

Robostar Robot Controller Manual

Robostar Robot Controller

Controller Series-RcT  
Instruction and Maintenance Manual



- Instruction and Maintenance Manual
- Operation Manual
- Programming Manual
- Unihost Manual
- Alarm Code Manual

Robostar Robot Controller Manual

**Robostar**

Robostar Co., Ltd.

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## Before Reading the Operation Manual

- ◆ Most of all, read through safety precautions to use the controller properly.
- ◆ Contents of the operation manual may vary depending on the software version and may be notified to the user without notice.
- ◆ Contact the person in charge in Robostar Co., Ltd for an inquiry about the updated manual version.
- ◆ Screens and pictures in the operation manual may be different from the actual thing.
- ◆ Prior to use, it is essential to check out the name plate of the controller and whether the robot is consistent with S/N.

# Product Warranty

Robostar products are manufactured under strict quality control and all Robostar products are warranted for one year from date of manufacture. During the warranty period, free services shall be provided only for : mechanical failure due to the negligence of Robostar, or failure caused by designs and in the manufacturing process during normal operation, Free services are not provided in the following cases.

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- (2) Failure caused by inappropriate repairs, alterations, and shifting that are instructed by your enterprise or the third party, as well as other mishandling failure.
- (3) Failure due to the use of unauthorized products, including parts and grease.
- (4) Failure due to incidents involving fire, disasters, earthquakes, damage from storm and flood, and other force majeure events.
- (5) Failure caused by the use of products outside the environment specified in our product specifications, such as in excretion and flooding.
- (6) Wear-out failures for consumables.
- (7) Failure due to the negligence of conducting maintenance and inspection work as specified in the operation manual and the instruction manual.
- (8) Damages other than robot repair costs.

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# Configuration of This Manual

This manual consists of the following.

## **For safe use**

Describes safety precautions in use of a robot.








- **Ch.1 Controller Overview**  
Describes controller's features, model configuration, and the attachment location of a name plate.
- **Ch.2 Basic Specifications**  
Describes controller installation environment, performance and specifications.
- **Ch.3 Controller Installation Method**  
Describes environmental conditions in controller installation and ventilation direction.
- **Ch.4 Controller Configuration**  
Describes controller size, Connector and names of main components.
- **Ch.5. Teach Pendant(T/P) Configuration**  
Describes how to connect T/P, how to use a Deadman.

# Safe Use Guidelines

## ■ Robot Safety (General)

For safe use of this product, be sure to become well aware of the manual prior to use. Each manual contains the following marks in where special attention is required for safe use. So, take a close look the manual before using the product.

## ■ Safety Marks

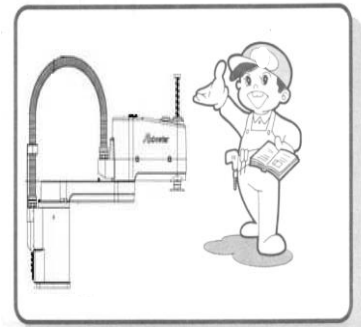
Symbol	Description
 위험	It indicates that critical damage to persons or property may occur if handled incorrectly.
 경고	It indicates that product failure, malfunction or incidents may arise if handled incorrectly.
 주의	It indicates that the product may do wrong operation or fail to operate due to incorrect use, which therefore requires special attention.
 금지	It indicates things prohibited for the normal use of the product. Ex.) Mark for use of fire prohibited 
 필수	It indicates what should be done for normal use of the product. Ex.) Mark for mandatory grounding 

This robot and the robot controller are industrial equipment manufactured with high technology, therefore, be sure to follow the precautions listed below to be prepared for possible incidents.



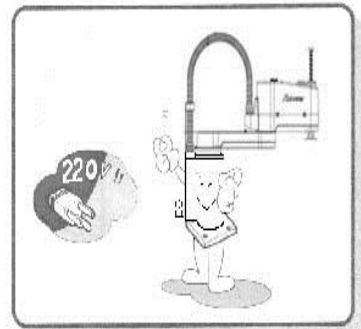
**주의**

For safer and more effective use, be sure to become aware of the manual prior to use



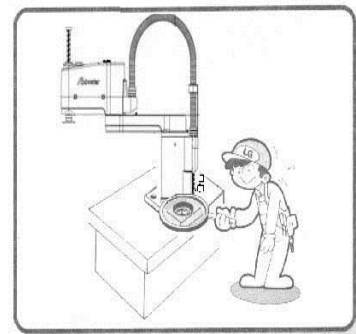
**경고**

Keep all loads and power supplies within the rated range. Particularly, do ensure input power supply is AC 220V before use.



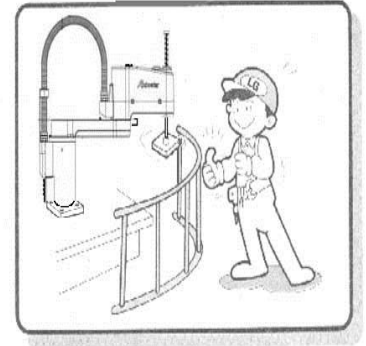
**경고**

When installing a robot, fix it firmly so that it cannot be moved.





**위험** For safe work, install a safety net around the robot operating area.



**주의** Be sure to check the wiring before turning ON the controller power. An incorrect wiring may lead to the abnormal system operation.



**필수**

For prevention of electric shock accidents, be sure to install FG (Frame Ground).







**위험**

While the robot is in motion or in and-by mode, take caution and do not step into the robot operating area. Take the same caution any time even when the robot is stopped.



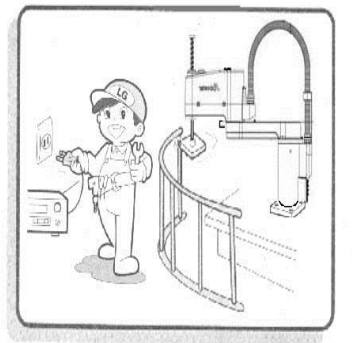
**위험**

When several people are working at time, check for mutual safety before, proceeding with the work, in particular, involving power ON/OFF, motor activation, and hand-operated operation.



**주의**

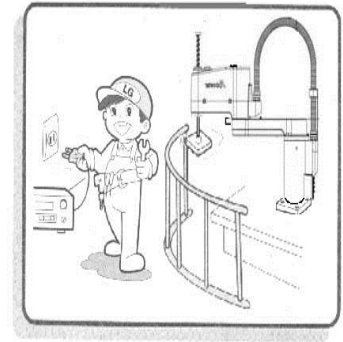
robot maintenance, be sure to disconnect controller power switch, remove the power plug from the controller, and wait for over 3 minutes before starting the inspection.





주의

When turning off the controller power while the robot is working or Servo On, Z (up, down) axis may fall 5~10mm. Stop the robot from working, turn Servo Off and turn the power Off.



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# Ch.1 Controller Overview

## 1.1 Features

RcT Series is a high-performance robot motion controller suitable for a variety of applications, containing the following features below

- PC-based robot controller
- Multitasking support
- Easy to expand an Option Card by employing an industrial standard PCI bus
- Enables driving maximum 16 axes by employing the Servo amp of communication Type
- Provides rich input/output interface
  - User In/Out(32점/32점), Option In/Out(32점/32점)
- Rich built-in robot commands
  - User definition function
  - String manipulation function
  - Special function function (Align, Mapping, etc)
- Monitoring function while in operation
- Provides data backup and edit program

Besides, robot control performance improvement enables

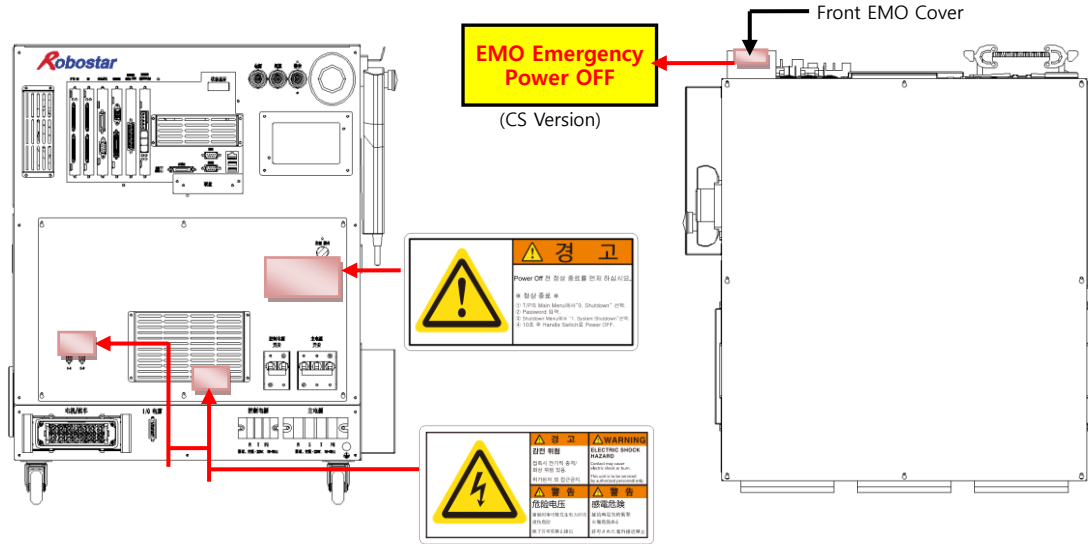
- Parallel processing of robot commands while in operation, such as input/output by conditions and processing of transfer instruction
- Pass Motion function such as travel distance ratio setup (FOS) becomes possible.

## 1.2 Examples of Model Configuration (Common)

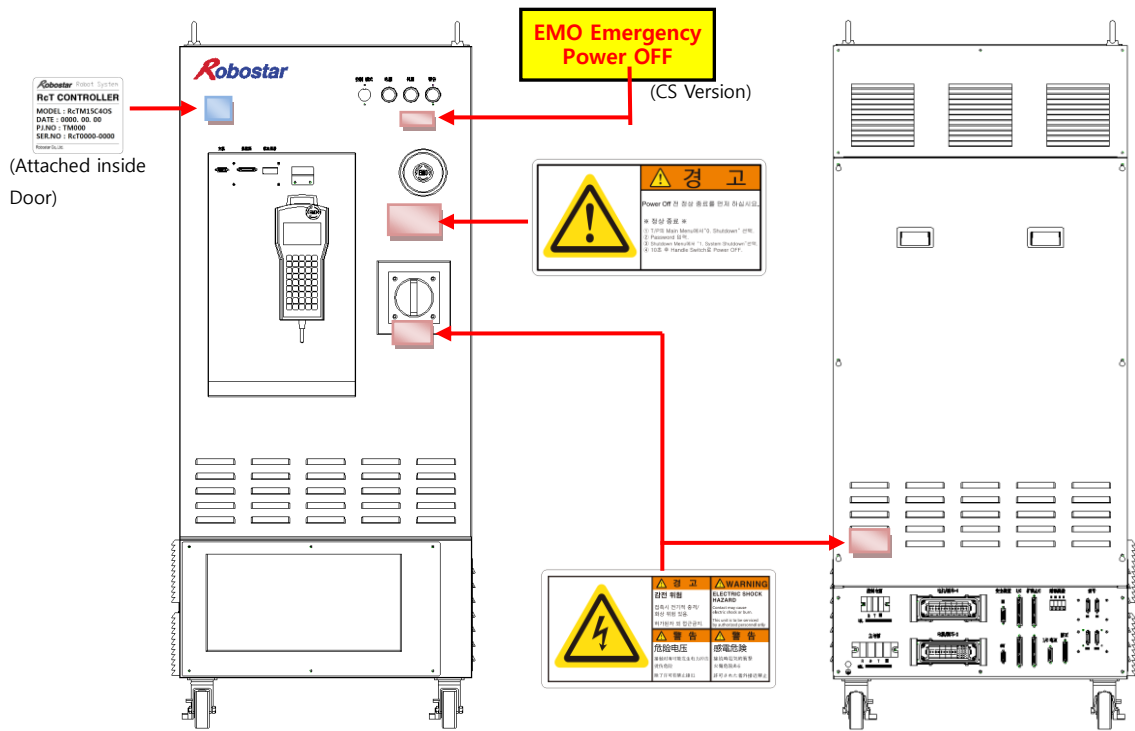
C	T	C	1	E	M	N	C	P	U	F	0	L
1				2	3	4	5	6	7	8	9	10
Classifi- cation	Name			Description								
1	Controller Classification			Controller Model :RcT 1 <sup>st</sup> generation								
2	Servo Type			E : EtherCat P : Pulse S : Serial								
3	Main B/D Option			X : None M : Ext Memory								
4	Ext B/D Option 1			N : Standard I/O I : Basic I/O + Extension I/O N com								
5	Ext B/D Option 2			C : CCLink I : PIO(NPN) 2 : RS232								
6	Motor/Servo Maker			P : Panasonic T : Servotronix								
7	Safety Level			2 : Category2 3 : Categor3 - CS PLC(Omron) U: Categor3 - CS Unit(Omron) 4 : Categor4 - PLC(Omron) T : Categor3 - CS PLC(Pilz) F : Categor4 - PLC(Pilz)								
8	Axis Number			0 ~ Z								
9	Option 1 (Servo List)			0 ~ Z								
10	Option 2 (Size)			S : Small Type M : Middle Type L : Large Type								

# 1.3 Nameplate

## 1.3.1 M Type (Mid-size)



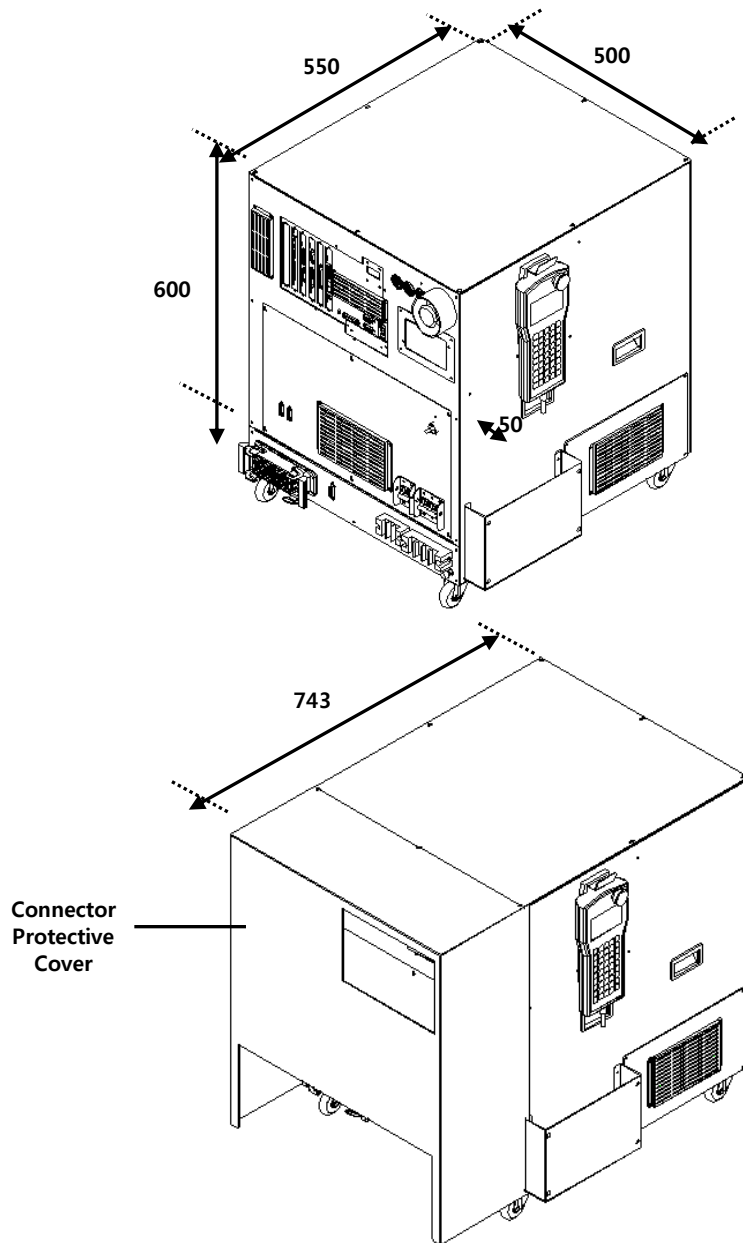
## 1.3.2L Type (Large Size)



## Ch.2 Basic Specifications

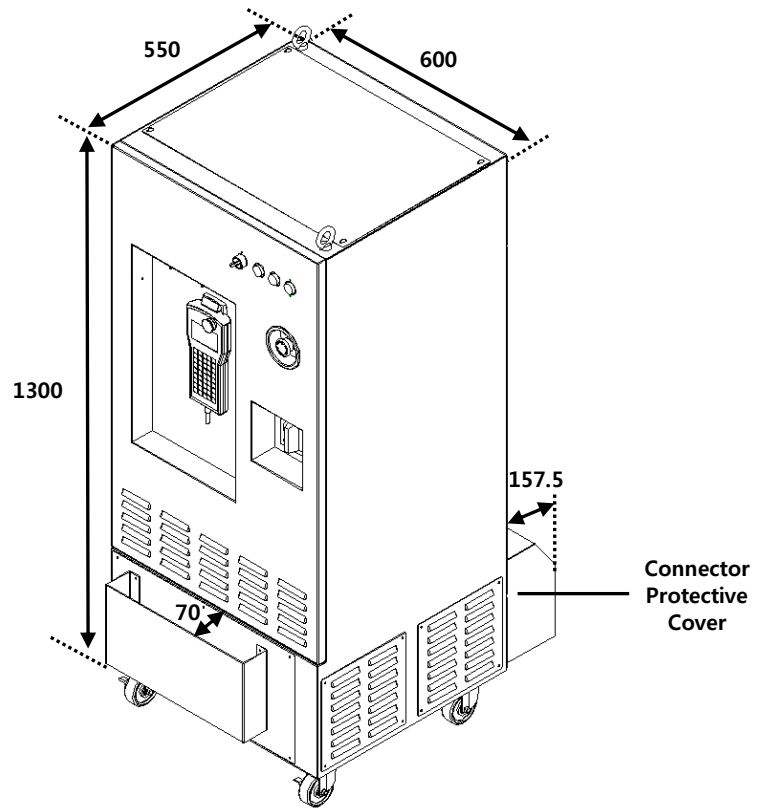
### 2.1 Size

#### 2.1.1M type



(Unit : mm)

2.1.2L type



(Unit : mm)



When installing a controller, keep the front/rear at an interval of 250mm or over to connect robot cables.



## 2.2 Installation and Surrounding Environment

Item	Description
Controller Input Power	AC 220V, $\pm 10\%$ 2Phase, 50-60Hz
Motor Input Power	AC 220V, $\pm 10\%$ 3Phase, 50-60Hz
Controller Input Capacity	Max. 1.46VA
Motor Input Capacity	Max. 20kVA
Encoder Size	17bit Absolute Encoder (Serial Type)
Operating Ambient Temperature	0 ~ 40°C
Operating Ambient Humidity	20 ~ 80% RH (Should be condensation free)
Ambient Temperature for Storage	-15 ~ 60°C
Ambient Humidity for Storage	10 ~ 90% RH (Should be condensation free)

## 2.3 Performance

Item	Description
Withstanding Voltage	AC-FG간 1.5kV, 10mA 1minute, between 1st-2nd 3kV, 10mA 1minute
Power Noise Withstand Capability	$\pm 1,500\text{Vp-p}$ , 1usec, COMMON and Normal 1minute
Noise Withstand Capability	Motor/Encoder $\pm 1,500\text{Vp-p}$ , 1usec, induction Noise 1minute
	I/O $\pm 1,500\text{Vp-p}$ , 1usec, induction Noise 1minute
Insulation Resistance	Between input power and FG : Over 20M $\Omega$
Instantaneous Interruption Withstand Capability	1/2 CYCLE per 10 cycle of input power frequency
Position Precision	$\pm 1$ PULSE of ENCODER
Servo Capacity	Max. 5Kw
I/O	Min Input Current 5mA/1 point
	Max Output Current 50mA/1 point
Brake Control	24V Motor Brake operation
Motor Control Method	AC Servo Motor operation (Sine wave PWM current control)

## 2.4 Specifications

Item		Description
Robot Application		Transfer Robot
Operation Control Method		Point To Point Motion
Control Axis Setting		Max 15 axes
Position Feedback		By absolute encoder
Drive System		AC Servomotor
Digital I/O	Basic I/O	Input :32 Points
		Output :32 Points
	Extension I/O	Input : 32 Points
		Output : 32 Points
Teaching Method		Direct Teaching (Teach Pendant) On-Line Teaching (Uni-Host)
Multi-robot Support		Maximum 3
Robot Language		RRL (ROBOSTAR Robot Language)
Specifications for Robot Program Support	Job	Max 250/ Channel(3Ch)
	Point	Max 40000
	Step	Max 10000
	Global Variable	Integer-type max 1000, real-type max 1000
External Communication Specification (Option)		CC Link, PIO, RS232
Error Display		7-Segment , Teach Pendant
On - Line Function		Job, Point, Parameter edit, save function
Protection Function		OverCurrent, OverLoad, OverSpeed, Position Error, etc
Specific Function		Position Latch
Safety Specification		Category 3, Category4
Cooling Method		Forced Ventilation
Weight	M Type	Max 75 Kg
	L Type	Max 200Kg

## Ch.3 How to Install a Controller

### 3.1 Securing Appropriate Installation Environment



주의

Installation environment for the robot body and controller is very important, so be sure to implement installation environment specified below. If installation environment is found to be inappropriate, it may prevent functions and performances from fully working, cause the machine life to be shortened, further cause an unexpected machine failure.

#### 3.1.1 Requirements for Installation Environment

- As the robot and the controller are not made free of explosion, dust and splash, they are unable to be installed in the following places.
  - ▶ Operating environment associated with flammable gas and combustible liquid.
  - ▶ Environment where conductive materials such as processed metal chips are being scattered.
  - ▶ Environment where corrosive gas such as acids and alkalis exists.
  - ▶ Environment where mist such as cutting fluid and abrasive fluid exists.
  - ▶ Environment where mist such as oil-containing cutting fluid and abrasive fluid exists.
  - ▶ Environment close to the source of electric noise such as a large inverter, a high power & high-frequency oscillator, a large conductor and a welder.

#### 3.1.2 Ambient Temperature and Humidity

- Set the ambient temperature at the range of 0 ~ 40 °C while operating.
- Keep the humidity below 80 % RH(MAX).
- Keep the place well ventilated, and dust, dirt and humidity at minimized level.

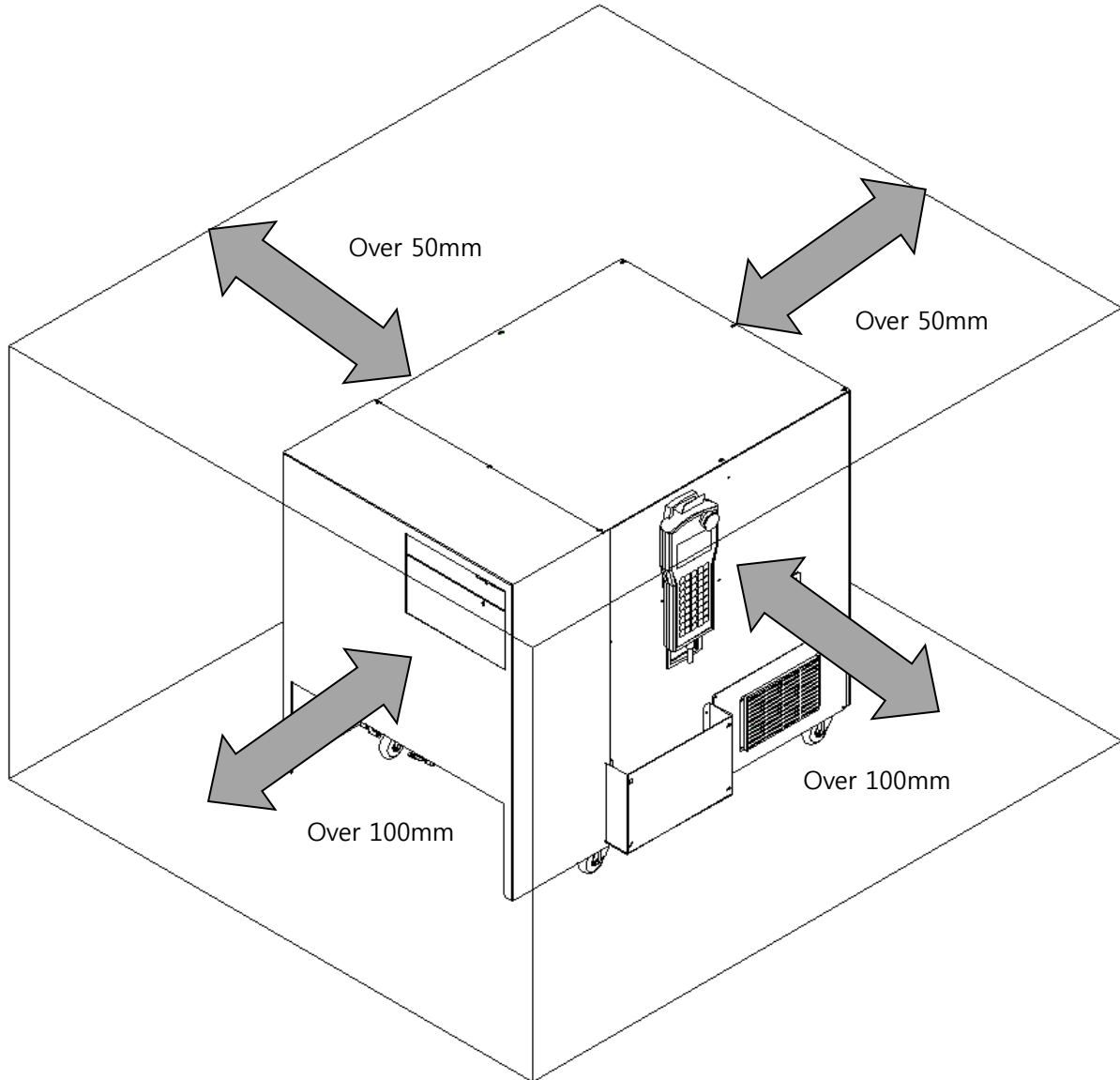
#### 3.1.3 Vibration

- Install the machine away from the environment where an excessive vibration and impacts are imposed.

