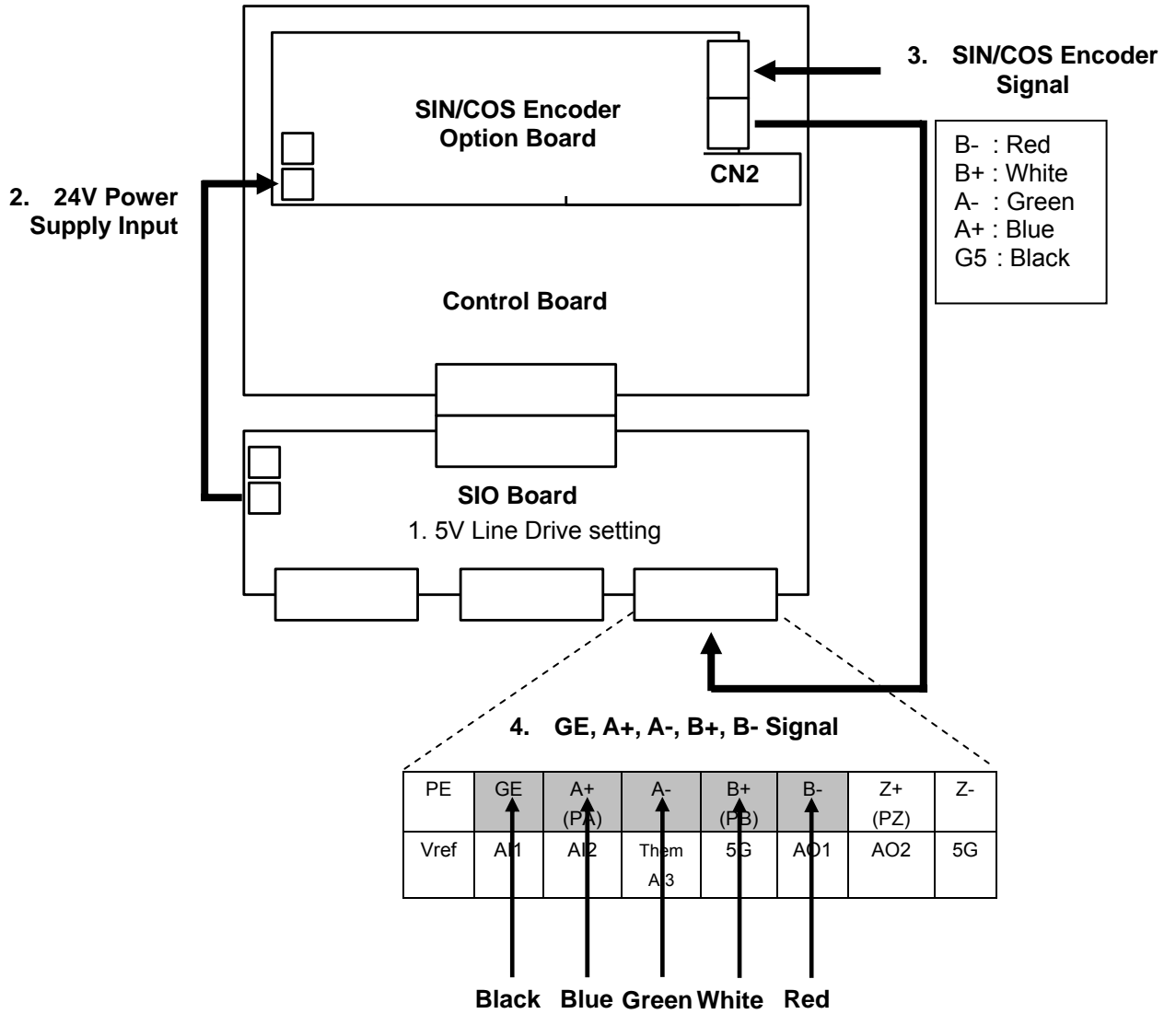
2.3 Installation



Installation of SV-iV5 SIN/COS Encoder Option Board

2.4 Connection

1. Set the encoder input of the SIO board to 5V line drive.
2. Connect 24V power supply to the option board.
3. Connect SIN/COS Encoder input signal to CN2.
4. SIN/COS board connects to SIO board with cable.



3. Operation Ready

3.1 SIN/COS Encoder Option Board Setting

Set up LCD loader with SIN/COS encoder option board mounted.



1. Check SIN/COS encoder pulse count. (Refer to Encoder datasheet.)
2. Check the available multiplication number. (JP1)
3. Using the formula written below 1, set up the encoder pulse count for MRL and iv5.
4. Refer to the instruction manuals of MRL and IV5 for other configuration set-ups.

1) In case of MRL

The setting value of encoder pulse count (PAR_10) = SIN/COS encoder pulse (Pulse/Rotation) X multiplication number

- limited multiplication number due to SIN/COS encoder of MRL (JP1)

| SIN/COS Encoder Pulse (Pulse/Rotation) | Available Multiplication Number (JP1) |
|--|---------------------------------------|
| 512 | x16, x32, x64 |
| 1024 | x16, x32 |
| 2048 | x16 |

Example)

| SIN/COS Encoder Pulse Count | Multiplication Number (JP1) | The setting value of Encoder Pulse Count (PAR_10) |
|-----------------------------|-----------------------------|---|
| 512 | 32 | 512 x 32 = 16384 |
| 1024 | 16 | 1024 x 16 = 16384 |
| 2048 | 16 | 2048 x 16 = 32768 |

| Loader Indication | Description |
|---|--|
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> PAR ▶ Enc Pulse 10 32768 </div> | Enter the value for Encoder pulse count. (Max. setting value: 32768) |

2) In case of iV5

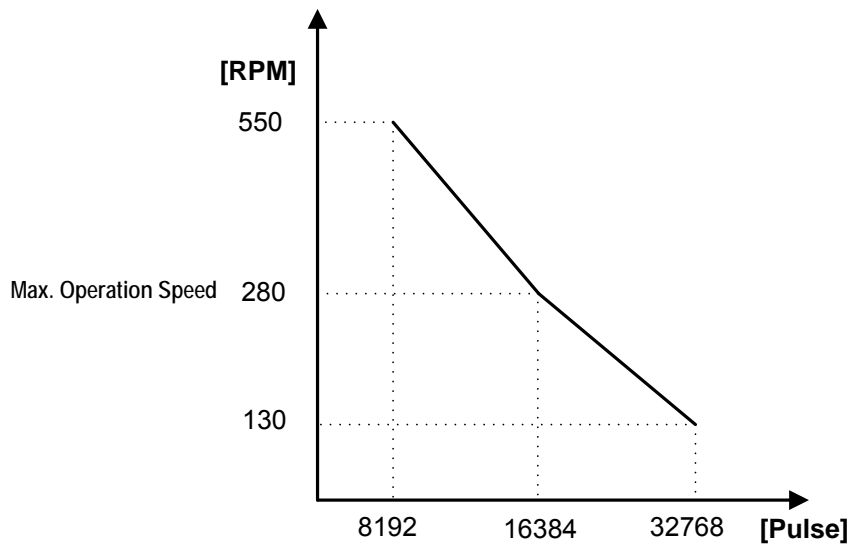
| Loader Indication | Description |
|--|---|
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> PAR ▶ Enc Pulse 10 512 </div> | Enter the Encoder pulse count for motor. (Ex.: 512, 1024, 2048 etc.) |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> PAR ▶ Enc Scale 33 x16 </div> | Enter the multiplication number of SIN/COS encoder option board. (Ex.: x1, x16, x32, x64) ※ x1 is the set-up value when not using SIN/COS encoder option board. |

※ **iV5 has no limitation on available multiplication number.**

3.2 Max. Operation Speed

SIN/COS encoder option board has a limitation on maximum operation speed due to the hardware specification of SIO board. Make sure to check the figure and the table regarding the maximum speed. Please operate the inverter at optimal speed.