## 3.2 Securing Installation Space

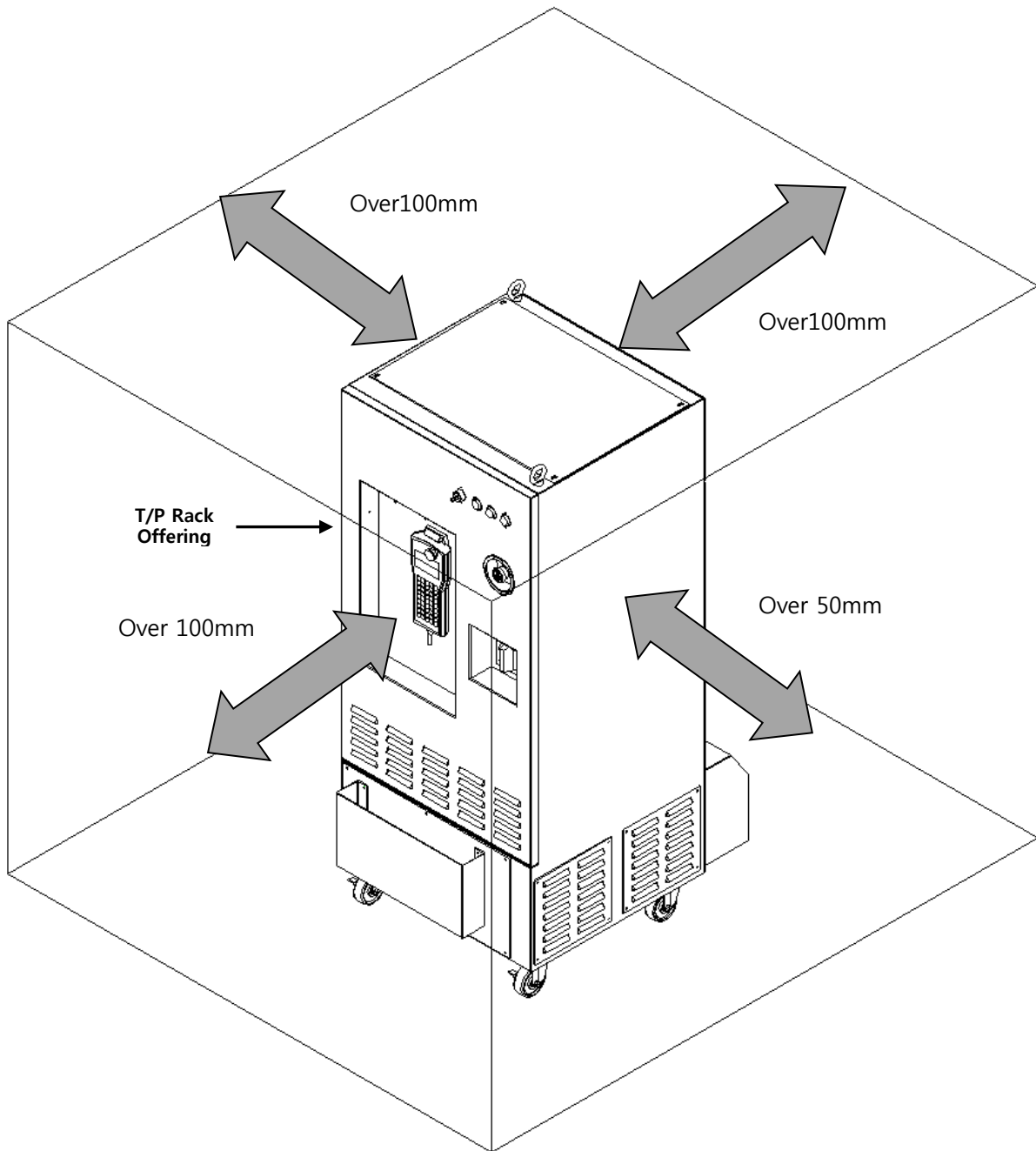
Be sure to secure enough space, as shown below, by considering the interference of a cooling fan, the securing of ventilation space and the bend of a robot cable.

### 3.2.1 M Type



- ▶ The controller runs by a forced ventilation method as a way of cooling method. Be sure to secure some space so no interference is generated in the cooling fan.
- ▶ Secure space including the protective cover when installing a protective cover. This is for robot cables not to have a sharp curve.
- ▶ Secure space in the right part in charge of storing T/P so that an emergency switch should not operate. Robot can stop in an emergency by operating the emergency switch.

## 3.2.2L type



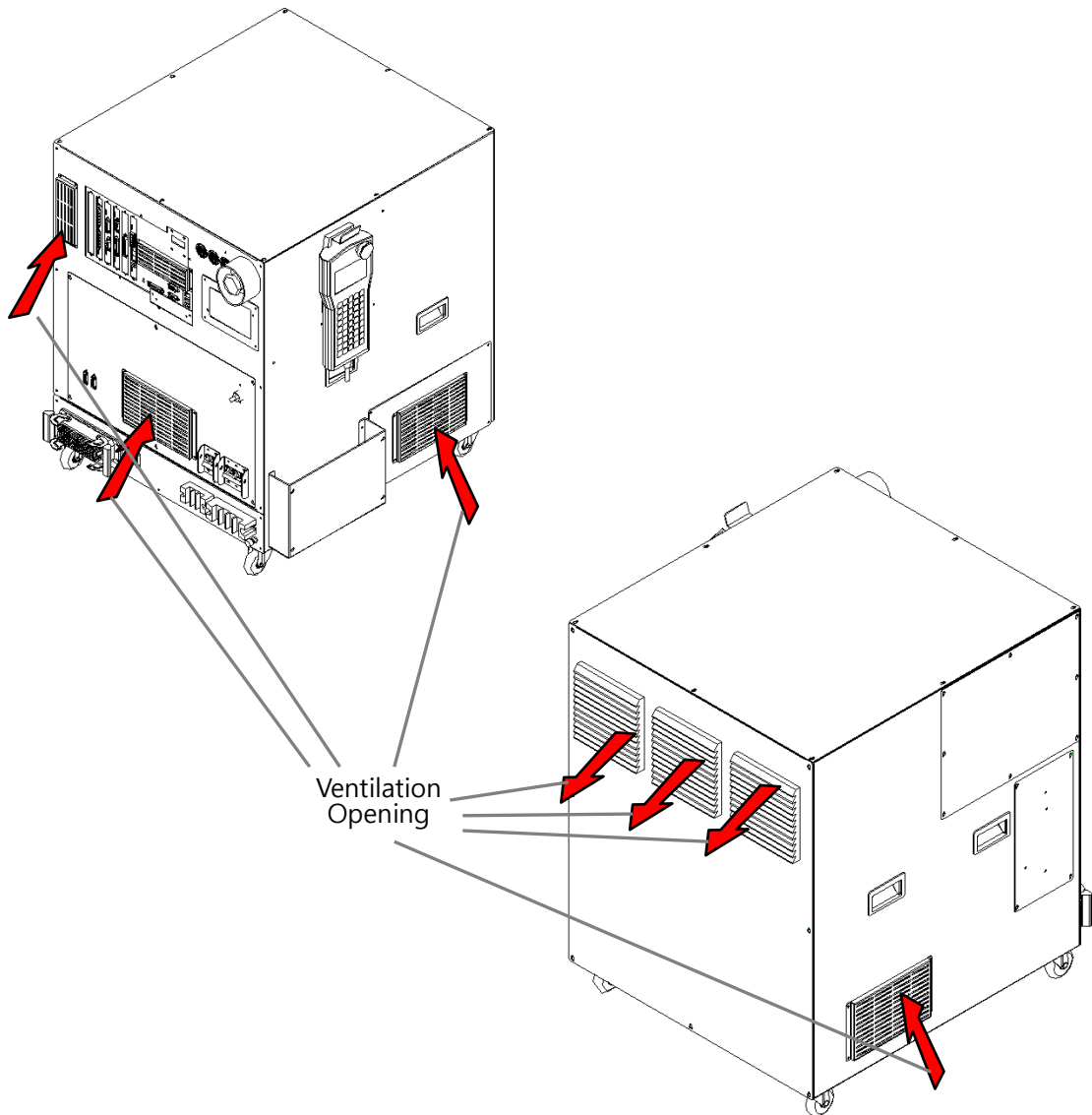
주의

- ▶ The controller runs by a forced ventilation method as a way of cooling method. Be sure to secure some space so no interference is generated in the cooling fan.
- ▶ Secure space including the protective cover when installing a protective cover. This is for robot cables not to have a sharp curve.
- ▶ If storing T/P on the left T/P rack, secure space so that an emergency switch should not operate. Robot can stop in an emergency by operating the emergency switch

## 3.3 Ventilation Direction

The controller takes ventilation directions as shown below. Refer to this when installing the controller.

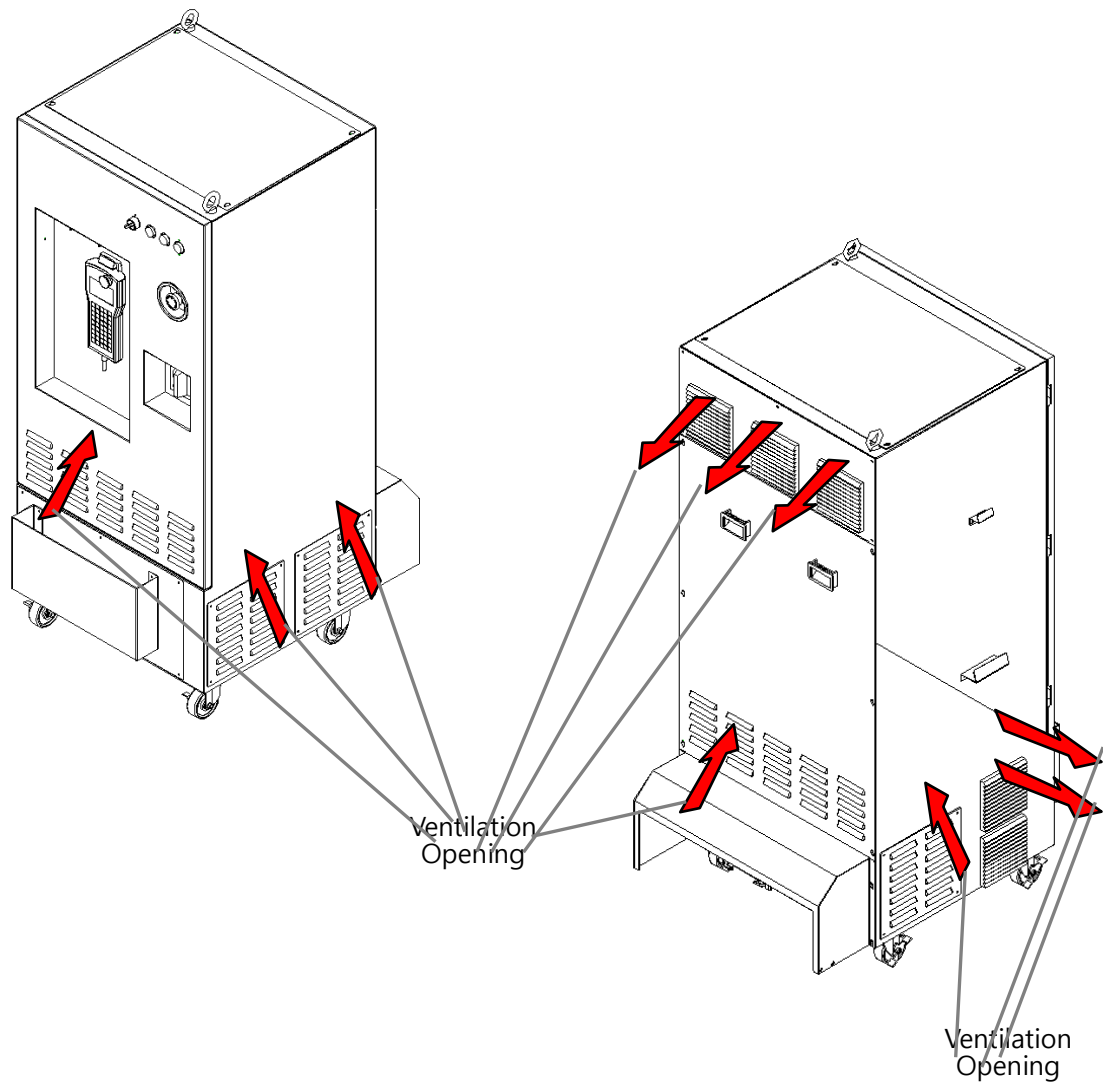
### 3.3.1 M type



주의

▶ Do the installation so the flow of air is not disturbed.  
Refer to < 3.2 Securing Installation Space >.

### 3.3.2L Type



주의

▶ Do the installation so the flow of air is not disturbed.  
Refer to < 3.2 Securing Installation Space >.

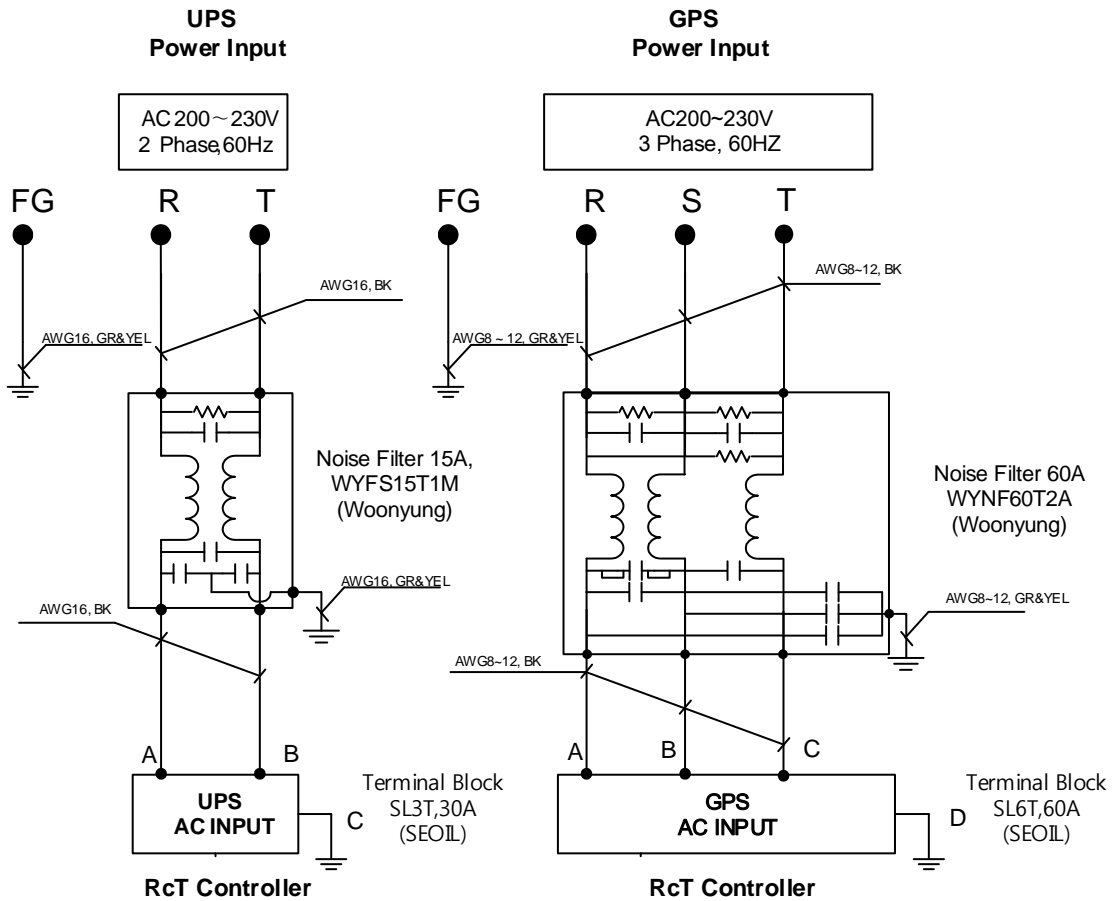
### 3.4 Power Supply and Connecting Method

For power input to the controller, be sure to use the EMI/EMC FILTER to supply power source.

#### 3.4.1 Noise(EMI/EMC)Filter Specifications

Classification	Part Name	Name	Maker
M Type	UPS Noise Filter	WYFS10T1M	Woonyung
	GPS Noise Filter	WYNF40T2A	Woonyung
L Type	UPS Noise Filter	WYFS15T1M	Woonyung
	GPS Noise Filter	WYNF60T2A	Woonyung

#### 3.4.2 Controller Power Connection BLOCK



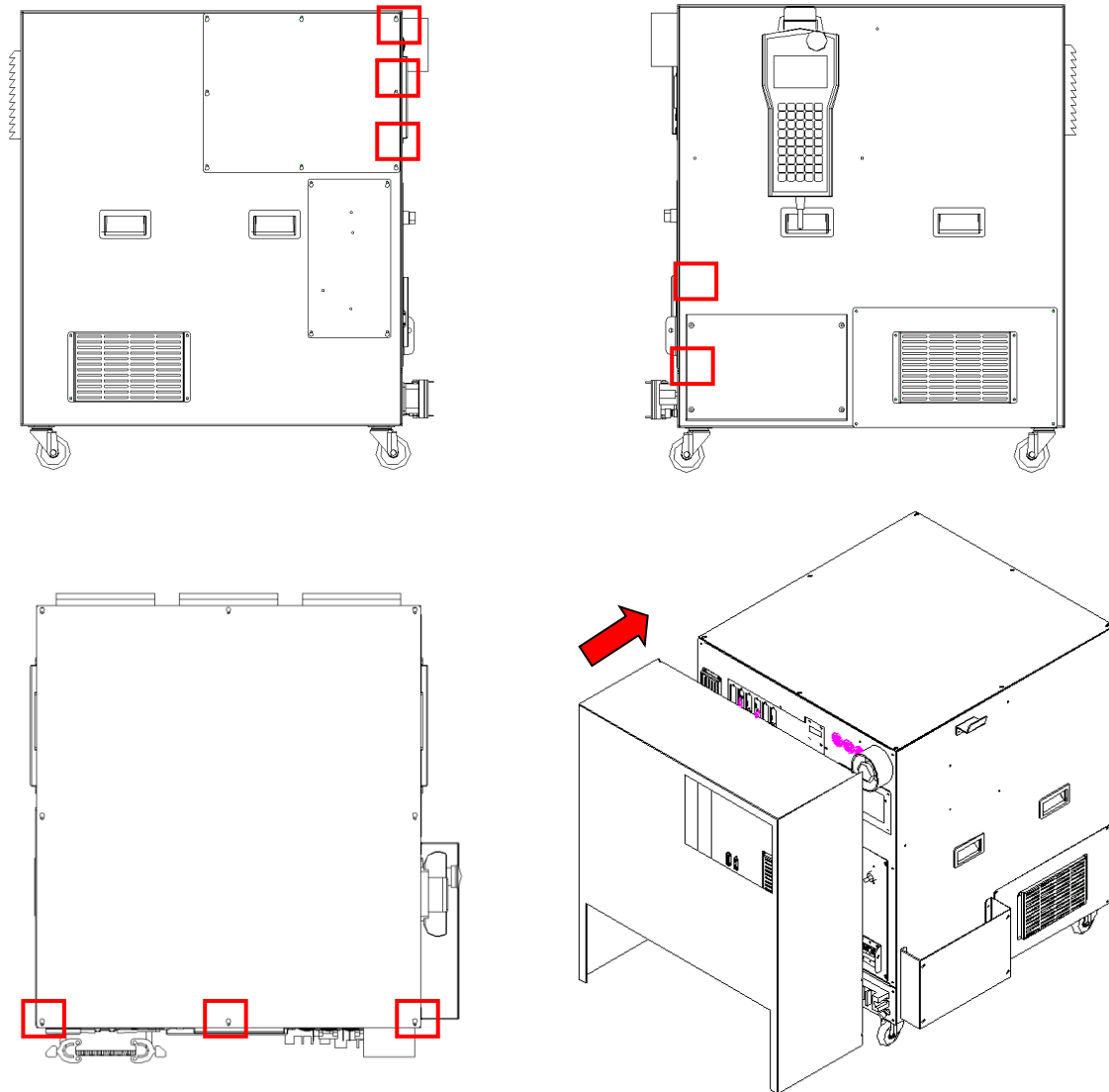
\*Note.

1. Noise Filter specified, the same part as the filter inside the controller, is for a reference.



## 3.5 Protective Cover Installation

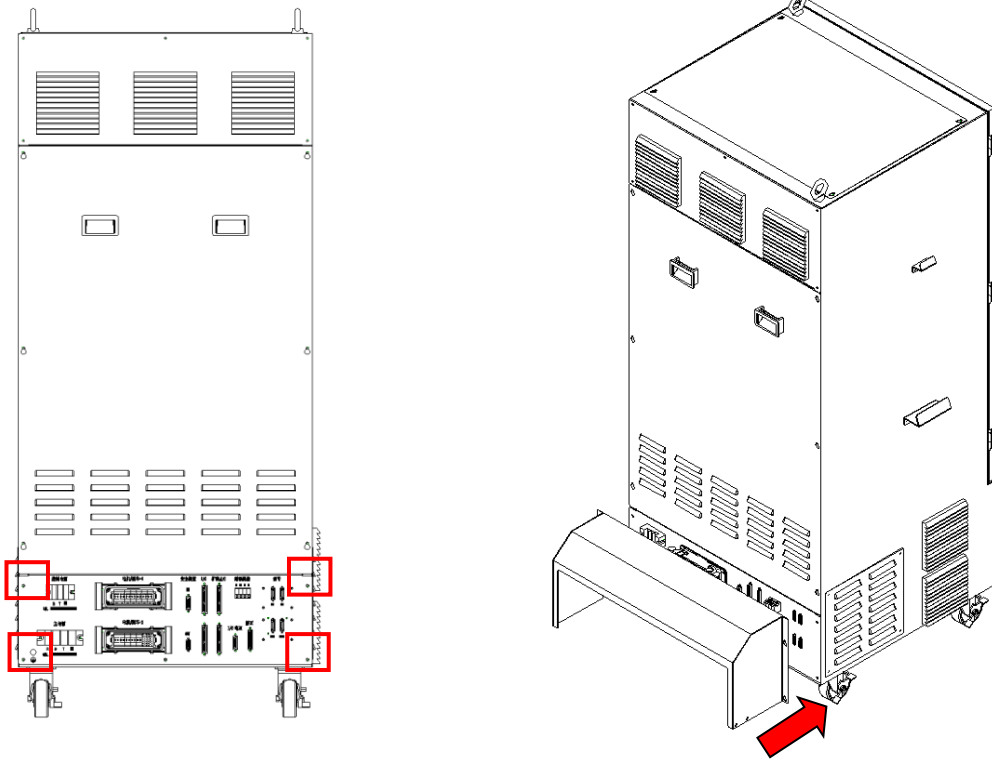
### 3.5.1 M Type



#### ◆ Installation Procedure

1. Loosen  $\frac{1}{2}$  of the bolts in the marked part.
2. Install the protective cover on the controller in the marked direction.  
(Be careful that cables should not be interfered when installing.)
3. After installation, completely tighten the loosened bolts in 1.

## 3.5.2L Type



## ◆ Installation Procedure

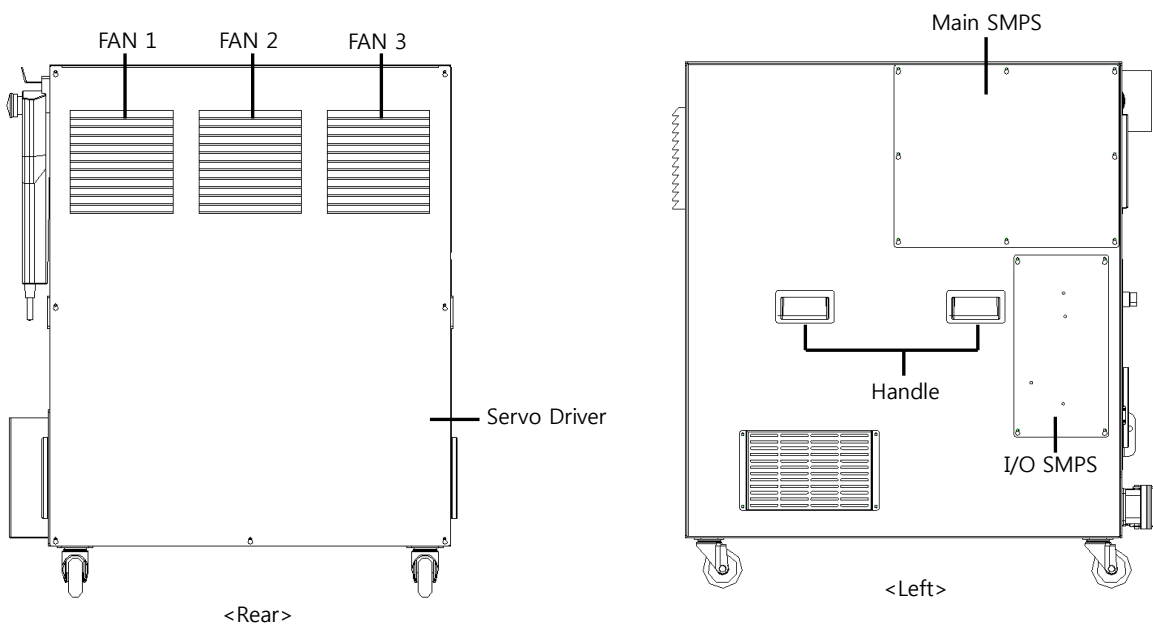
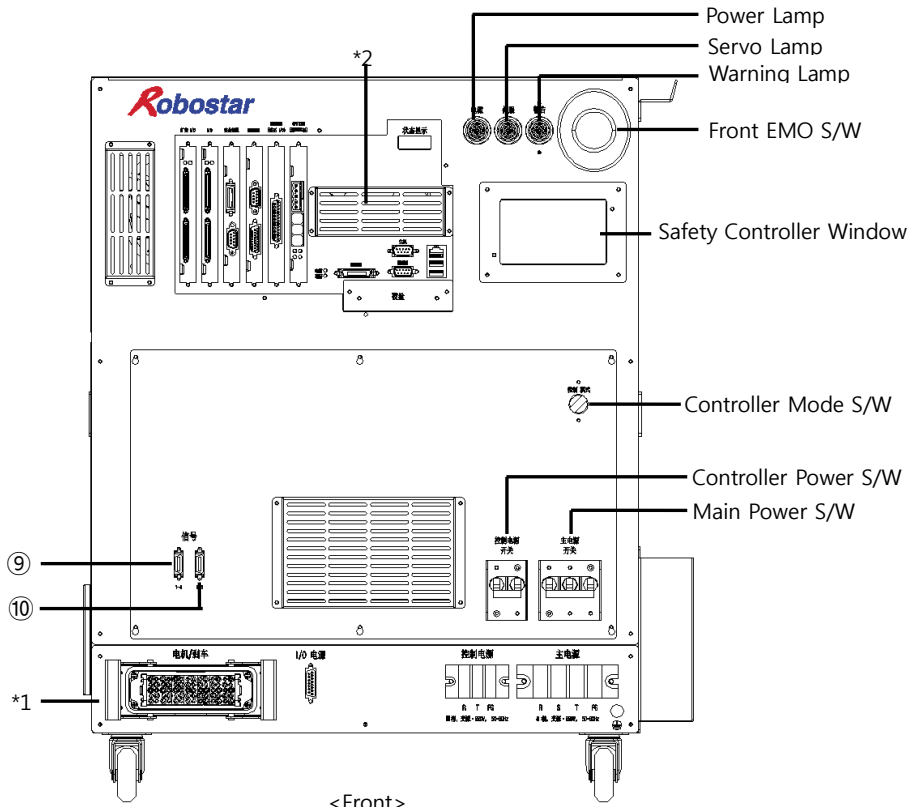
- 1 Loosen  $\frac{1}{2}$  of the bolts in the marked part.
- 2 Install the protective cover on the controller in the marked direction.  
(Be careful that cables should not be interfered when installing.)
- 3 After installation, completely tighten the loosened bolts in 1.

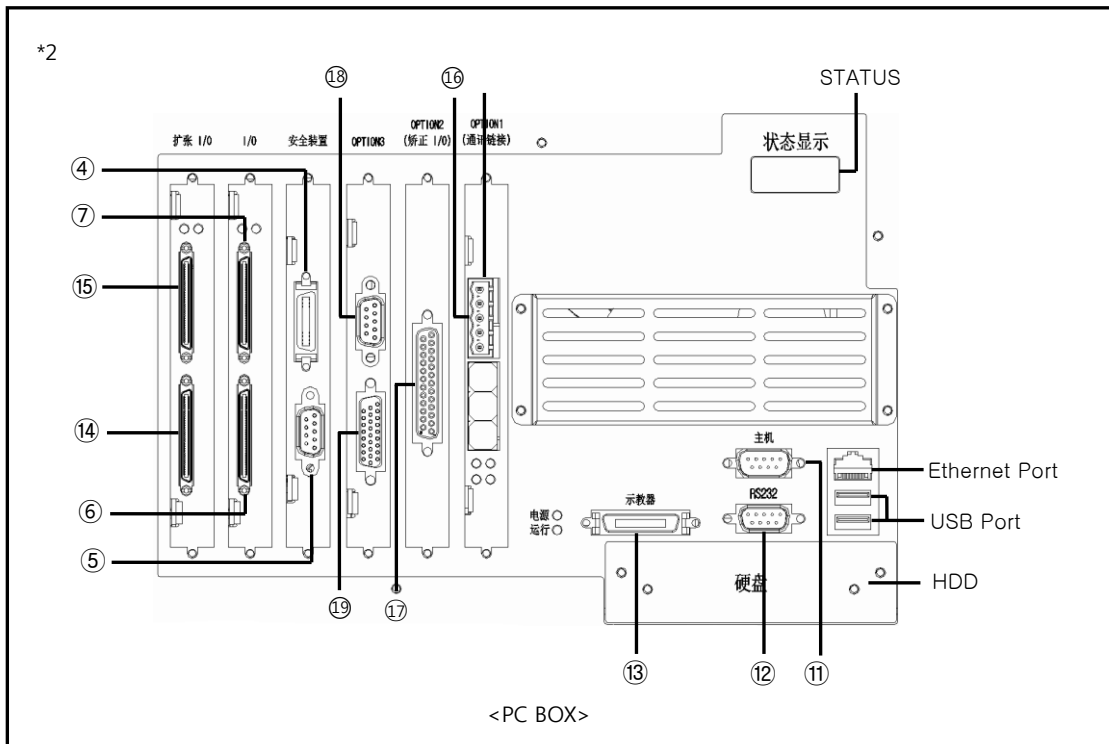
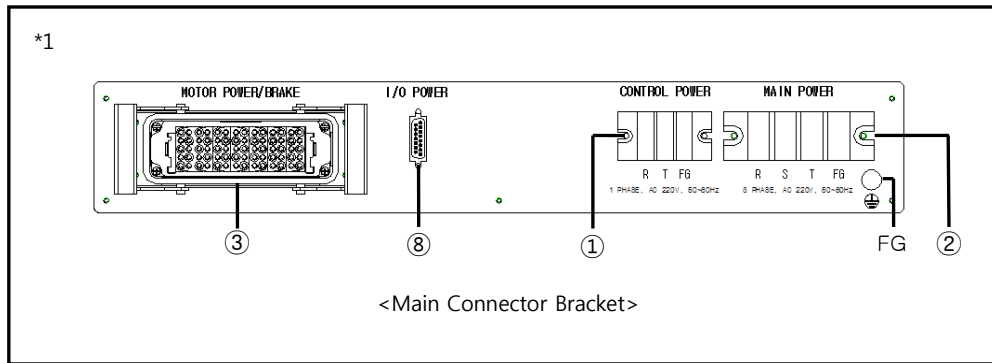
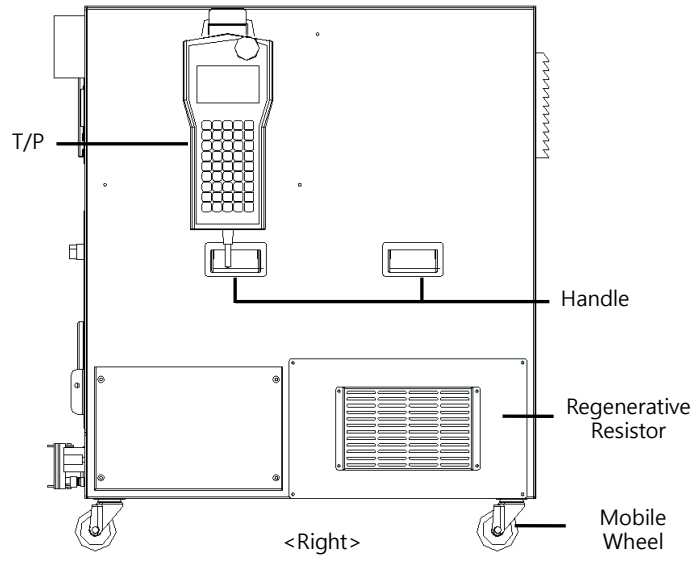
# Ch.4 Controller Configuration

## 4.1 M-type(Mid-size)

### 4.1.1 Controller Connector, Names and Description of Main Components

The figure below shows the names of each part in controller exterior.





## (1) Connector Description

No.	Connector No.	External Display (Name)	Description
①	CN1	CONTROL POWER	AC 220V 1Phase, 50-60Hz, Control Input Power
②	CN2	MAIN POWER	AC 220V 3Phase, 50-60Hz, Motor Input Power
③	CN3	MOTOR/BRAKE-1	Motor Drive, Brake Power Output Connector
④	CN4	SAFETY	IN External Safety Input Interface Connector
⑤	CN5		OUT External Safety Output Interface Connector
⑥	CN6	I/O	Basic Robot Sensor Input/Output Connector (In/Out 0~15)
⑦	CN7		Basic Robot Sensor Input/Output Connector (In/Out 16~31)
⑧	CN8	I/O/PW	Robot Sensor Power Connector
⑨	CN9	ENCODER	1~4 Motor Encoder Connector
⑩	CN10		5~8
⑪	CN11	HOST	Host Connector
⑫	CN12	RS232	Top RS232 Connector
⑬	CN13	T/P	T/P Connector
⑭	CN14	EXT I/O	Extension Robot Sensor Input/Output Connector (In/Out 0~15)
⑮	CN15		Extension Robot Sensor Input/Output Connector (In/Out 16~31)
⑯	CN16	OPTION1 (CCLink)	CC-Link Connector
⑰	CN17	OPTION2 (LATCH I/O)	Latch Function Input Connector (Align, Mapping)
⑱	CN18	OPTION3	Internal Safety Input Interface Connector - CS Version
⑲	CN19	OPTION3	External Safety Input Interface Connector - For CS Version

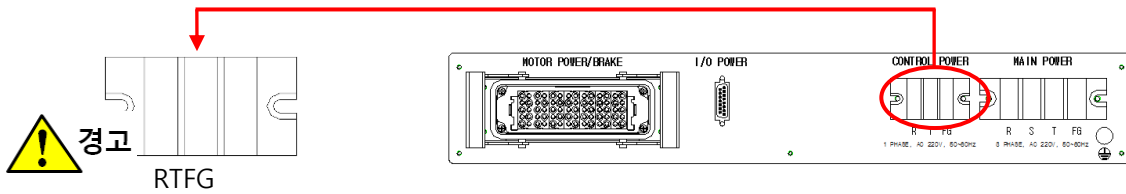
## (2) Description of Main Components

Names	External Display	Description
Power Lamp	POWER	Main Power Lamp (White)
Servo Lamp	SERVO	Servo Driver Ready Lamp (Green)
Warning Lamp	WARNIGN	Servo Drive Warning Lamp (Red) - LD Version
Controller Mode S/W	CONTROL MODE	Controller Mode S/W - CS Version
Front EMO S/W	-	Front Emergency Stop S/W
HDD	HDD	Hard Disk Installation Unit
Safety Controller Window	-	Safety PLC or UNIT Check Window
7-Segment	STATUS	Controller Status Display
UPS POWER S/W	CONTROL POWER SWITCH	Control Input Power SWITCH
GPS POWER S/W	MAIN POWER SWITCH	Motor Input Power SWITCH
T/P	-	Teach Pendant
Main SMPS	-	Main SMPS Board, I/O SMPS Board (Small Capacity - 3.5A) Installation Unit
I/O SMPS	-	I/O SMPS (Large Capacity - 10A) Installation Unit
Servo Driver	-	Servo Driver Installation Unit
Regenerative Resistance	-	Regenerative Resistor Installation Unit
Fan 1, 2, 3	-	Controller Internal Fan
FG Terminal	⊥	FG (Frame Ground) Connection Terminal
Handle	-	Controller Plastic Handle
Mobile Wheel	-	Mobile Wheel

### 4.1.2 Connector In-depth Description

#### (1) CN1 (CONTROL POWER)

Controller Side Connector	SL3T (Seoil Electronics Co., Ltd)
Robot Cable Side Connector	8Ø-M5 Ring Terminal

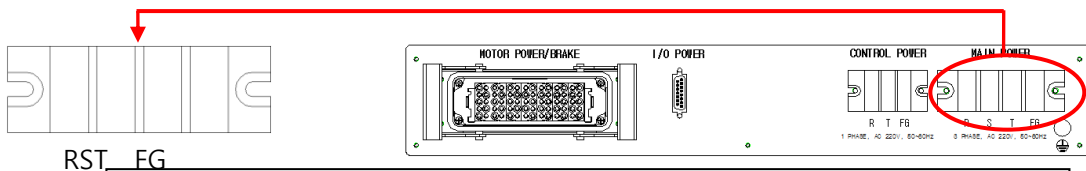


CN No	External Display	Power Display	In-depth Description
CN1	CONTROL POWER	R	AC220V ± 10%, 50-60Hz Input
		T	AC220V ± 10%, 50-60Hz Input
		FG	Frame Ground

In case the robot cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.

#### (2) CN2 (MAIN POWER)

Controller Side Connector	SL6T (Seoil Electronics Co., Ltd )
Robot Cable Side Connector	10Ø-M6 Ring Terminal



CN No	External Display	Power Display	In-depth Description
CN2	MAIN POWER	S	AC220V ± 10%, 50-60Hz Input
		T	AC220V ± 10%, 50-60Hz Input
		FG	Frame Ground

In case the robot cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.

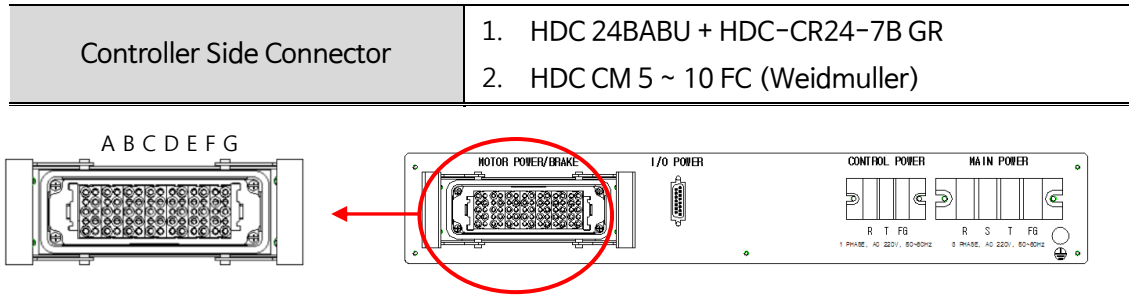


(3) CN3 (MOTOR/BRAKE)

Refers to an interface for motor power and a brake.

MOTOR/BRAKE Pin Map changes depending on Robot's situations.

The table below shows an example of a 7-axis Robot.



■ Motor/Brake Interface Description

CN No	External Display	Frame	Pin No	Signal Name	In-depth Description
CN3	MOTOR/BRAKE	A	1	U(T)	T-axis Motor 'U' Phase
			2	V(T)	T-axis Motor 'V' Phase
			3	W(T)	T-axis Motor 'W' Phase
			4	FG(T)	T-axis Motor Ground
			5	-	-
			6	U(T)	T-axis Motor 'U' Phase
			7	V(T)	T-axis Motor 'V' Phase
			8	W(T)	T-axis Motor 'W' Phase
			9	FG(T)	T-axis Motor Ground
			10	-	-
		B	1	U(Z)	Z-axis Motor 'U' Phase
			2	V(Z)	Z-axis Motor 'V' Phase
			3	W(Z)	Z-axis Motor 'W' Phase
			4	FG(Z)	Z-axis Motor Ground
			5	BK+(Z)	Z-axis Motor BRAKE +
			6	U(Z)	Z-axis Motor 'U' Phase
			7	V(Z)	Z-axis Motor 'V' Phase
			8	W(Z)	Z-axis Motor 'W' Phase
			9	FG(Z)	Z-axis Motor Ground
			10	BK-(Z)	Z-axis Motor BRAKE -
		C	1	U(L)	L-axis Motor 'U' Phase
			2	V(L)	L-axis Motor 'V' Phase
			3	W(L)	L-axis Motor 'W' Phase
			4	FG(L)	L-axis Motor Ground
			5	-	-
			6	U(R(U))	R(U)-axis Motor 'U' Phase
			7	V(R(U))	R(U)-axis Motor 'V' Phase
			8	W(R(U))	R(U)-axis Motor 'W' Phase
			9	FG(R(U))	R(U)-axis Motor Ground
			10	-	-
D	1	U(X)	T-axis Motor 'U' Phase		

	2	V(X)	T-axis Motor 'V' Phase
	3	W(X)	T-axis Motor 'W' Phase
	4	FG(X)	T-axis Motor Ground
	5	-	-
	6	U(X)	T-axis Motor 'U' Phase
	7	V(X)	T-axis Motor 'V' Phase
	8	W(X)	T-axis Motor 'W' Phase
	9	FG(X)	T-axis Motor Ground
	10	-	-
E	1~10	Motor Power Spare	Spare
F	1	U(LV)	LV-axis Motor 'U' Phase
	2	V(LV)	LV-axis Motor 'V' Phase
	3	W(LV)	LV-axis Motor 'W' Phase
	4	FG(LV)	LV-axis Motor Ground
	5	-	-
	6	U(R(U)V)	R(U)V-axis Motor 'U' Phase
	7	V(R(U)V)	R(U)V-axis Motor 'V' Phase
	8	W(R(U)V)	R(U)V-axis Motor 'W' -axis
	9	FG(R(U)V)	R(U)V-axis Motor Ground
	10	-	-
G	1~10	Motor Power Spare	Spare



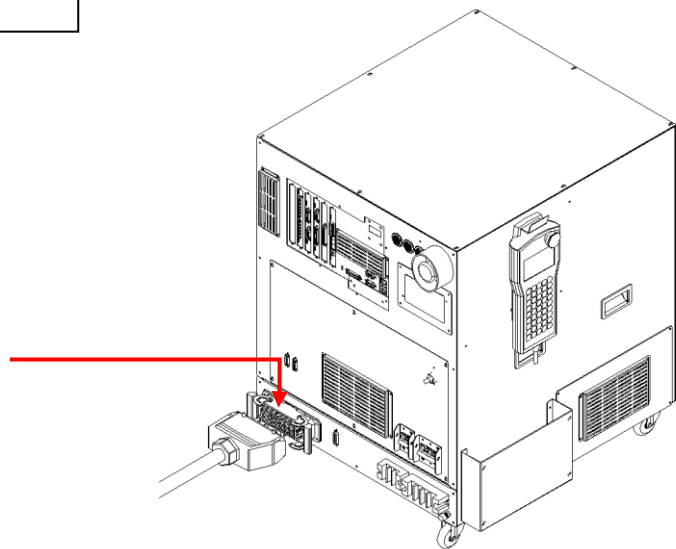
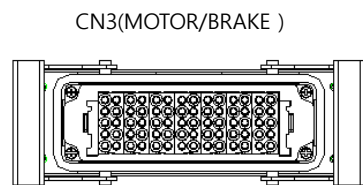
## ■ How to connect Motor/Brake interface and precautions

### \* Correct method of connection

1. Mount the external cable connector and the controller connector in the same direction.
2. When not being inserted, move slightly from side to side and push it in.

### \* Precautions

Do not mount by tilting either to the left or to the right. If mounted to the right or to the left with force, the pin of the external Cable Connector may bend.



경고

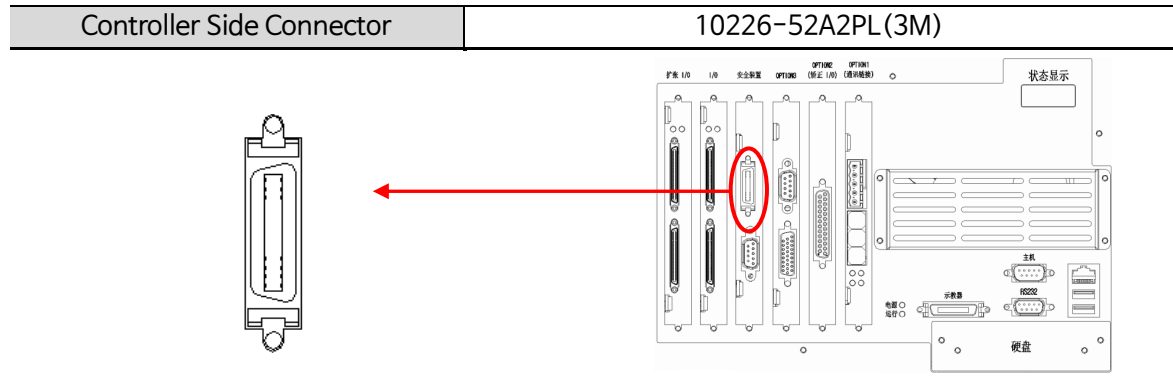
- ▶ In case the connector on the robot power cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.
- ▶ After connecting the motor cable, be sure to turn off the controller lever. When the cable is removed while the robot is working, it may bring a critical danger.

### \*Note.

1. The mark "-" means an unused pin.
2. Connector specifications and Pin Map may vary depending on Robot specifications.

(4) CN4(SAFETY IN)

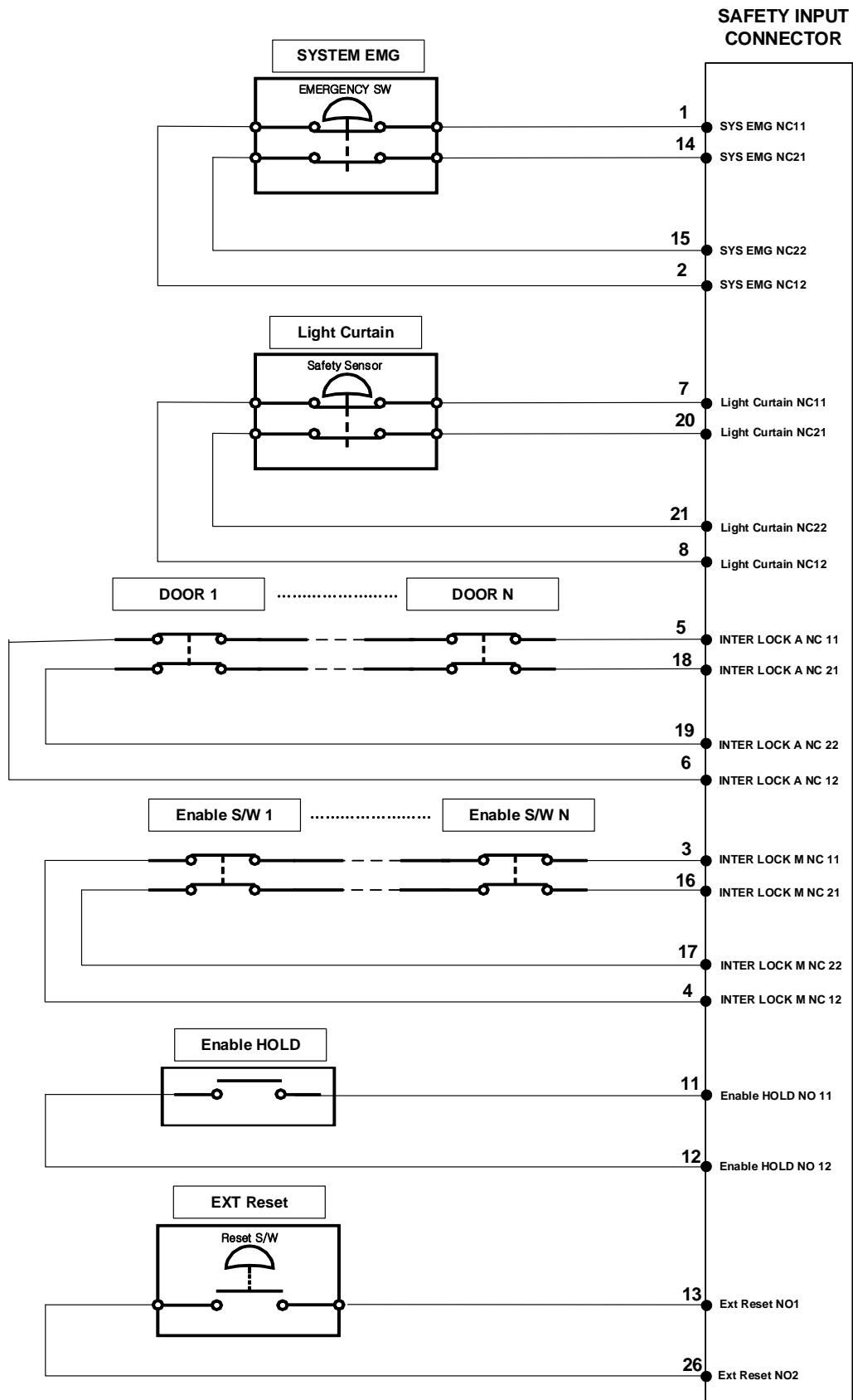
Refers to the external safety interface which varies depending on specifications.