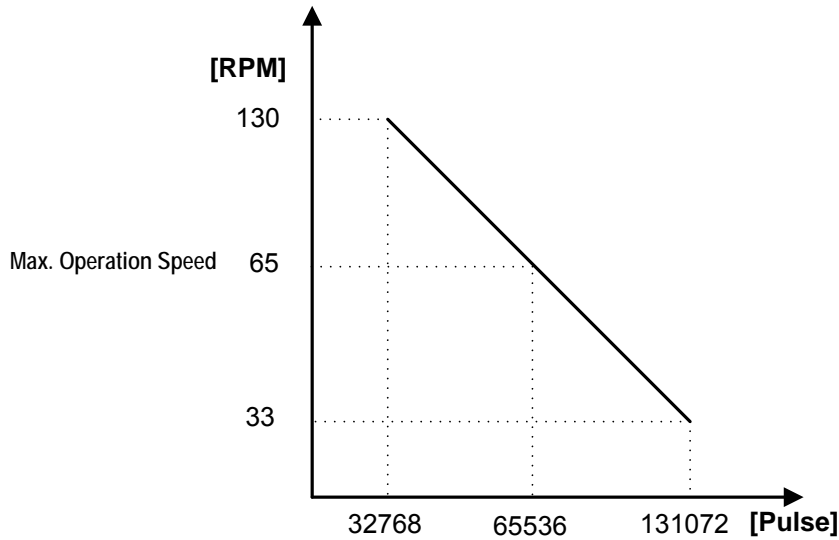
1) In case of MRL



Encoder Pulse Count (PAR_10) Setting value (applied with 512 Pulse encoder)

| SIN/COS Encoder Pulse Count (Pulse/Rotation) | JP1 Setting | Encoder Pulse Count (PAR_10 setting value) | Max. Operation Speed |
|--|-------------|--|----------------------|
| 512 | x16 | 8192 | 550RPM |
| | x32 | 16384 | 280RPM |
| | x64 | 32768 | 130RPM |
| 1024 | x16 | 16384 | 280RPM |
| | x32 | 32768 | 130RPM |
| 2048 | x16 | 32768 | 130RPM |

2) In case of iV5



Encoder Pulse Count (PAR_10) X Multiplication Number of SIN/COS encoder option board (PAR_33)
(Applied with 2048 Pulse encoder)

| SIN/COS Encoder Pulse Count (Pulse/Rotation) | Max. operation speed according to JP1 setting | | |
|--|---|--------|--------|
| | x16 | x32 | x64 |
| 512 | 550RPM | 280RPM | 130RPM |
| 1024 | 280RPM | 130RPM | 65RPM |
| 2048 | 130RPM | 65RPM | 33RPM |

Reference) Standard Encoder Specification

- Encoder Signal Specification (HEIDENHAIN encoder)

| | |
|-----------------------|---|
| Interface | Sinusoidal voltage signals \sim 1Vpp |
| Incremental signals | 2 nearly sinusoidal signals A and B Signals amplitude M : 0.6 to 1.2 Vpp; typ. 1 Vpp Asymmetry $ P-N /2M$: ≤ 0.065 Signal ratio MA/MB : 0.8 to 1.25 Phase angle $ \varphi_1 + \varphi_2 /2$: $90^\circ \pm 10^\circ$ el. |
| Reference mark signal | 1 or more signal peaks R Usable component G : 0.2 to 0.85V Quiescent value H : 0.04V to 1.7V Signal-to-noise ratio E, F : ≥ 40 mV Zero crossovers K, L : $180^\circ \pm 90^\circ$ elec. |
| Connecting cable | HEIDENHAIN cable with shielding |
| Cable length | PUR $[4(2 \times 0.14 \text{ mm}^2) + (4 \times 0.5 \text{ mm}^2)]$ |
| Propagation time | Max. 150m at distributed capacitance 90 pF/m 6 ns/m |

- Pulse limitation according to encoder extension cable (with standard cable)

| Length | Frequency |
|--------|------------|
| 100m | 500~100kHz |
| 150m | 300~100kHz |

Warranty

| | | | | |
|---------------|-------------------------------------|--|-------------------|--|
| Product Name | LSIS Encoder Option Card | | Installation Date | |
| Model Name | SV-iV5 SIN/COS Encoder option board | | Warranty Period | |
| Customer | Name | | | |
| | Address | | | |
| | Tel. | | | |
| Sales Offices | Name | | | |
| | Address | | | |
| | Tel. | | | |

Note

This product has been manufactured through the strict QC control and inspection of LS Industrial Systems. Warranty period is 12 months after installation or 18 months after manufactured when the installation date unidentified. However, the guarantee term may vary on the sales term.

● In-warranty service information

- ▶ If the defective part has been identified under normal and proper use within the guarantee term, contact your local authorized LS distributor or LS service center.

● Out-of-warranty service information

- ▶ The guarantee will not apply in the following cases.
 - ▶ Troubles are attributable to a user's intentional negligence or carelessness.
 - ▶ Damage was caused by abnormal voltage and peripheral devices' malfunction (failure).
 - ▶ Damage was caused by natural disasters (earthquake, fire, flooding, lightning and etc.).
- ▶ When LS nameplate is not attached.