① SD Version

CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	SAFETYIN	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	INDEX AUTO NC1	Top Auto Mode NC Contact 1
		10	INDEX AUTO NC2	Top Auto Mode NC Contact 2
		11	ENABLE HOLD1	Enable Device HOLD NO Contact 11
		12	ENABLE HOLD2	Enable Device HOLD NO Contact 12
		13	EXT RESET NO1	External Reset NO Contact 1
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	INDEX MANUAL NO1	Top Manual Mode NO Contact 1
		23	INDEX MANUAL NO2	Top Manual Mode NO Contact 2
		24	P24V_S	Safety P24V Power
		25	G24V_S	Safety G24V Power
		26	EXT RESET NO2	External Reset NO Contact 2

■ Safety Input Interlock Diagram





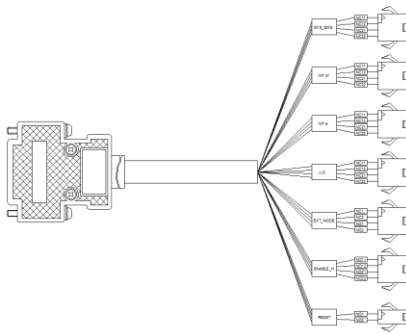
주의

- ▶ System EMG, Light Curtain, Interlock A, Interlock B must let NC11, NC12, NC21 and NC22 contacts turn simultaneously ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain operates in controller's Manual/Auto mode.
- ▶ Interlock A operates only in controller's Auto Mode.
- ▶ Interlock M operates only in controller's Manual Mode.

\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety In Dummy Connector



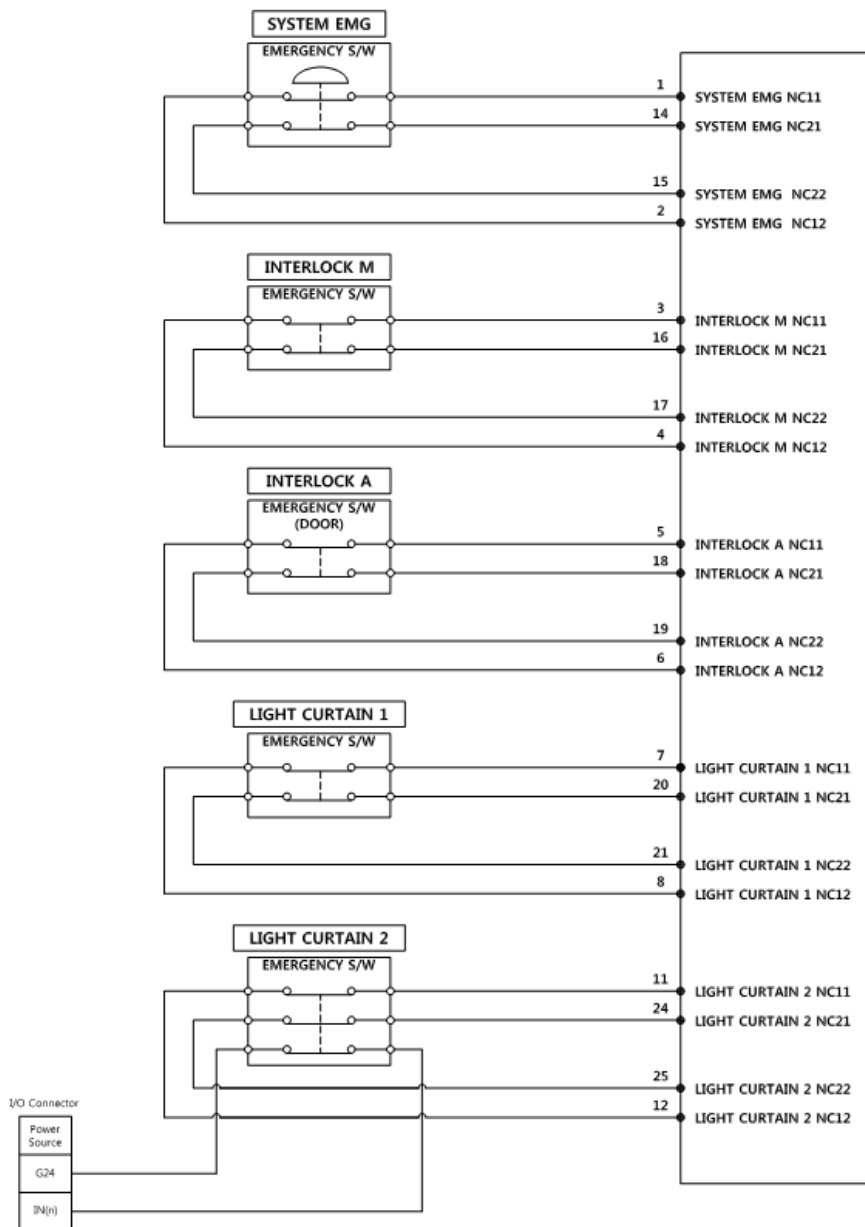
주의

- ▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.
- ▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector : SMP-04, SMP-02- JST)
- ▶ When the connection is wrongly made, it may cause an error in controller operation.

## ② LD Version

CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	SAFETYIN	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	-	-
		10	-	-
		11	LIGHT CURTAIN2 NC11	Ankle Detection2 NC Contact 11
		12	LIGHT CURTAIN2 NC12	Ankle Detection2 NC Contact 12
		13	P24V_S	Safety P24V Power
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	-	-
		23	-	-
		24	LIGHT CURTAIN2 NC21	Ankle Detection2 NC Contact 21
		25	LIGHT CURTAIN2 NC22	Ankle Detection2 NC Contact 22
		26	G24V_S	Safety G24V Power

■ Safety Input Interlock Diagram



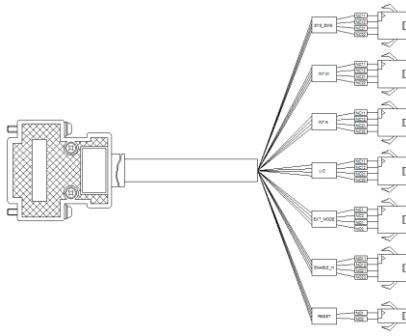
- ▶ All Safety Inputs in Safety Input Block diagram should let NC11, NC12, NC21, and NC22 contacts turn simultaneously ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain 1, 2 operates in controller's Manual/Auto mode.
- ▶ Interlock A operates only in controller's Auto Mode.
- ▶ Interlock M operates only in controller's Manual Mode.
- ▶ When using Light Curtain 2, N.O contact (Monitoring contact) of Light Curtain Sensor should be wired to controller I/O.

\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety in Dummy Connector



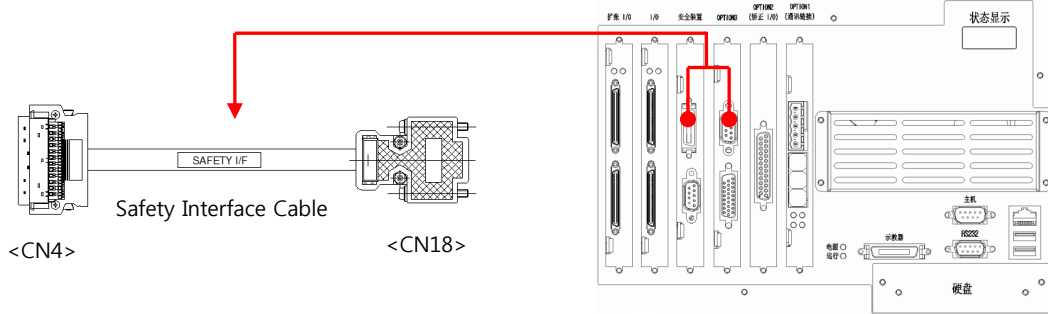


- ▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.
- ▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector: SMP-04, SMP-02- JST)
- ▶ When the connection is wrongly made, it may cause an error in controller operation.

③ CS Version(Unit)

CS Version should cone Safety Interface Cable connecting CN4 and CN18.  
For the external safety interface, refer to 4.1.2 CN19(OPTION3).

CN4 Connector	10126-3000PE + 10326-52A0-008(3M)
CN18 Connector	DB-9SP(Misumi)



Connecting CN No	Pin No	Signal Name	In-depth Description
CN4	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
	2~12	-	-
	13	MODE_NO11	Controller Control Mode NO Contact 11
	14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
	15~23	-	-
	24	P24V_S	Safety P24V Power
	25	G24V_S	Safety G24V Power
	26	MODE_NO12	Controller Control Mode NO Contact 12
CN18	1	SYS_NC11	User Emergency Stop NC Contact 11
	2	SYS_NC21	User Emergency Stop NC Contact 21
	3	-	-
	4	MODE_NO11	Controller Control Mode Signal NO11
	5	MODE_NO12	Controller Control Mode Signal NO12
	6	-	-
	7	P24V_S	User SAFETY Power (Internal DC 24V)
	8	G24V_S	User SAFETY Power (Internal DC 24V)
	9	-	-

Be sure to use SCREW products for HOOD in cable side connector.



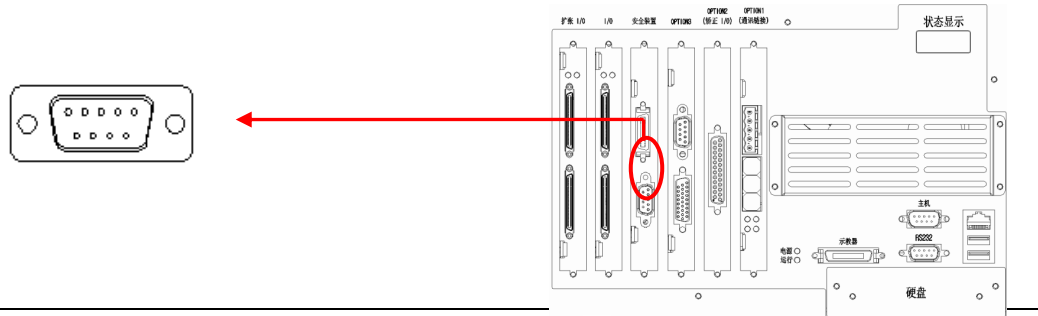
- \* Note .
1. The mark "-" means an unused pin.
  2. User SAFETY power must be used in SAFETY-related signals.



(5) CN5(SAFETY OUT)

Refers to the external safety output interface.

Controller Side Connector	DB-9SS (Misumi)
External Connector	DB-9SP (Misumi)



■ Description of Safety Output Interface

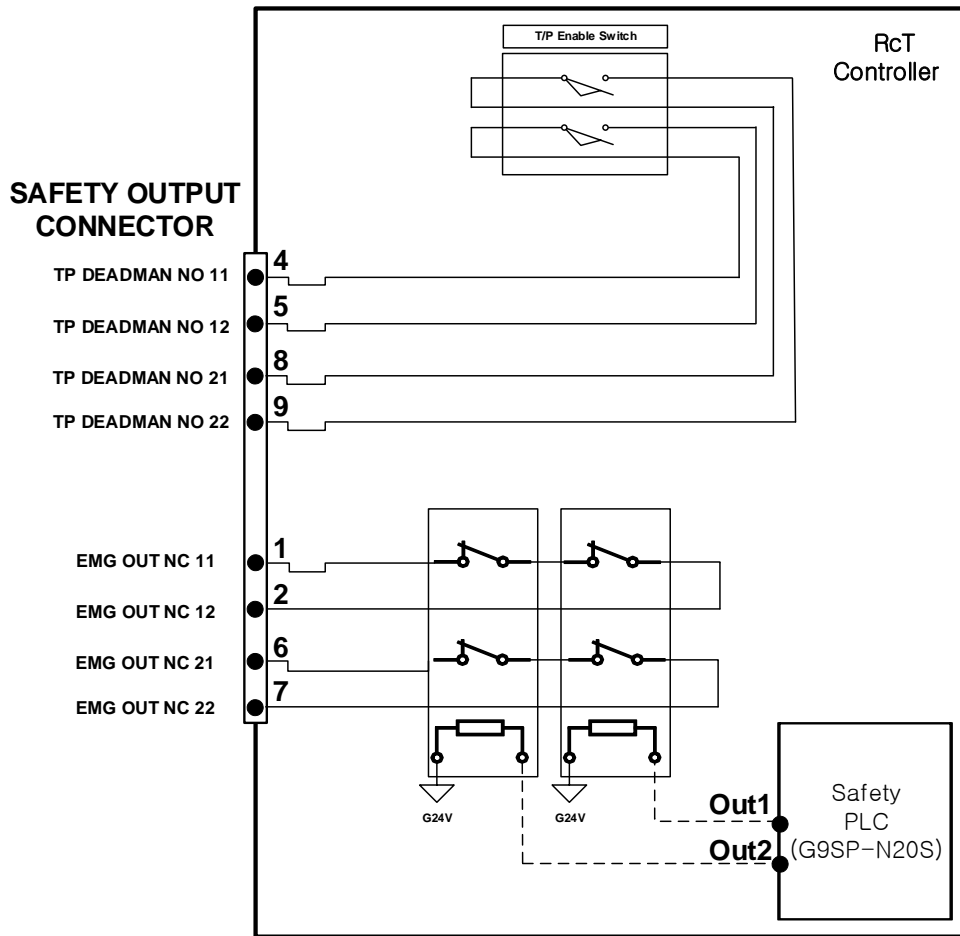


주의

Be sure to use SCREW products for HOOD in cable side connector.

CN6	SAFETY OUT	1	EMG OUT_11	Robot Emergency Stop NC Contact 11
		2	EMG OUT_12	Robot Emergency Stop NC Contact 12
		3	-	-
		4	R TP DEADMAN_11	T/P Enable NO Contact 11
		5	R TP DEADMAN_12	T/P Enable NO Contact 12
		6	EMG OUT_21	Robot Emergency Stop NC Contact 21
		7	EMG OUT_22	Robot Emergency Stop NC Contact 22
		8	R TP DEADMAN_21	T/P Enable NO Contact 21
		9	R TP DEADMAN_22	T/P Enable NO Contact 22

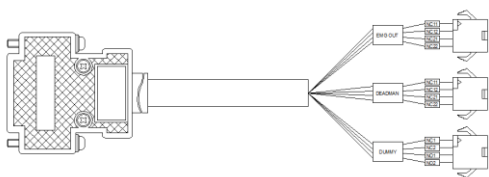
■ Safety Output Diagram



주의

- ▶ Emergency stop signals in robot itself come out through the Safety PLC.
- ▶ Signals such as EMG OUT NC11, EMG OUT NC12, EMG OUT NC21, and EMG OUT NC22 come out by contacts through Relay operation of controller's Safety Board.
- ▶ Outputs Enable Switch contact status of Teach Pendant. Enable HOLD N.O contact should turn On/Off depending on this contact status among Safety Input signals.

■ Safety Output Dummy Connector



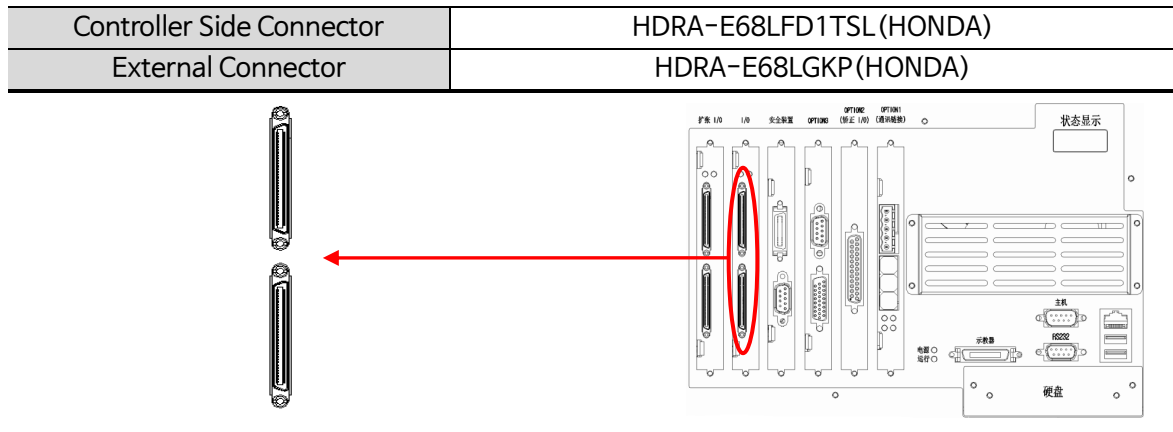
주의

- ▶ When the connection is wrongly made, it may cause an error in controller operation.

(6) CN6,CN7(I/O)

Refers to an interface for robot I/O(Sensor) connection.

Basic I/O includes providing CN6, CN7(Input 16 points Output 16points per Connector).



When connecting the external cable to I/O Connector, the color sticker next to Connector and the color of the shrink tube in the external Cable Connector part should match.

■ Description of I/O Interface

CN No	External Display	Pin No	Signal Name	In-depth Description
CN6	I/O	5	DIN0	User Input Contact 0
		6	DIN1	User Input Contact 1
		7	DIN2	User Input Contact 2
		8	DIN3	User Input Contact 3
		9	DIN4	User Input Contact 4
		10	DIN5	User Input Contact 5
		11	DIN6	User Input Contact 6
		12	DIN7	User Input Contact 7
		17	DIN8	User Input Contact 8
		18	DIN9	User Input Contact 9
		19	DIN10	User Input Contact 10
		20	DIN11	User Input Contact 11
		21	DIN12	User Input Contact 12
		22	DIN13	User Input Contact 13
		23	DIN14	User Input Contact 14
		24	DIN15	User Input Contact 15
		39	DOUT0	User Output Contact 0
		40	DOUT1	User Output Contact 1
		41	DOUT2	User Output Contact 2

CN7	42	DOUT3	User Output Contact 3
	43	DOUT4	User Output Contact 4
	44	DOUT5	User Output Contact 5
	45	DOUT6	User Output Contact 6
	46	DOUT7	User Output Contact 7
	51	DOUT8	User Output Contact 8
	52	DOUT9	User Output Contact 9
	53	DOUT10	User Output Contact 10
	54	DOUT11	User Output Contact 11
	55	DOUT12	User Output Contact 12
	56	DOUT13	User Output Contact 13
	57	DOUT14	User Output Contact 14
	58	DOUT15	User Output Contact 15
	1	P24V_IN-1	User I/O Power (Internal DC 24V)
	2	P24V_IN-2	User I/O Power (Internal DC 24V)
	35	G24_IN	User I/O Power (Internal DC 24V)
	32	P24_EX	User I/O Power (External DC 24V)
	66	G24_EX	User I/O Power (External DC 24V)
	5	DIN16	User Input Contact 16
	6	DIN17	User Input Contact 17
	7	DIN18	User Input Contact 18
	8	DIN19	User Input Contact 19
	9	DIN20	User Input Contact 20
	10	DIN21	User Input Contact 21
	11	DIN22	User Input Contact 22
	12	DIN23	User Input Contact 23
	17	DIN24	User Input Contact 24
	18	DIN25	User Input Contact 25
	19	DIN26	User Input Contact 26
	20	DIN27	User Input Contact 27
	21	DIN28	User Input Contact 28
	22	DIN29	User Input Contact 29
	23	DIN30	User Input Contact 30
	24	DIN31	User Input Contact 31
	39	DOUT16	User Output Contact 16
	40	DOUT17	User Output Contact 17
	41	DOUT18	User Output Contact 18
	42	DOUT19	User Output Contact 19
	43	DOUT20	User Output Contact 20
	44	DOUT21	User Output Contact 21

	45	DOUT22	User Output Contact 22
	46	DOUT23	User Output Contact 23
	51	DOUT24	User Output Contact 24
	52	DOUT25	User Output Contact 25
	53	DOUT26	User Output Contact 26
	54	DOUT27	User Output Contact 27
	55	DOUT28	User Output Contact 28
	56	DOUT29	User Output Contact 29
	57	DOUT30	User Output Contact 30
	58	DOUT31	User Output Contact 31
	1	DOUT32	User Output Contact 32
	2	P24V_IN-1	User I/O Power (Internal DC 24V)
	35	P24V_IN-2	User I/O Power (Internal DC 24V)
	32	G24_IN	User I/O Power (Internal DC 24V)
	66	P24_EX	User I/O Power (External DC 24V)



주의

Be sure to use SCREW products for HOOD in cable side connector.




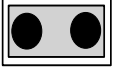
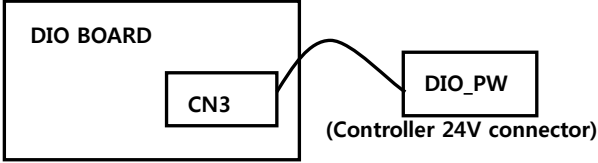
\* Note .

1. The mark "-" means an unused pin.
2. For user I/O power (Internal DC24V), use small-capacity Sensor power.  
(ex. Detect Sensor)
3. I/O power basically utilizes internal(controller) power.

When using external power, user I/O power (Internal DC24V) power is not allowed to be used.

① How to set the power

The DIGITAL I/O board can set whether I/O power (+24V DC) is used as the external power or the internal power. How to select the power is listed below.

I/O Power	Jumper Setting	Setting Method
External Power	 <p>JP1 1-2 Pins Short</p>  <p>JP2 Open</p>	<ol style="list-style-type: none"> <li>1) When using the external power, short circuit JP1 1-2 pins with a short socket.</li> <li>2) Open JP2.</li> </ol>
Internal Power	 <p>JP1 2-3 Pins Short</p>  <p>JP2 Short</p>	<ol style="list-style-type: none"> <li>1) When using the internal power, short circuit JP1 1-3 pins with a short socket.</li> <li>2) Short circuit JP2 with a short socket.</li> <li>3) Connect a 24V harness (label :DIO_PW) to DIGITAL I/O board's CN3 (Internal power input connector).</li> </ol> <div style="text-align: center;">  <p>DIO BOARD</p> <p>CN3</p> <p>DIO_PW (Controller 24V connector)</p> </div>

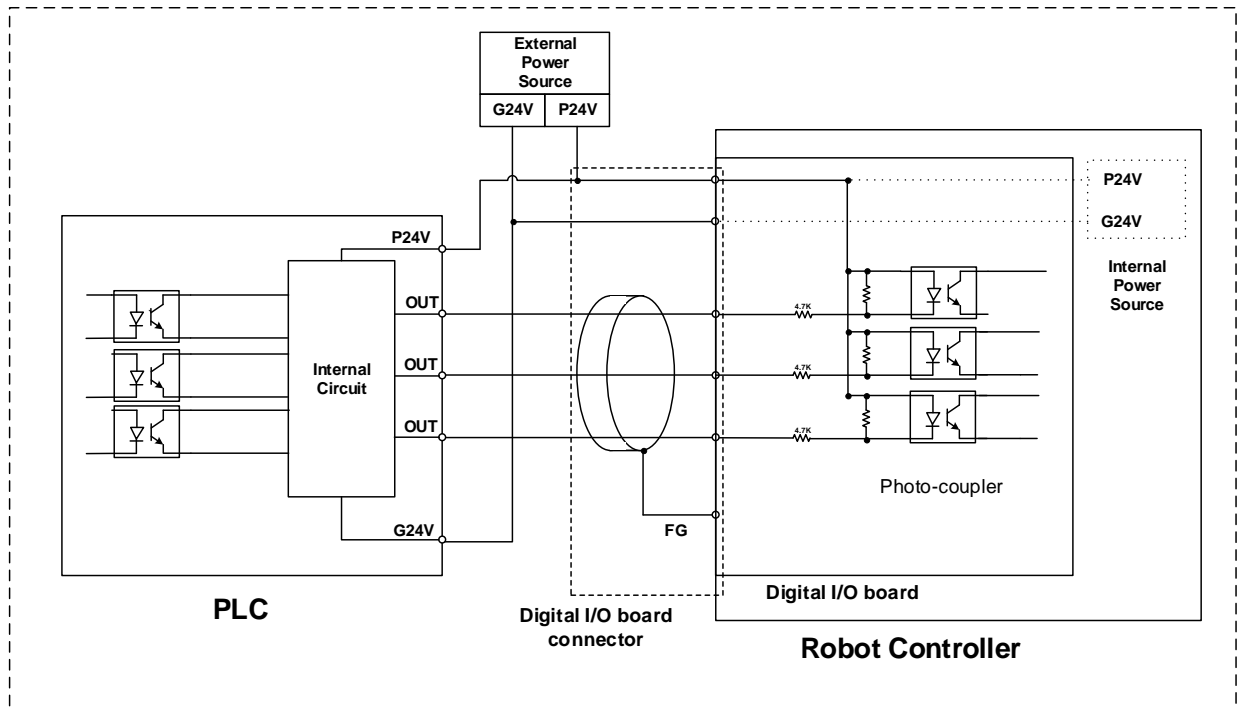


주의

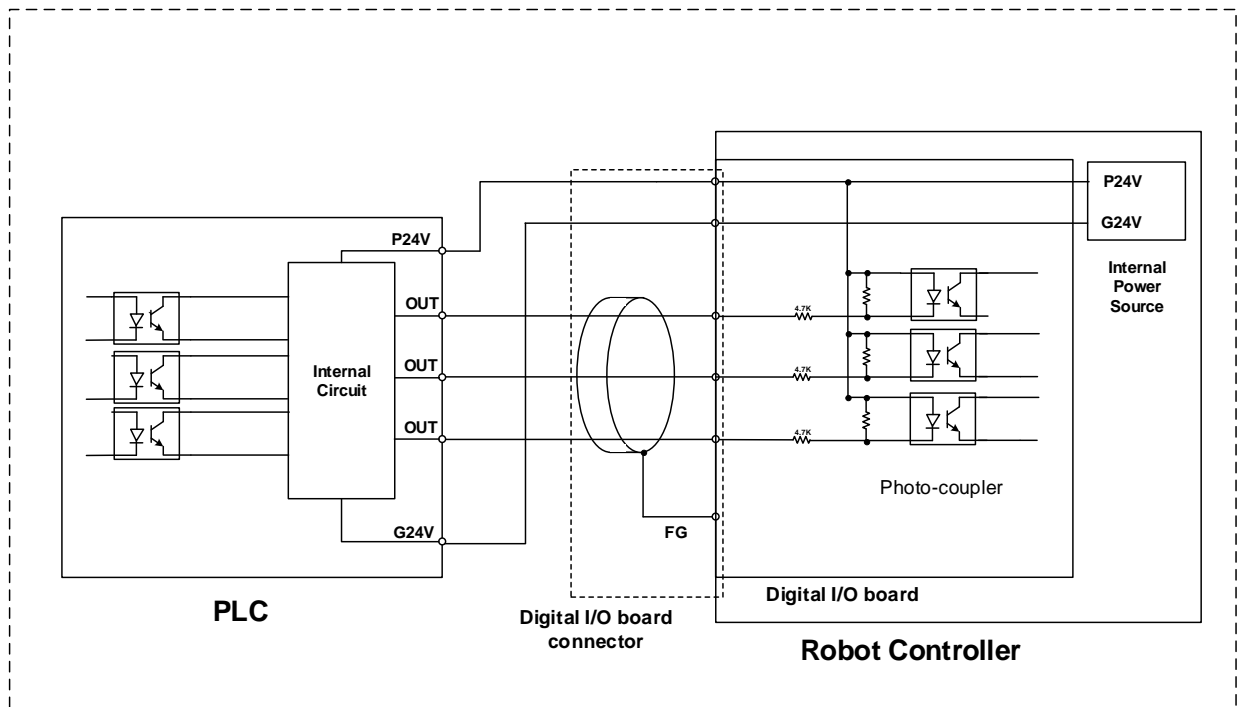
- ▶ Selecting External Power and Internal Power is optional.
- ▶ Do not use External Power and Internal Power simultaneously.
- ▶ Be sure to do the setting with the controller power OFF.

② Input/Output Interface Structure Diagram

■ Input Interface Structure Diagram

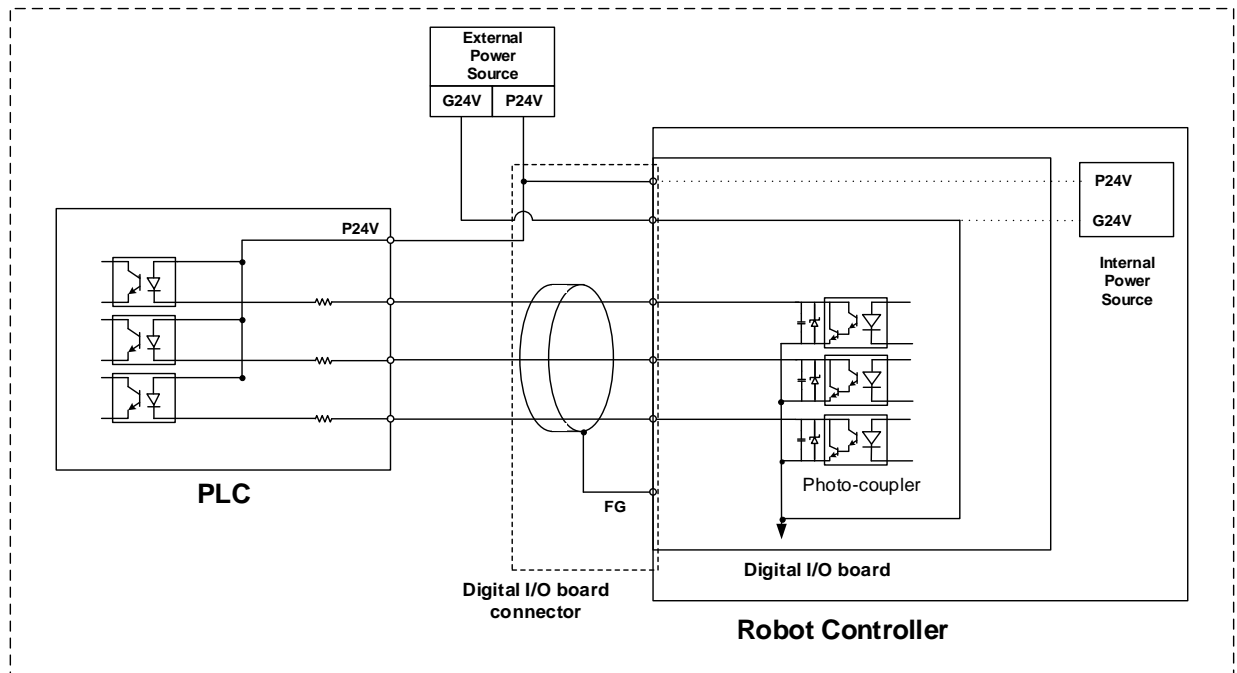


Input Circuit (NPN Type) in Using External Power

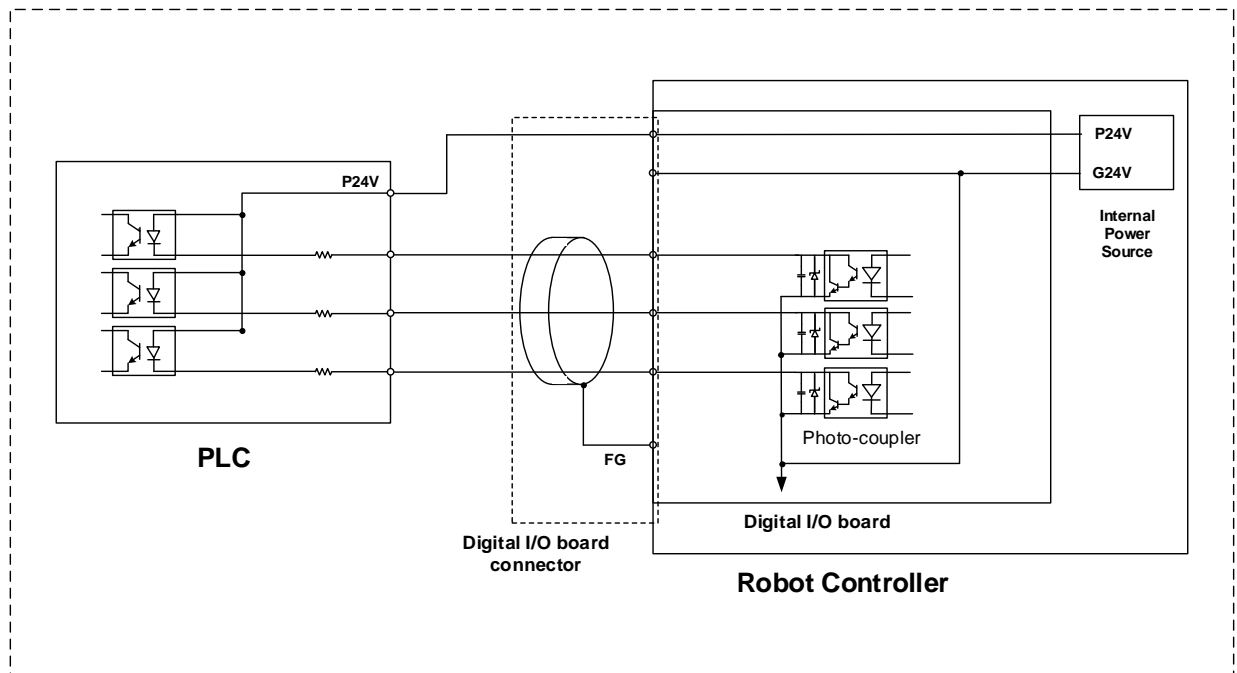


Using Internal Power (NPN Type)

■ Output Interface Structure Diagram



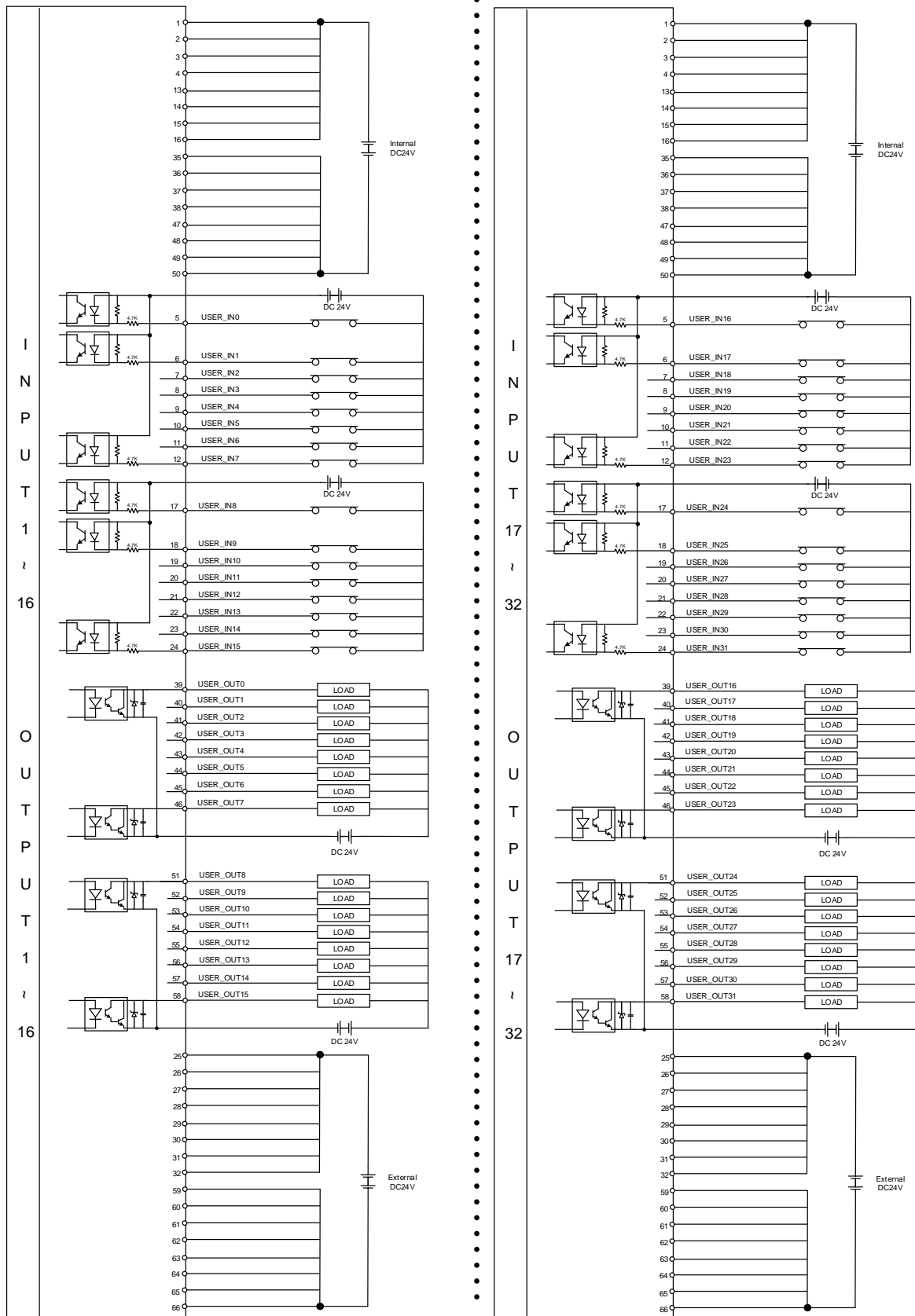
Output Circuit (NPN Type) in Using External Power



Output Circuit (NPN Type) in Using Internal Power



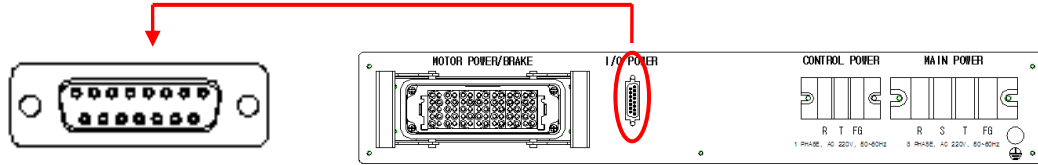
③ Block Diagram of DIO Board Input/Output Whole Circuit



(7) CN8(I/O POWER)

Refers to a Robot Sensor power Connector. Be sure to use CN8 when Sensor power capacity is large.

Controller Side Connector	DB-15SS(Misumi)
External Connector	DB-15SP(Misumi)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN3	I/O POWER	1	P24-01-04	Robot Sensor Power (G_DC24V)
		2	G24-01-04	
		3	-	
		4	-	
		5	-	
		6	-	
		7	-	
		8	-	
		9	-	
		10	-	
		11	-	
		12	-	
		13	-	
		14	P24-02-03	
		15	G24-02-03	



주의

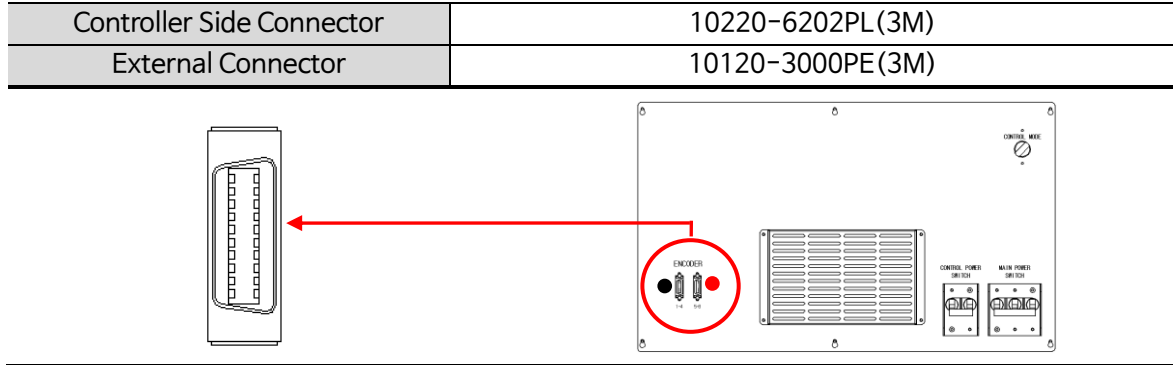
▶ Be sure to use SCREW products for HOOD in Safety OUT cable side connector.  
 \* Note .  
 1. The mark "-" means an unused pin.

2. I/O power is internal power to controller so external power connection is not allowed.
3. Use SAFETY-related signals only for user SAFETY power.

(8) CN9, CN10(ENCODER)

Refers to the interface for Motor Encoder connection.

The battery for Encoder's absolute position backup is attached to the robot mechanism.



When connecting the external cable to Encoder Connector, the color sticker next to Connector and the color of the shrink tube in the external Cable Connector part should match.

CN No	External Display (Color Classification)	Pin No	Signal Name	In-depth Description
CN14	ENCODER 1 ~ 4 (Black)	1	P5V(n)	n-axis P5V Power
		2	GND(n)	n-axis G5V Power
		3	PS(n)	n-axis Encoder Input +
		4	/PS(n)	n-axis Encoder Input -
		5	P5V(n+1)	n+1 axis P5V Power
		6	GND(n+1)	n-axis G5V Power
		7	PS(n+1)	n+1 axis Encoder Input +
		8	/PS(n+1)	n+1 axis Encoder Input -
		9	FG(n+1)	n-axis Motor Encoder Ground
		10	FG(n+1)	n+1 axis Motor Encoder Ground
CN15	ENCODER 5 ~ 8 (Red)	11	P5V(n+2)	n+2 axis P5V Power
		12	GND(n+2)	n+2 axis G5V Power
		13	PS(n+2)	n+2 axis Encoder Input +
		14	/PS(n+2)	n+2 axis Encoder Input -
		15	P5V(n+3)	n+3 axis P5V Power
		16	GND(n+3)	n+3 axis G5V Power
		17	PS(n+3)	n+3 axis Encoder Input +
		18	/PS(n+3)	n+3 axis Encoder Input -
		19	FG(n+2)	n+2 axis Motor Encoder Ground
		20	FG(n+3)	n+3 axis Motor Encoder Ground



주의

케이블 측 커넥터의 HOOD에 반드시 SCREW 나사의 제품을 사용해야 합니다.

Be sure to use SCREW products for HOOD in cable side connector.

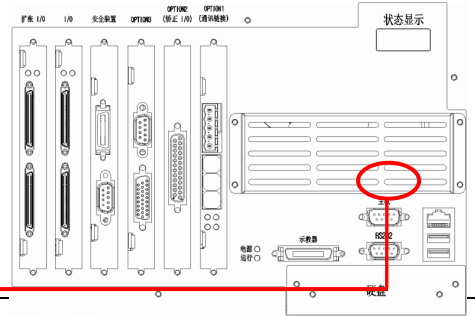
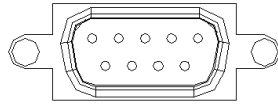
\*Note.

- 외부 Cable 제작 시 Connector 옆의 스티커의 색상과 일치하는 수축튜브를 사용하여 제작 하시기 바랍니다.

(9) CN11 (HOST)

Refers to a HOST interface between PC and controller.

Controller Side Connector	RDED-9P-LNA (HIROSE)
PC Side Connector	HDEB -9S (HIROSE)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN6	HOST	1	-	-
		2	RXD	HOST RS 232 Data Reception
		3	TXD	HOST RS 232 Data Transmission
		4	-	-
		5	GND	HOST RS 232 Ground
		6	-	-
		7	RTS	HOST RS 232 RTS
		8	CTS	HOST RS 232 CTS
		9	-	-

\*Note.

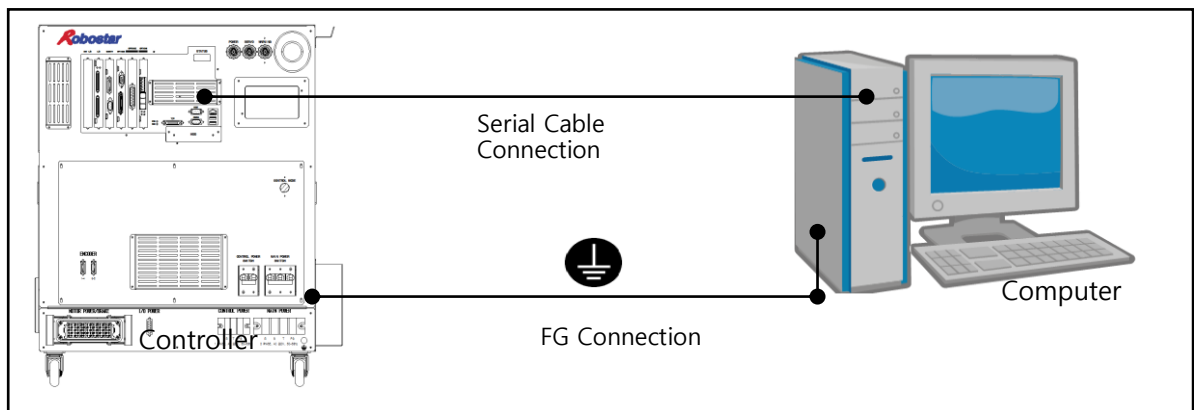
1. The mark "-" means an unused pin.



주의

To connect HOST, it is required to convert T/P to 7.ONLINE mode.

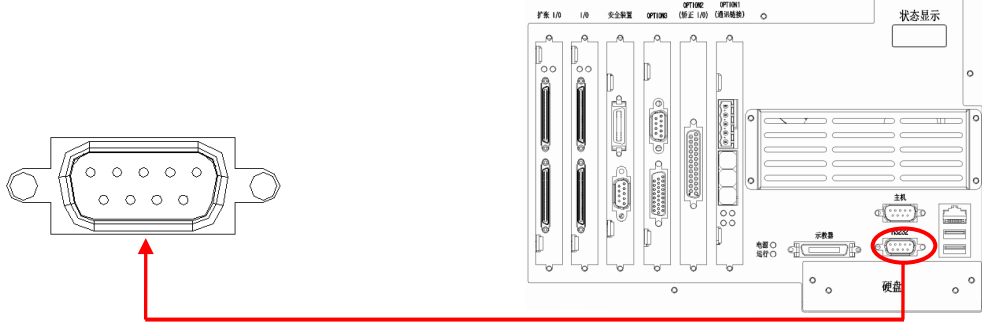
■ Cable Connection Diagram



(10) CN12(RS-232)

Refers to the upper equipment and serial communication interface.

Controller Side Connector	RDED-9P-LNA (HIROSE)
PC Side Connector	HDEB -9S (HIROSE)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	RS232	1	RC	-
		2	RXD-1	Channel 1 RS 232 Data Reception
		3	TXD-1	Channel 1 RS 232 Data Transmission
		4	-	-
		5	GND-1	Channel 1 RS 232 Ground
		6	RXD-2	Channel 2 RS 232 Data Reception
		7	TXD-2	Channel 2 RS 232 Data Transmission
		8	-	-
		9	GND-2	Channel 2 RS 232 Ground

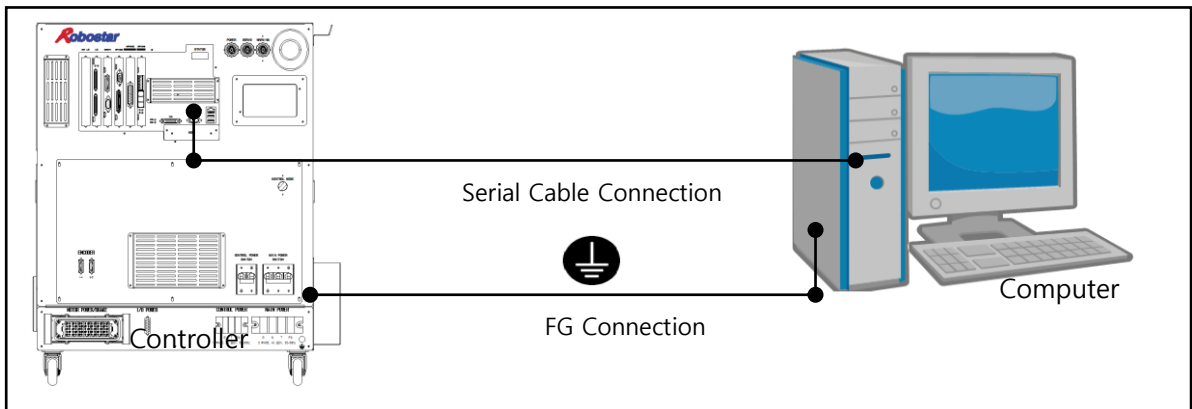
\*Note.

1. The mark "-" means an unused pin.



Upper RS-232 2 channels available for use.  
Use each RS-232 channel individually.

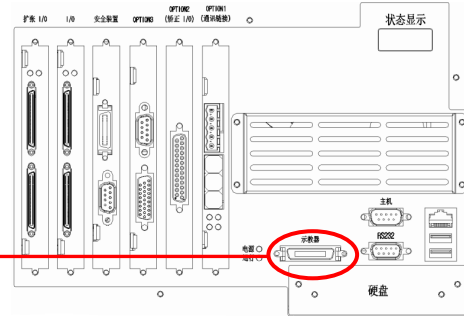
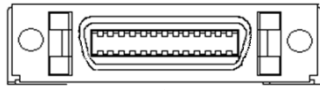
■ Cable Connection Diagram



(11) CN13(T/P)

Refers to the teach pendant interface.

Controller Side Connector	10236-52A2 (3M)
T/P Connector + Hood	10136-3000PE (3M)
T/P Cable Side Hood	10336-52A0-008 (3M)



CN No	External Display	Pin No	Signal	In-depth Description
CN7	T/P	1	G12V	T/P Power Ground
		2	G12V	T/P Power Ground
		3	G12V	T/P Power Ground
		4	GND	RS232 Ground
		5	GND	RS232 Ground
		6	Graphic T/P Open	Graphic T/P Connection Input
		7	T/P Open	T/P Connection Input
		8	T/P Mode	T/P Mode Change Input
		9	T/P DeadMan	T/P Deadman Input
		10	T/P EMG	T/P Emergency Stop NO Contact
		11	DeadMan 11	T/P Deadman Interlock NCContact 11
		12	DeadMan 12	T/P Deadman Interlock NCContact 12
		13	DeadMan 21	T/P Deadman Interlock NCContact 21
		14	DeadMan 22	T/P Deadman Interlock NCContact 22
		15	Mode NC 1	T/P Mode NC Contact 1
		16	Mode NC 2	T/P Mode NC Contact 2
		17	Mode NO 1	T/P Mode NO Contact 1
		18	Mode NO 2	T/P Mode NO Contact 2
		19	P12V	T/P Power 12V
		20	P12V	T/P Power 12V
		21	P24V	Graphic T/P Power 24V
		22	P24V	Graphic T/P Power 24V
		23	P24V	Graphic T/P Power 24V
		24	G24V	Graphic T/P Power Ground
		25	G24V	Graphic T/P Power Ground
		26	G24V	Graphic T/P Power Ground
		27	T/P RX	T/P RS232 Data Reception
		28	T/P TX	T/P RS232 Data Transmission
		29	Graphic T/P RD+	Graphic T/P Ethernet Data Reception +
		30	Graphic T/P RD-	Graphic T/P Ethernet Data Reception -
		31	Graphic T/P TD+	Graphic T/P Ethernet Data Transmission +

	32	Graphic T/P TD-	Graphic T/P Ethernet Data Transmission -
	33	EMG NC 11	T/P Emergency Stop NC Contact 11
	34	EMG NC 12	T/P Emergency Stop NC Contact 12
	35	EMG NC 21	T/P Emergency Stop NC Contact 21
	36	EMG NC 22	T/P Emergency Stop NC Contact 22

\*Note.

1. The mark "-" means an unused pin.



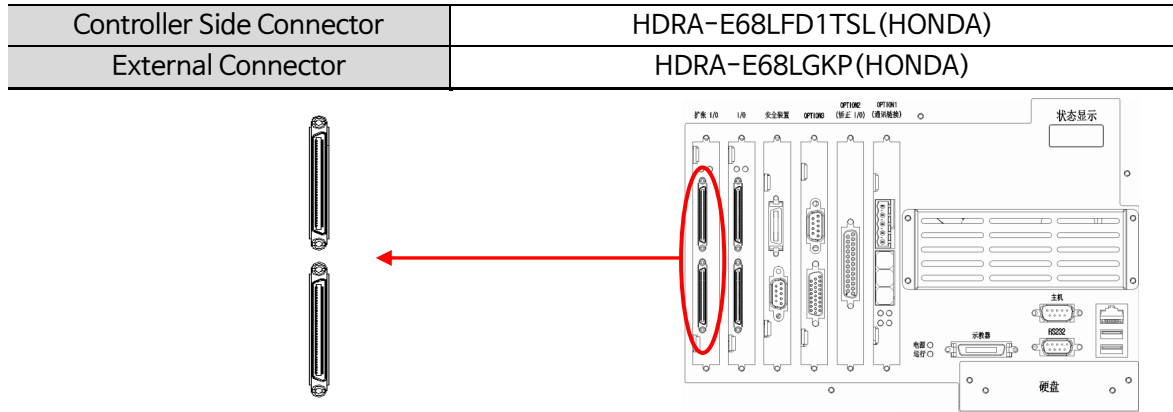
주의

▶ When the controller boots and T/P Connector is removed, the controller power should be OFF→ON. (Applies in installing Safety Module.)

## 4.1.3Option

## (1) CN14,CN15(EXT-I/O)

Refers to the interface for an extension robot I/O(Sensor) connection. Provided for use when basic I/O is insufficient. Extension I/O includes providing CN14, CN15(Input 16 points, Output 16 points per Connector).



Extension I/O(CN14, CN15) is all the same as basic I/O(CN6, CN7), Pin Map and power setting method and structure.

For pin Map, setting method and structure, refer to 4.1.2 CN6, CN7(I/O).



Be sure to use SCREW products for HOOD in cable side connector.

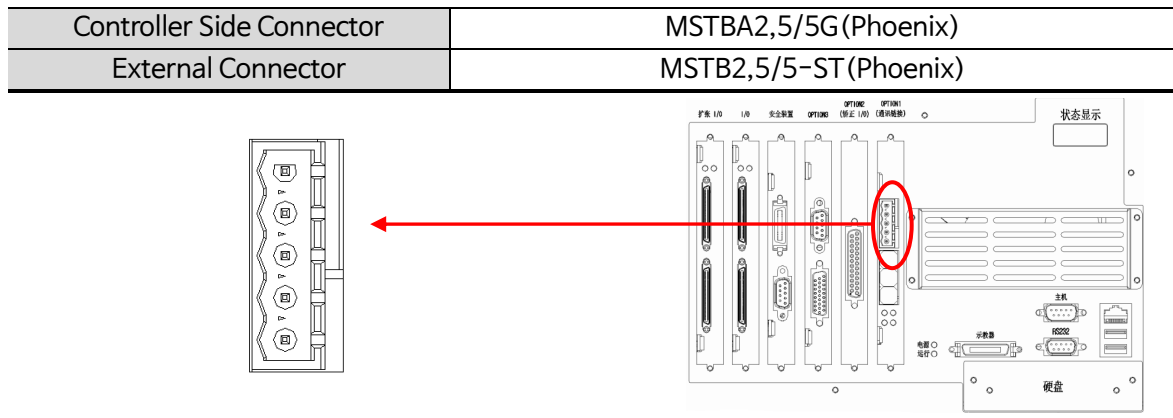
\* Note .

1. The mark "-" means an unused pin.
2. For user I/O power (Internal DC24V), use small-capacity Sensor power. (ex. Detect Sensor)
3. When using external power, user I/O power (Internal DC24V) power is not allowed to be used.
4. I/O basically utilizes internal(controller) power. For use of external power, refer to '4.1.2. CN6,CN7(I/O)' IO Board Setting Description.
5. Produce an external Cable by using the shrink tube that matches the color of the sticker next to Connector as an identifier.



(2) CN16(CC-LINK)

Refers to the interface that communicates with upper control (PC, PLC).



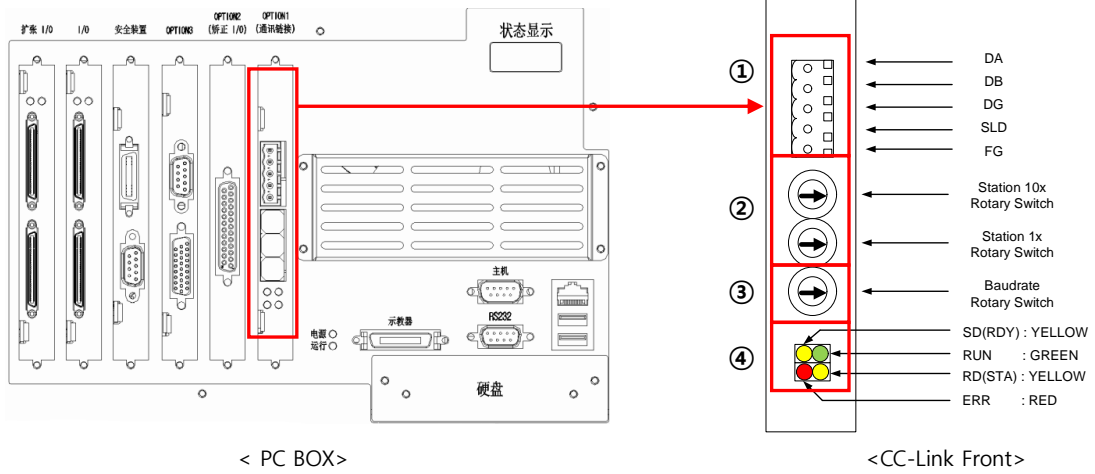
■ CC-Link Interface Description

CN No	External Display	Signal Name	In-depth Description (Cable Color)
CN11	CCLINK	DA	Blue
		DB	White
		DG	Yellow
		FG	Shield

■ CC-Link Specifications

Function	Description
Station Type	- Remote device station
Response Version	- Ver 1.1
Number of Stations Possessed	- 4 stations
Access	- Dual port memory
Max Transfer Rate	- 10Mbps
Interface	-RS485
Plug	-Combicon 5-pin
Communication Controller	-MFP3
Data Connection	- Polling
Data	- Max 128 points I/O data -16 word I/O
Configuration	- From jumper or application program
LED Display	-RDY, RUN, STA, ERR
Power Consumption	5V ±5% / 500mA
External Dimension	134 x 107 x 20mm
Operating Temperature	0~50°C

■ CC-Link Setting (Bus Address and Baudrate)



Switch	Valid Value
Bus address(1,2)	1 ~ 64
Baud rate(3)	0 ~ 4

(Station occupied: 4 stations)

■ Baudrate Setting

External Display	Switch	Baudrate
BAUD	0	156Kbps
	1	625Kbps
	2	2.5Mbps
	3	5Mbps
	4	10Mbps
	5~E	Invalid
	F	Baud rate is taken over from the configuration file

■ Status Display

- Refer to CC-Link Manual.

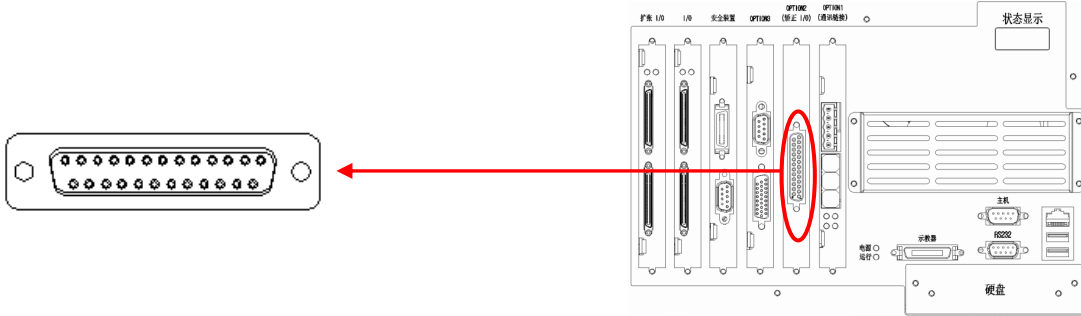
\* Note .

1. Used a dedicated CC-Link Cable for CC-Link connection Cable.

(3) CN17(LATCH I/O)

Refers to the interface for Latch functions such as robot Align, Mapping.  
This is an option so make a request when deciding specifications.

Controller Side Connector	DB-25SS(Misumi)
External Connector	DB-25SP(Misumi)



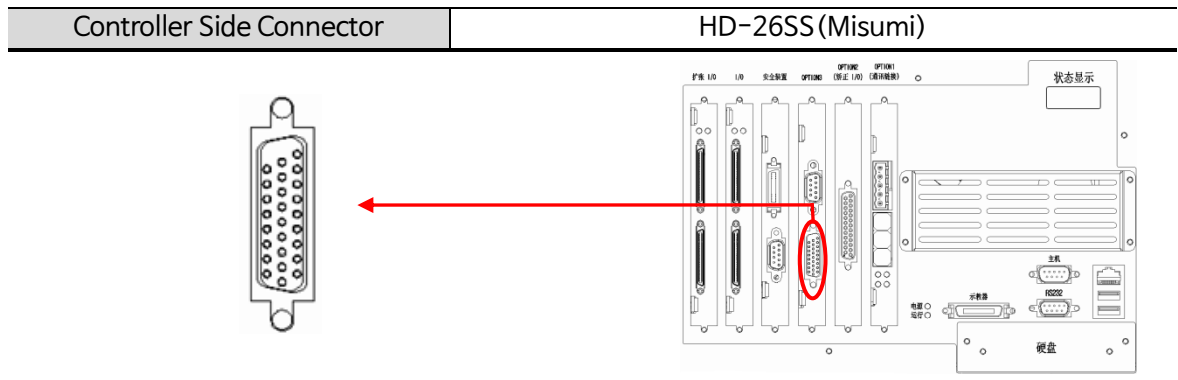
CN No	External Connector	Notes
CN13	LATCH	Be sure to use SCREW products for HOOD in cable side connector.
		2 G24_AL User Sensor power (Internal DC 24V)
		3 * Note -
		4 L/AL 1 L Align Signal 1
		5 L/AL 2 L Align Signal 2
		6 3. User Sensor power is internal (controller) power.
		7 The sensor using external power cannot be used.
		8 R/AL 1 R Align Signal 1
		9 R/AL 2 R Align Signal 2
		10 -
		11 -
		12 T/AL 1 T Align Signal 1
		13 T/AL 2 T Align Signal 2
		14~25 -

(4) CN18(OPTION3) - CS Version(Unit)

For Pin Map, setting method and structure, refer to CS Version(Unit) in 4.1.2  
CN4(Safety IN).

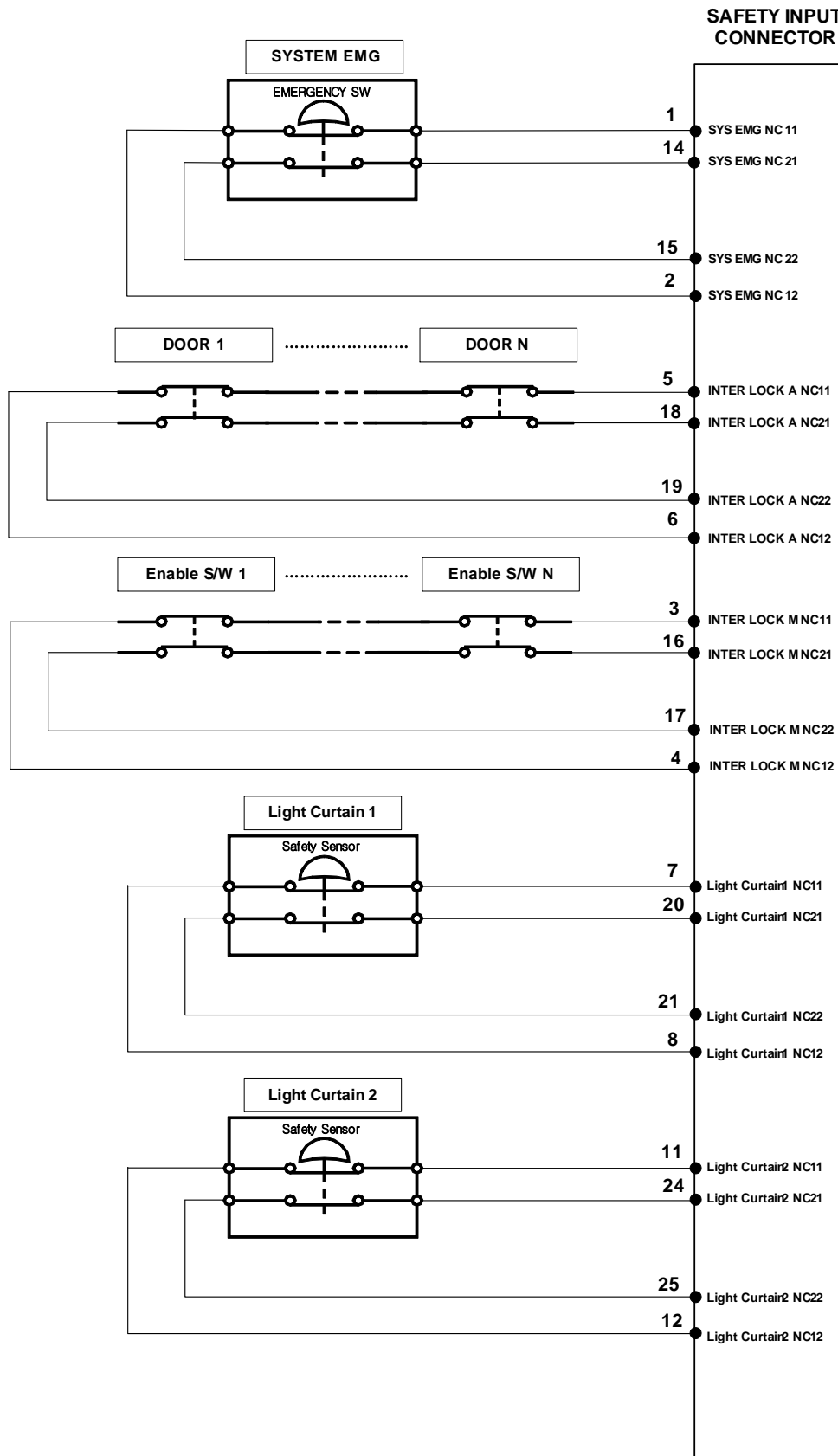
(5) CN19(OPTION3) - CS Version(Unit)

Refers to the external safety interface which varies depending on specifications.



CN No	External Display	Pin No	Signal Name	In-depth Description
CN19	OPTION3	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	-	-
		10	-	-
		11	LIGHT CURTAIN2 NC11	Ankle Detection2 NC Contact 11
		12	LIGHT CURTAIN2 NC12	Ankle Detection2 NC Contact 12
		13	P24V_S	Safety P24V Power
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	-	-
		23	-	-
		24	LIGHT CURTAIN2 NC21	Ankle Detection2 NC Contact 21
		25	LIGHT CURTAIN2 NC22	Ankle Detection2 NC Contact 22
		26	G24V_S	Safety G24V Power

■ Configuration Diagram of Safety Input Interlock



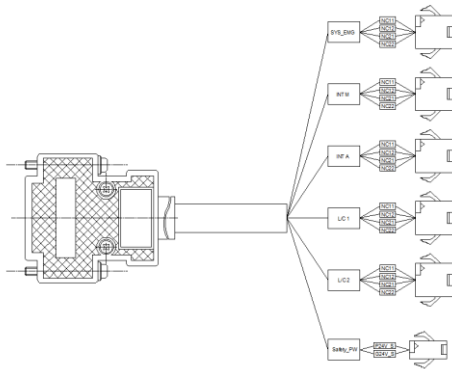
- ▶ System EMG, Light Curtain, Interlock A, and Interlock B should have NC11, NC12, NC21 and NC22 contacts simultaneously turn ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain operates in controller's Manual/Auto mode.
- ▶ Interlock A operates only in controller's Auto Mode.
- ▶ Interlock M operates only in controller's Manual Mode.



\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety In Dummy Connector



▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.

▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector : SMP-04, SMP-02- JST).

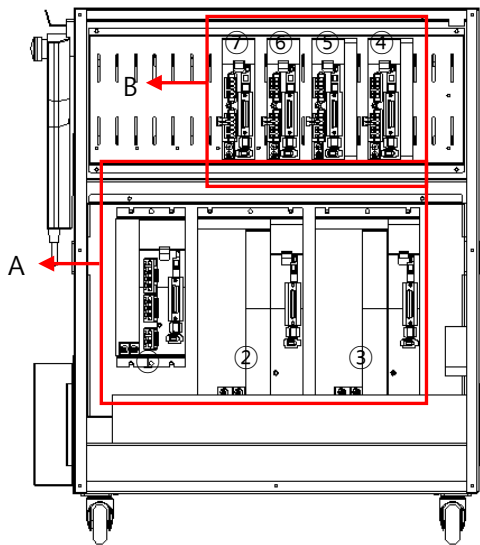
▶ When the connection is wrongly made, it may cause an error in controller operation.



### 4.1.4 Servo Driver Capacity and Arrangement

Refers to examples of Servo Driver capacity and arrangement for 5.5G Panel Robot (6 axes). Servo Driver capacity and arrangement vary depending on Robot specifications.

## 7 Axis Robot Controller



Classification	No	Classification	Description	Capacity
A	①	1 Axis(T)	Rotation Axis	2kW
	②	2 Axis(Z)	Up, down axis	4kW
	③	5 Axis(X)	Driving Axis	5kW
B	④	3 Axis(R1)	Arm 1	400W
	⑤	4 Axis(R2)	Arm 2	400W
	⑥	6 Axis(R3)	Arm 3	400W
	⑦	7 Axis(R4)	Arm 4	400W
	⑧	8 Axis(Q1)	R1 Variable	100W
	⑨	9 Axis(V1)	R1 Hand Variable	100W



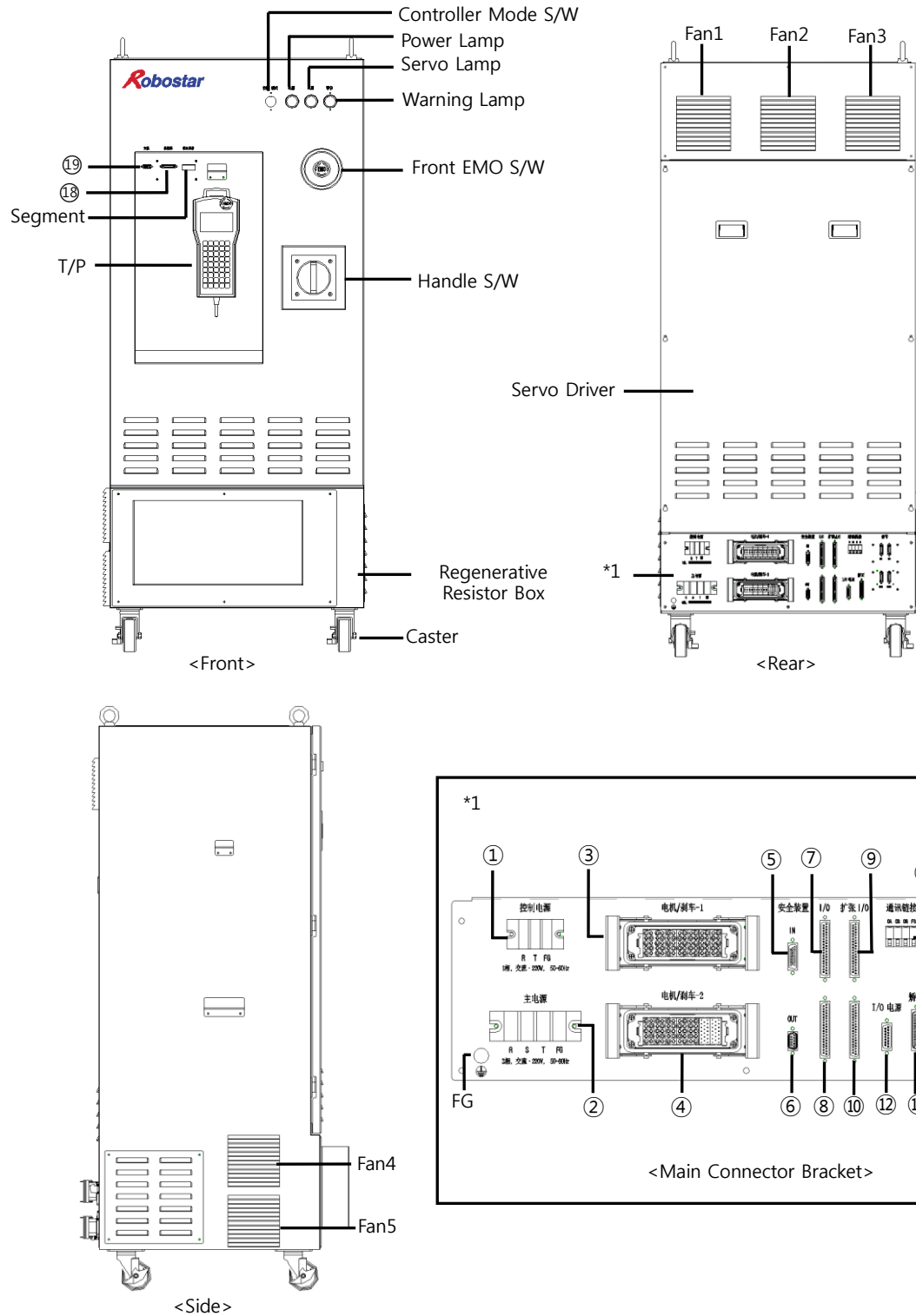
주의

- ▶ Classification A enables installation up to 5kW.
- ▶ Classification B enables installation up to 750W.
- ▶ Installation enables up to 8 axes.
- ▶ Make an inquiry before applying a Robot with new specifications.

## 4.2 L Type (Large Size)

### 4.2.1 Controller Connector, Names and Description of Main Components


The figure below shows names of each component in the controller exterior.



## (1) Connector Description

No.	Connector No.	External Display (Name)	Description	
①	CN1	CONTROL POWER	AC 220V 1Phase, 50-60Hz, Control Power Input	
②	CN2	MAIN POWER	AC 220V 3Phase, 50-60Hz, Motor Input Power	
③	CN3	MOTOR/BRAKE-1	Motor Drive, Brake Power Output Connector	
④	CN4	MOTOR/BRAKE-2		
⑤	CN5	SAFETY	IN	External Safety Input Interface Connector
⑥	CN6		OUT	External Safety Output Interface Connector
⑦	CN7	I/O		Basic Robot Sensor Input/Output Connector
⑧	CN8			
⑨	CN9	EXT I/O		Extension Robot Sensor Input/Output Connector
⑩	CN10			
⑪	CN11	CCLINK	CC-Link Connector	
⑫	CN12	I/O/PW	Robot Sensor Power Connector	
⑬	CN13	LATCH	Latch Function Input Connector (Align, Mapping)	
⑭	CN14	ENCODER	1~4	Motor Encoder Connector
⑮	CN15		5~8	
⑯	CN16		9~12	
⑰	CN17		13~16	
⑱	CN18	HOST	Host Connector	
⑲	CN19	T/P	T/P Connector	

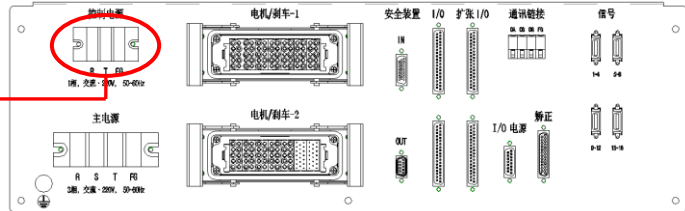
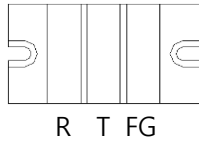
## (2) Description of Main Components

Names	External Display	Description
Power Lamp	POWER	Main Power Lamp(White)
Servo Lamp	SERVO	Servo Driver Ready Lamp(Green)
Warning Lamp	WARNIGN	Servo Drive Warning Lamp(Red) - for LD Version
Controller Mode S/W	-	Controller Mode S/W - for CS Version
Front EMO S/W	-	Front Emergency Stop S/W
7-Segment	STATUS	Status Display Segment
Handle S/W	-	Control Power S/W
T/P	-	Teach Pendant
Regenerative Resistor	-	Regenerative Resistor Installation Unit
Servo Driver	-	Servo Driver Installation Unit
Fan 1, 2, 3	-	Controller Internal Fan
Fan 4, 5	-	Regenerative Resistor Fan
FG Terminal		FG(Frame Ground) Connection Terminal
Caster	-	Mobile Wheel

### 4.2.2 Connector In-depth Description

#### (1) CN1 (CONTROL POWER)

Controller Side Connector	SL3T (Seoil Electronics Co., Ltd)
Robot Cable Side Connector	8Ø - M5 Ring Terminal



CN No	External Display	Power Display	In-depth Description
CN1	CONTROL POWER	R	AC220V ± 10%, 50-60Hz Input
		T	AC220V ± 10%, 50-60Hz Input
		FG	Frame Ground

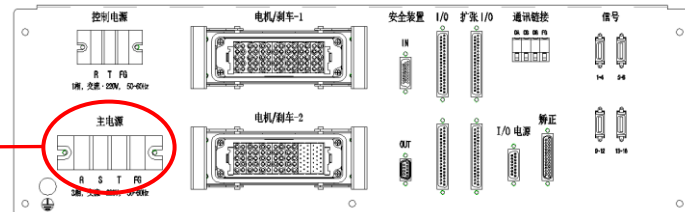
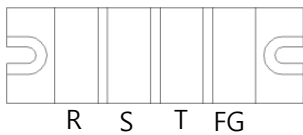


경고

In case the robot cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.

#### (2) CN2 (MAIN POWER)

Controller Side Connector	SL6T (Seoil Electronics Co., Ltd)
Robot Cable Side Connector	10Ø - M6 Ring Terminal



CN No	External Display	Power Display	In-depth Description
CN2	MAIN POWER	R	AC220V ± 10%, 50-60Hz Input
		S	AC220V ± 10%, 50-60Hz Input
		T	AC220V ± 10%, 50-60Hz Input
		FG	Frame Ground



경고

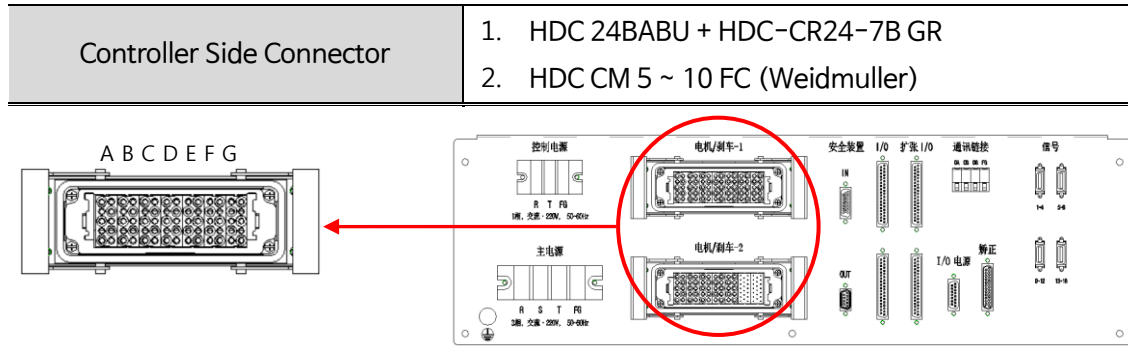
In case the robot cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.

(3) CN3, CN4 (MOTOR/BRAKE-1, 2)

Refers to the interface for a motor power and a brake.

Depending on Robot situations, MOTOR/BRAKE-1 and MOTOR/BRAKE-2 are used.

The table below shows an example of Q4 Robot.



■ Description of Motor/Brake Interface

CN No	External Display	Frame	Pin No	Signal Name	In-depth Description
CN3	MOTOR/BRAKE-1	A	1	U(T)	T-axis Motor 'U' Phase
			2	V(T)	T-axis Motor 'V' Phase
			3	W(T)	T-axis Motor 'W' Phase
			4	FG(T)	T-axis Motor Ground
			5	-	-
			6	U(T)	T-axis Motor 'U' Phase
			7	V(T)	T-axis Motor 'V' Phase
			8	W(T)	T-axis Motor 'W' Phase
			9	FG(T)	T-axis Motor Ground
			10	-	-
		B	1	U(Z)	Z-axis Motor 'U' Phase
			2	V(Z)	Z-axis Motor 'V' Phase
			3	W(Z)	Z-axis Motor 'W' Phase
			4	FG(Z)	Z-axis Motor Ground
			5	BK+(Z)	Z-axis Motor BRAKE +
			6	U(Z)	Z-axis Motor 'U' Phase
			7	V(Z)	Z-axis Motor 'V' Phase
			8	W(Z)	Z-axis Motor 'W' Phase
			9	FG(Z)	Z-axis Motor Ground
			10	BK-(Z)	Z-axis Motor BRAKE -
		C	1	U(R1)	R1-axis Motor 'U' Phase
			2	V(R1)	R1-axis Motor 'V' Phase
			3	W(R1)	R1-axis Motor 'W' Phase
			4	FG(R1)	R1-axis Motor Ground
			5	-	-
			6	U(R2)	R2-axis Motor 'U' Phase
			7	V(R2)	R2-axis Motor 'V' Phase
8	W(R2)		R2-axis Motor 'W' Phase		
9	FG(R2)		R2-axis Motor Ground		

		10	-	
D		1	U(X)	T-axis Motor 'U' Phase
		2	V(X)	T-axis Motor 'V' Phase
		3	W(X)	T-axis Motor 'W' Phase
		4	FG(X)	T-axis Motor Ground
		5	-	-
		6	U(X)	T-axis Motor 'U' Phase
		7	V(X)	T-axis Motor 'V' Phase
		8	W(X)	T-axis Motor 'W' Phase
		9	FG(X)	T-axis Motor Ground
		10	-	-
E	1	Motor Power Spare	Spare	
F		2	V(R3)	R3-axis Motor 'V' Phase
		3	W(R3)	R3-axis Motor 'W' Phase
		4	FG(R3)	R3-axis Motor Ground
		5	-	-
		6	U(R4)	R3-axis Motor 'U' Phase
		7	V(R4)	R3-axis Motor 'V' Phase
		8	W(R4)	R3-axis Motor 'W' Phase
		9	FG(R4)	R3-axis Motor Ground
		10	-	-
	G	1~10	Motor Power Spare	Spare
A		1	U(Q1)	Q1-axis Motor 'U' Phase
		2	V(Q1)	Q1-axis Motor 'V' Phase
		3	W(Q1)	Q1-axis Motor 'W' Phase
		4	FG(Q1)	Q1-axis Motor Ground
		5	-	-
		6	U(V1)	V1-axis Motor 'U' Phase
		7	V(V1)	V1-axis Motor 'V' Phase
		8	W(V1)	V1-axis Motor 'W' Phase
		9	FG(V1)	V1-axis Motor Ground
		10	-	-
B		1	U(Q2)	Q2-axis Motor 'U' Phase
		2	V(Q2)	Q2-axis Motor 'V' Phase
		3	W(Q2)	Q2-axis Motor 'W' Phase
		4	FG(Q2)	Q2-axis Motor Ground
		5	-	-
		6	U(V2)	V2-axis Motor 'U' Phase
		7	V(V2)	V2-axis Motor 'V' Phase
		8	W(V2)	V2-axis Motor 'W' Phase
		9	FG(V2)	V2-axis Motor Ground
		10	-	-
C		1	U(Q3)	Q3-axis Motor 'U' Phase
		2	V(Q3)	Q3-axis Motor 'V' Phase
		3	W(Q3)	Q3-axis Motor 'W' Phase
		4	FG(Q3)	Q3-axis Motor Ground
		5	-	-
		6	U(V3)	V3-axis Motor 'U' Phase
		7	V(V3)	V3-axis Motor 'U' Phase
		8	V(V3)	V3-axis Motor 'V' Phase
		9	W(V3)	V3-axis Motor 'W' Phase

CN4

MOTOR/BRAKE-  
2

	10	FG(V3)	V3-axis Motor Ground
D	1	U(Q4)	Q4-axis Motor 'U' Phase
	2	V(Q4)	Q4-axis Motor 'V' Phase
	3	W(Q4)	Q4-axis Motor 'W' Phase
	4	FG(Q4)	Q4-axis Motor Ground
	5	-	-
	6	U(V4)	V4-axis Motor 'U' Phase
	7	U(V4)	V4-axis Motor 'U' Phase
	8	V(V4)	V4-axis Motor 'V' Phase
	9	W(V4)	V4-axis Motor 'W' Phase
	10	FG(V4)	V4-axis Motor Ground
E	1~10	Motor Power Spare	Spare
F	1~20	Motor Power Spare	Spare(Use a 20Pin Connector to tell from CN3)
G	1~20	Motor Power Spare	

\*Note.

1. The mark "-" means an unused pin.
2. Connector specifications and Pin Map may vary depending on Robot specifications.
3. Depending on Robot specifications, the Cover is installed in Motor/Brake-2 Connector when using Motor/Brake-1 Connector only.

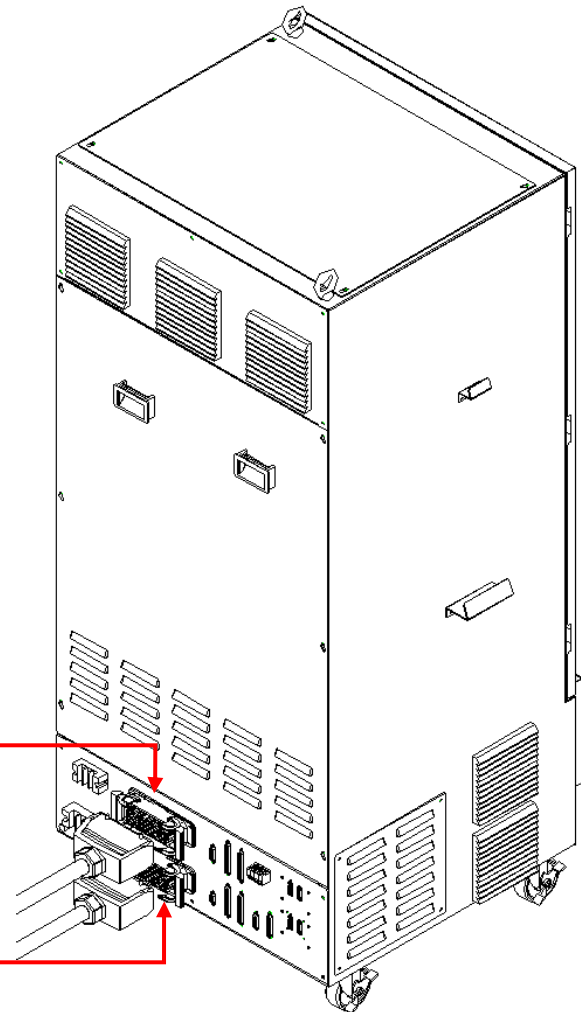
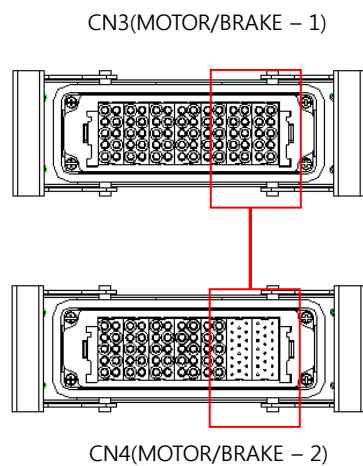
### ■ How to connect Motor/Brake interface and precautions

\* Correct method of connection

1. Connect the external cable connector and the controller connector in the same direction.
2. When not being inserted, move slightly from side to side and push it in.

\* Precautions

Do not mount by tilting either to the left or to the right. If mounted to the right or to the left with force, the pin of the external Cable Connector may bend.



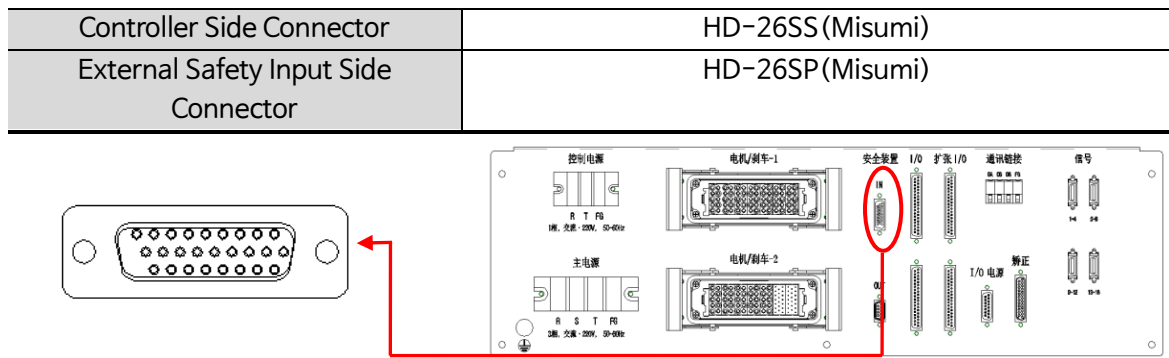
경고

- ▶ In case the connector on the robot power cable is wrongly connected, a circuit breaker shuts off or the controller may face internal damage.
- ▶ After connecting the motor cable, be sure to turn off the controller lever. When the cable is removed while the robot is working, it may bring a critical danger.
- ▶ When using CN3 and CN4 simultaneously, configure CN3 and CN4 connectors differently to prevent the Connectors from making a connection in turn due to the user's mistake. (Different configuration of CN3 F,G Frame(10Pin) and CN4 F,G Frame(20Pin) Connector)



(4) CN5(SAFETY IN)

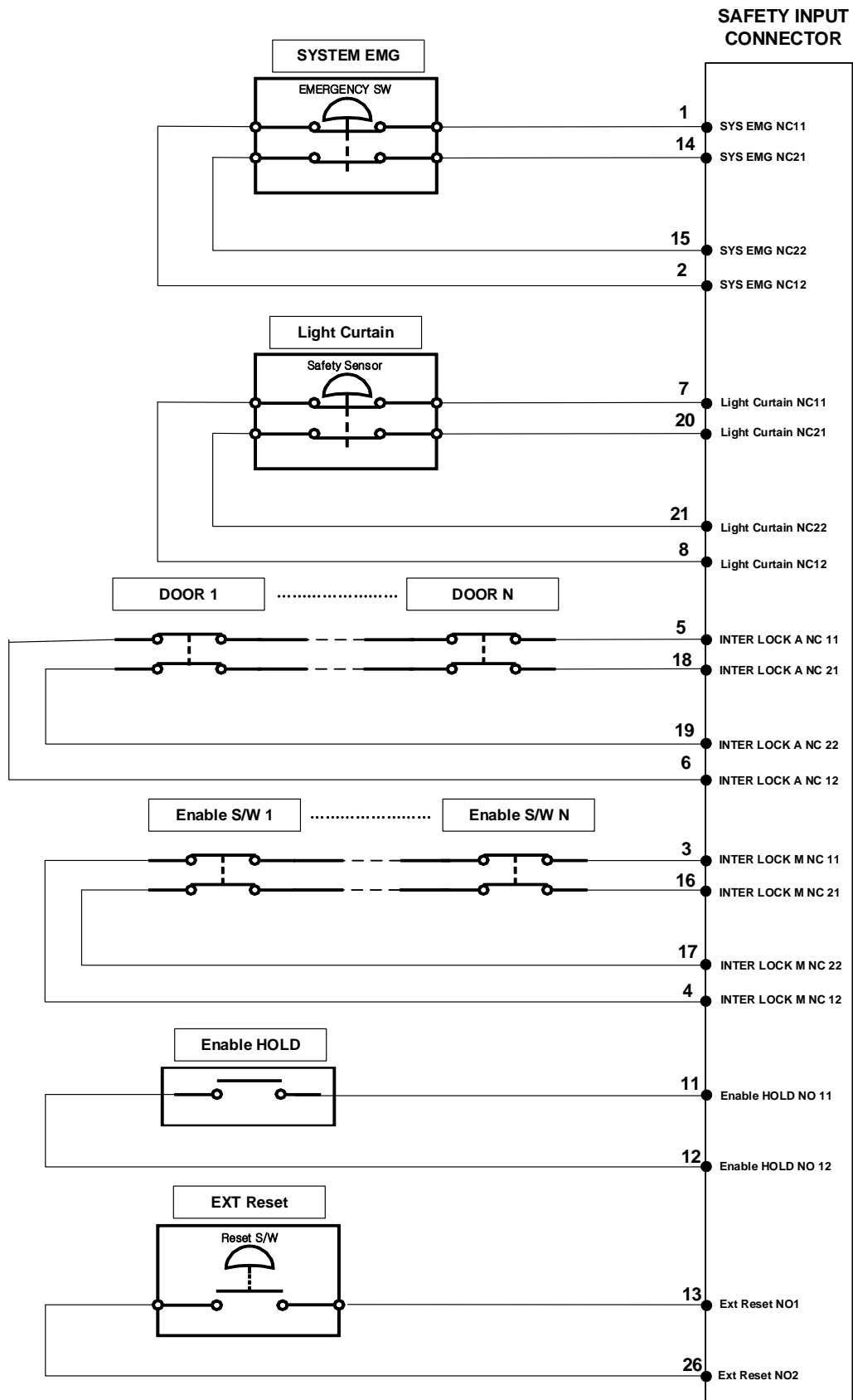
Refers to the external safety interface which varies depending on specifications.



① SD Version

CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	SAFETYIN	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	INDEX AUTO NC1	Top Auto Mode NC Contact 1
		10	INDEX AUTO NC2	Top Auto Mode NC Contact 2
		11	ENABLE HOLD1	Enable System HOLD NO Contact 11
		12	ENABLE HOLD2	Enable System HOLD NO Contact 12
		13	EXT RESET NO1	External Reset NO Contact 1
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	INDEX MANUAL NO1	Top Manual Mode NO Contact 1
		23	INDEX MANUAL NO2	Top Manual Mode NO Contact 2
		24	P24V_S	Safety P24V Power
		25	G24V_S	Safety G24V Power
		26	EXT RESET NO2	External Reset NO Contact 2

■ Configuration Diagram of Safety Input Interlock





주의

- ▶ System EMG, Light Curtain, Interlock A, and Interlock B should have NC11, NC12, NC21 and NC22 contacts simultaneously turn ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain operates in controller's Manual/Auto mode.
- ▶ Interlock A operates in controller's Auto Mode only.
- ▶ Interlock M operates in controller's Manual Mode only.

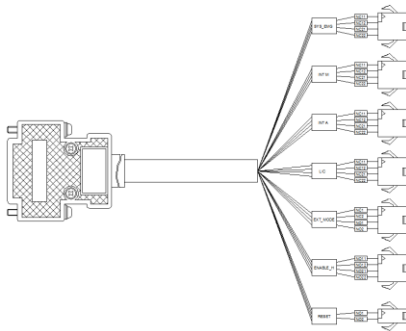
\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety In Dummy Connector



주의

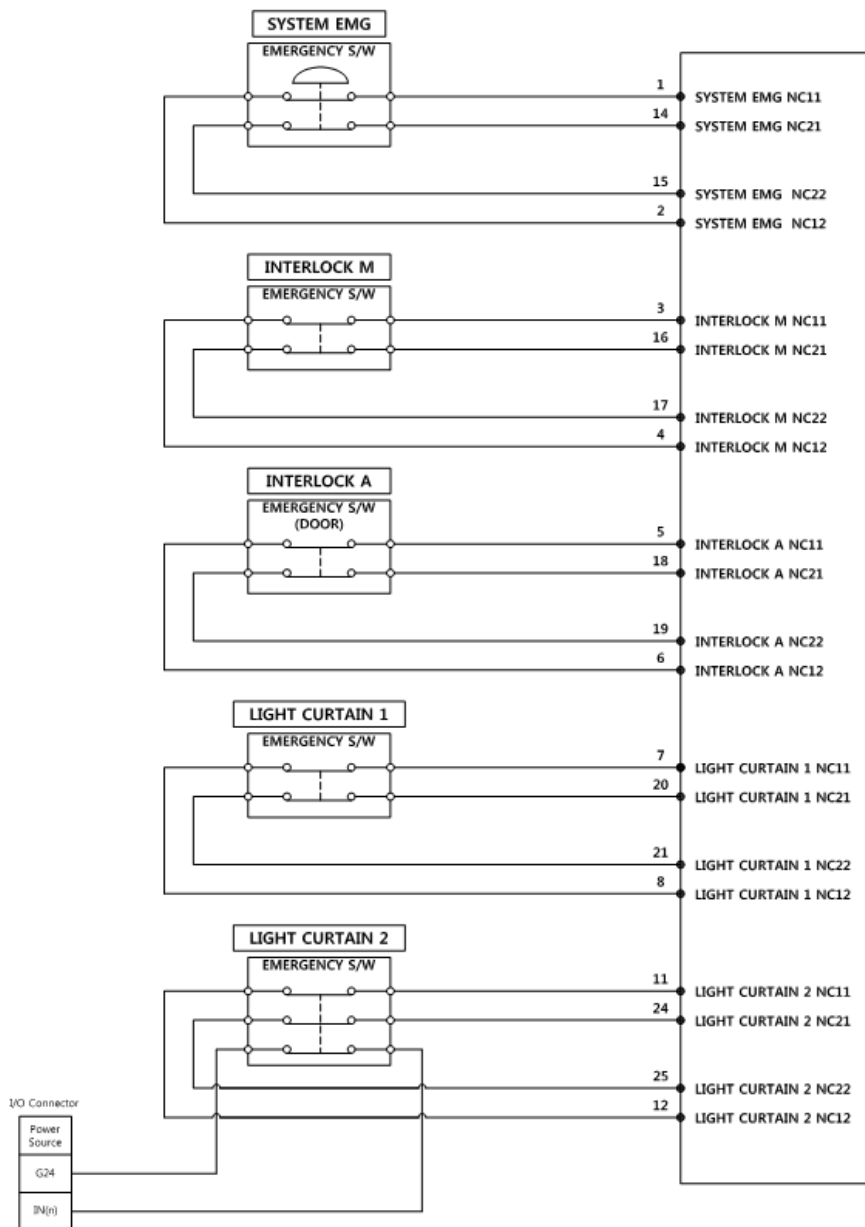


- ▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.
- ▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector : SMP-04, SMP-02- JST).
- ▶ When the connection is wrongly made, it may cause an error in controller operation.

## ② LD Version

CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	SAFETYIN	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	-	-
		10	-	-
		11	LIGHT CURTAIN2 NC11	Ankle Detection2 NC Contact 11
		12	LIGHT CURTAIN2 NC12	Ankle Detection2 NC Contact 12
		13	P24V_S	Safety P24V Power
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	-	-
		23	-	-
		24	LIGHT CURTAIN2 NC21	Ankle Detection2 NC Contact 21
		25	LIGHT CURTAIN2 NC22	Ankle Detection2 NC Contact 22
		26	G24V_S	Safety G24V Power

■ Configuration Diagram of Safety Input Interlock



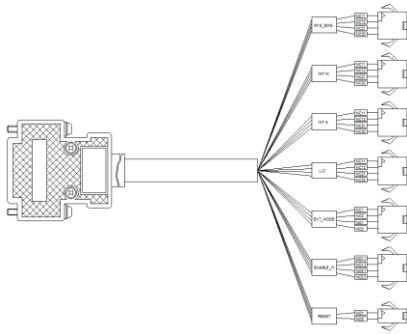
- ▶ All Safety Inputs in Safety Input Block diagram should have NC11, NC12, NC21 and NC22 contacts simultaneously turn ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain 1, 2 operate in controller's Manual/Auto mode.
- ▶ Interlock A operates in controller's Auto Mode only.
- ▶ Interlock M operates in controller's Manual Mode only.
- ▶ When using Light Curtain 2, Light Curtain Sensor's N.O contact(Monitoring contact) should be wired to controller I/O.

\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety In Dummy Connector

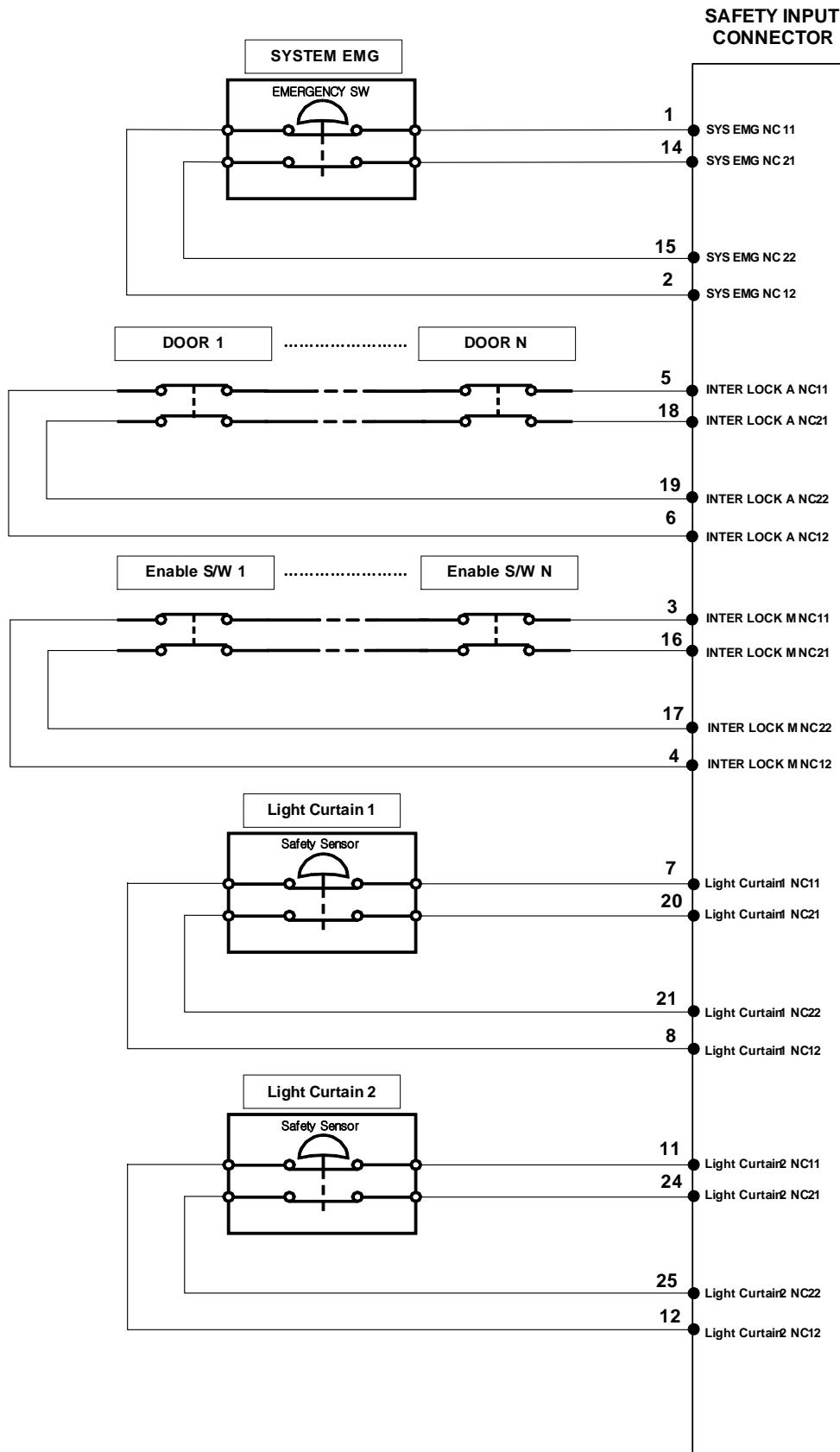




- ▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.
- ▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector : SMP-04, SMP-02- JST).
- ▶ When the connection is wrongly made, it may cause an error in controller operation.

## ③ CS Version (Unit)

CN No	External Display	Pin No	Signal Name	In-depth Description
CN5	SAFETYIN	1	SYSTEM_EMG NC11	User Emergency Stop NC Contact 11
		2	SYSTEM_EMG NC12	User Emergency Stop NC Contact 12
		3	INTERLOCK_M NC11	Manual Mode Interlock NC Contact 11
		4	INTERLOCK_M NC12	Manual Mode Interlock NC Contact 12
		5	INTERLOCK_A NC11	Auto Mode Interlock NC Contact 11
		6	INTERLOCK_A NC12	Auto Mode Interlock NC Contact 12
		7	LIGHT CURTAIN1 NC11	Ankle Detection NC Contact 11
		8	LIGHT CURTAIN1 NC12	Ankle Detection NC Contact 12
		9	-	-
		10	-	-
		11	LIGHT CURTAIN2 NC11	Ankle Detection2 NC Contact 11
		12	LIGHT CURTAIN2 NC12	Ankle Detection2 NC Contact 12
		13	P24V_S	Safety P24V Power
		14	SYSTEM_EMG NC21	User Emergency Stop NC Contact 21
		15	SYSTEM_EMG NC22	User Emergency Stop NC Contact 22
		16	INTERLOCK_M NC21	Manual Mode Interlock NC Contact 21
		17	INTERLOCK_M NC22	Manual Mode Interlock NC Contact 22
		18	INTERLOCK_A NC21	Auto Mode Interlock NC Contact 21
		19	INTERLOCK_A NC22	Auto Mode Interlock NC Contact 22
		20	LIGHT CURTAIN1 NC21	Ankle Detection NC Contact 21
		21	LIGHT CURTAIN1 NC22	Ankle Detection NC Contact 22
		22	-	-
		23	-	-
		24	LIGHT CURTAIN2 NC21	Ankle Detection2 NC Contact 21
		25	LIGHT CURTAIN2 NC22	Ankle Detection2 NC Contact 22
		26	G24V_S	Safety G24V Power



■ Configuration Diagram of Safety Input Interlock





주의

- ▶ System EMG, Light Curtain, Interlock A, and Interlock B should have NC11, NC12, NC21 and NC22 contacts simultaneously turn ON-OFF. (Use of 2B)
- ▶ System EMG operates in controller's Manual/Auto mode.
- ▶ Light Curtain operates in controller's Manual/Auto mode.
- ▶ Interlock A operates in controller's Auto Mode only.
- ▶ Interlock M operates in controller's Manual Mode only.

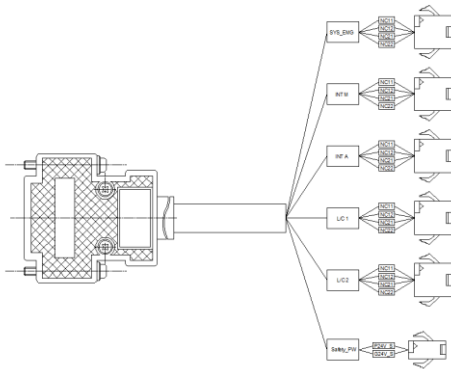
\* Note .

- Safety Interlock configuration may vary upon request.

■ Safety In Dummy Connector



주의

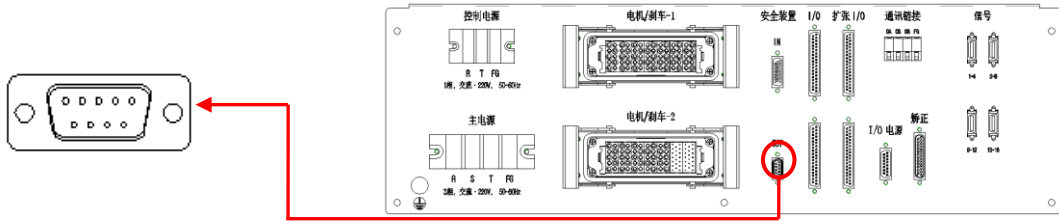


- ▶ When corresponding safety functions are not in use, be sure to connect a Dummy Connector to disable safety function.
- ▶ Dummy Connector is basically provided and should be used by connecting a corresponding Connector. (Controller Connector : SMP-04, SMP-02- JST).
- ▶ When the connection is wrongly made, it may cause an error in controller operation.

(5) CN6(SAFETY OUT)

Refers to the external safety output interface.

Controller Side Connector	DB-9SS (Misumi)
External Connector	DB-9SP (Misumi)



■ Description of Safety Output Interface

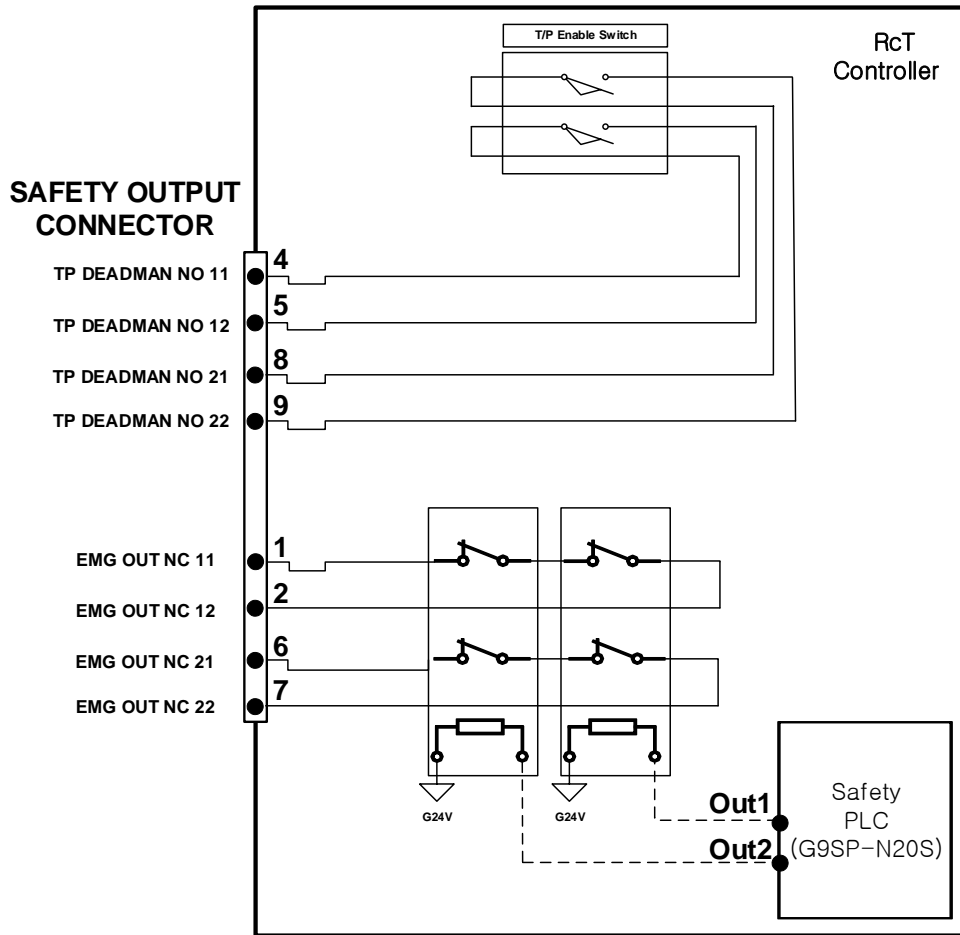
CN No	External Display	Pin No	Signal Name	In-depth Description
CN6	SAFETY OUT	1	EMG OUT_11	Robot Emergency Stop NC Contact 11
		2	EMG OUT_12	Robot Emergency Stop NC Contact 12
		3	-	-
		4	R TP DEADMAN_11	T/P Enable NO Contact 11
		5	R TP DEADMAN_12	T/P Enable NO Contact 12
		6	EMG OUT_21	Robot Emergency Stop NC Contact 21
		7	EMG OUT_22	Robot Emergency Stop NC Contact 22
		8	R TP DEADMAN_21	T/P Enable NO Contact 21
		9	R TP DEADMAN_22	T/P Enable NO Contact 22



주의

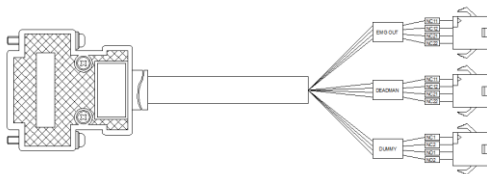
- ▶ Be sure to use SCREW products for HOOD in Safety OUT cable side connector.
- ▶ When the robot cable side connector is wrongly connected, it may cause an error in controller operation.

■ Configuration Diagram of Safety Output



- ▶ Emergency stop signals in robot itself come out through the Safety PLC.
- ▶ Signals such as EMG OUT NC11, EMG OUT NC12, EMG OUT NC21, and EMG OUT NC22 come out by contacts through Relay operation of controller's Safety Board.
- ▶ Outputs Enable Switch contact status of Teach Pendant. Enable HOLD N.O contact should turn On/Off depending on this contact status among Safety Input signals.

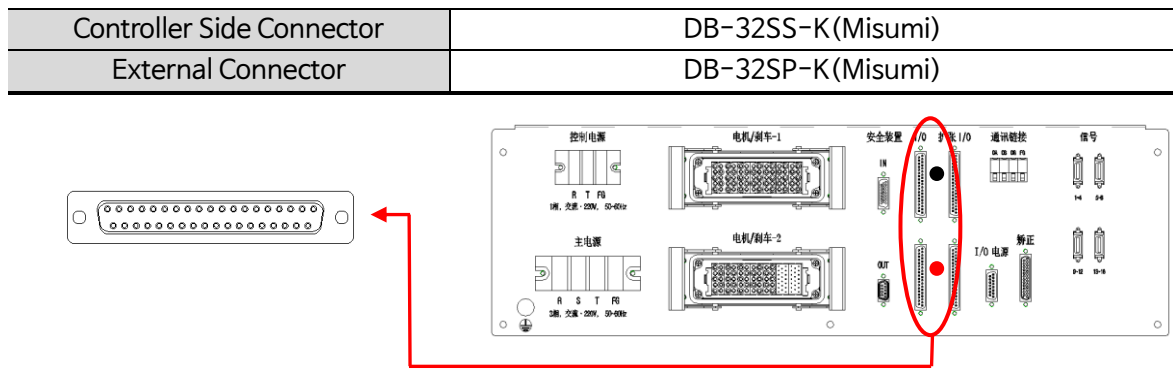
■ Safety Output Dummy Connector



- ▶ When the connection is wrongly made, it may cause an error in controller operation.

## (6) CN7, CN8(I/O)

Refers to the interface for a robot I/O(Sensor) connection. CN7, CN8 (Input 16 points Output 16 points per Connector) are provided as basic I/O.



When connecting the external cable to I/O Connector, the color sticker next to Connector and the color of the shrink tube in the external Cable Connector part should match.

■ I/O Interface Description

CN No	External Display	Sticker Color	Pin No	Signal Name	In-depth Description
CN7	I/O	Black	1	DIN0	User Input Contact 0
			2	DIN1	User Input Contact 1
			3	DIN2	User Input Contact 2
			4	DIN3	User Input Contact 3
			5	DIN4	User Input Contact 4
			6	DIN5	User Input Contact 5
			7	DIN6	User Input Contact 6
			8	DIN7	User Input Contact 7
			9	DIN8	User Input Contact 8
			10	DIN9	User Input Contact 9
			11	DIN10	User Input Contact 10
			12	DIN11	User Input Contact 11
			13	DIN12	User Input Contact 12
			14	DIN13	User Input Contact 13
			15	DIN14	User Input Contact 14
			16	DIN15	User Input Contact 15
			17	DOUT0	User Output Contact 0
			18	DOUT1	User Output Contact 1
			19	DOUT2	User Output Contact 2
			20	DOUT3	User Output Contact 3

CN8	Red	21	DOUT4	User Output Contact 4
		22	DOUT5	User Output Contact 5
		23	DOUT6	User Output Contact 6
		24	DOUT7	User Output Contact 7
		25	DOUT8	User Output Contact 8
		26	DOUT9	User Output Contact 9
		27	DOUT10	User Output Contact 10
		28	DOUT11	User Output Contact 11
		29	DOUT12	User Output Contact 12
		30	DOUT13	User Output Contact 13
		31	DOUT14	User Output Contact 14
		32	DOUT15	User Output Contact 15
		33	P24V_IN-1	User I/O Power (Internal DC 24V)
		34	P24V_IN-2	User I/O Power (Internal DC 24V)
		35	G24_IN	User I/O Power (Internal DC 24V)
		36	P24_EX	User I/O Power (External DC 24V)
		37	G24_EX	User I/O Power (External DC 24V)
		1	DIN16	User Input Contact 16
		2	DIN17	User Input Contact 17
		3	DIN18	User Input Contact 18
		4	DIN19	User Input Contact 19
		5	DIN20	User Input Contact 20
		6	DIN21	User Input Contact 21
		7	DIN22	User Input Contact 22
		8	DIN23	User Input Contact 23
		9	DIN24	User Input Contact 24
		10	DIN25	User Input Contact 25
		11	DIN26	User Input Contact 26
		12	DIN27	User Input Contact 27
		13	DIN28	User Input Contact 28
		14	DIN29	User Input Contact 29
		15	DIN30	User Input Contact 30
		16	DIN31	User Input Contact 31
		17	DOUT15	User Output Contact 15
		18	DOUT16	User Output Contact 16
		19	DOUT17	User Output Contact 17
		20	DOUT18	User Output Contact 18
21	DOUT19	User Output Contact 19		
22	DOUT20	User Output Contact 20		
23	DOUT21	User Output Contact 21		

			24	DOUT22	User Output Contact 22
			25	DOUT23	User Output Contact 23
			26	DOUT24	User Output Contact 24
			27	DOUT25	User Output Contact 25
			28	DOUT26	User Output Contact 26
			29	DOUT27	User Output Contact 27
			30	DOUT28	User Output Contact 28
			31	DOUT29	User Output Contact 29
			32	DOUT30	User Output Contact 30
			33	DOUT31	User Output Contact 31
			34	P24V_IN-1	User I/O Power (Internal DC 24V)
			35	P24V_IN-2	User I/O Power (Internal DC 24V)
			36	G24_IN	User I/O Power (Internal DC 24V)
			37	P24_EX	User I/O Power (External DC 24V)



주의





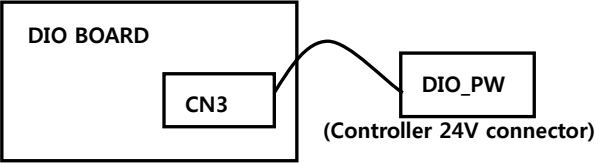
Be sure to use SCREW products for HOOD in cable side connector.

\* Note .

1. The mark "-" means an unused pin.
2. For user I/O power (Internal DC24V), use small-capacity Sensor power. (ex. Detect Sensor)
3. When using external power, user I/O power (Internal DC24V) power is not allowed to be used.
4. I/O basically utilizes internal(controller) power. For use of external power, refer to 'Ch.2 Description of Interface IO Board Setting.
5. Produce an external Cable by using the shrink tube that matches the color of the sticker next to Connector as an identifier.

① How to set the power

The DIGITAL I/O board can set whether I/O power (+24V DC) is used as the external power or the internal power. How to select the power is listed below

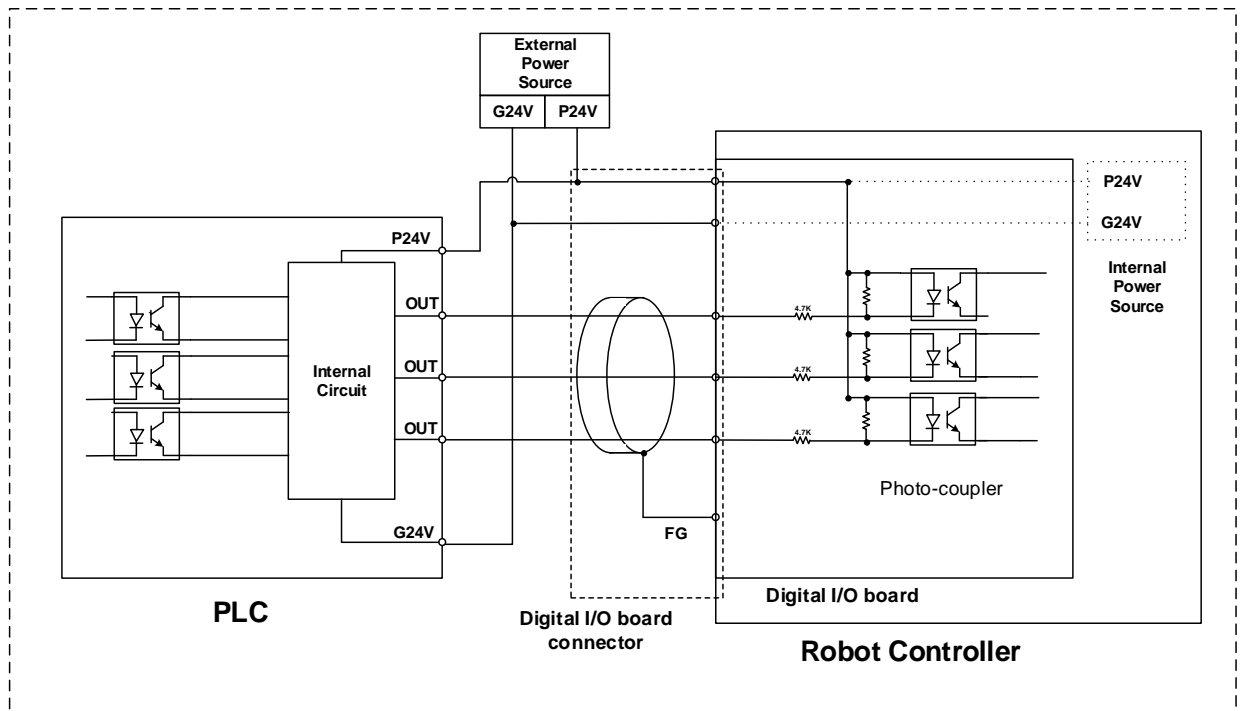
I/O Power	Jumper Setting	Setting Method
External Power	 <p>JP1 1-2Pins Short</p>  <p>JP2 Open</p>	<ol style="list-style-type: none"> <li>1) When using the external power, short circuit JP1 1-2 pins with a short socket</li> <li>2) Open JP2.</li> </ol>
Internal Power	 <p>JP1 2-3Pins Short</p>  <p>JP2 Short</p>	<ol style="list-style-type: none"> <li>1) When using the internal power, short circuit JP1 2-3 pins with a short socket.</li> <li>2) Short circuit JP2 with a short socket.</li> <li>3) Connect a 24V harness (label :DIO_PW) to DIGITAL I/O board's CN3 (Internal power input connector).</li> </ol> 



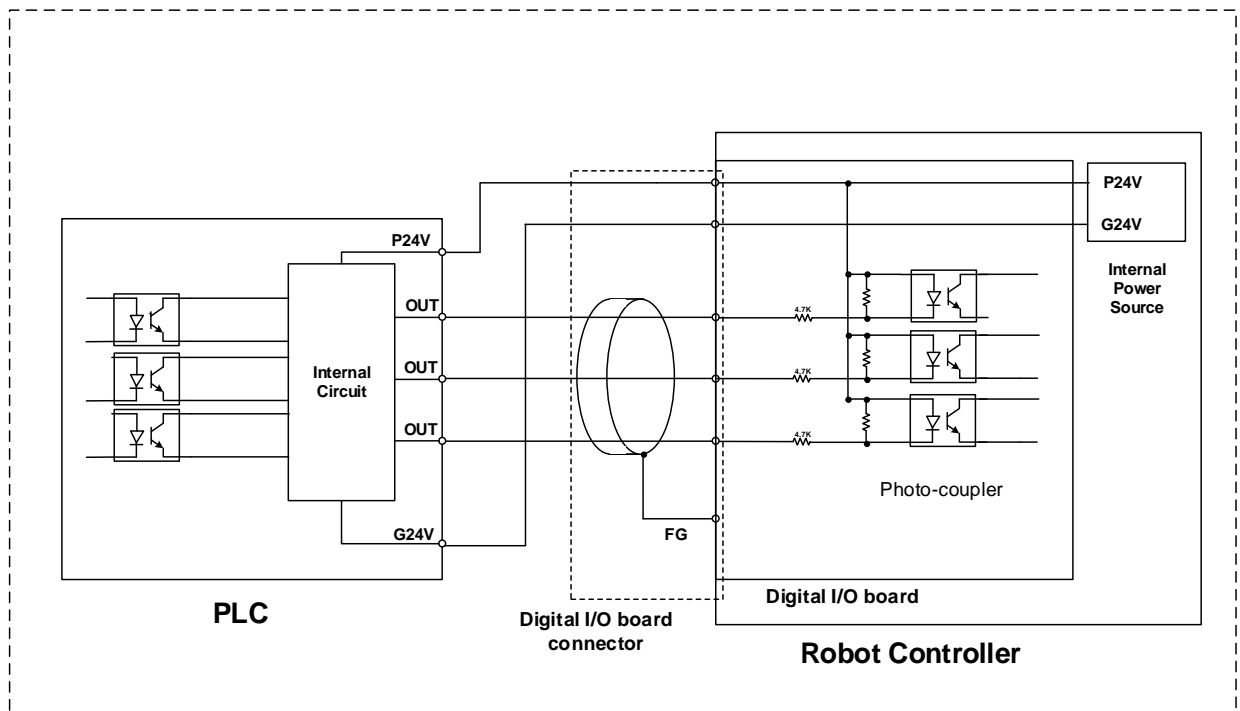
- ▶ Selecting External Power and Internal Power is optional.
- ▶ Do not use External Power and Internal Power simultaneously.
- ▶ Be sure to do the setting with the controller power OFF.

② Input/Output Interface Structure Diagram

■ Input Interface Structure Diagram



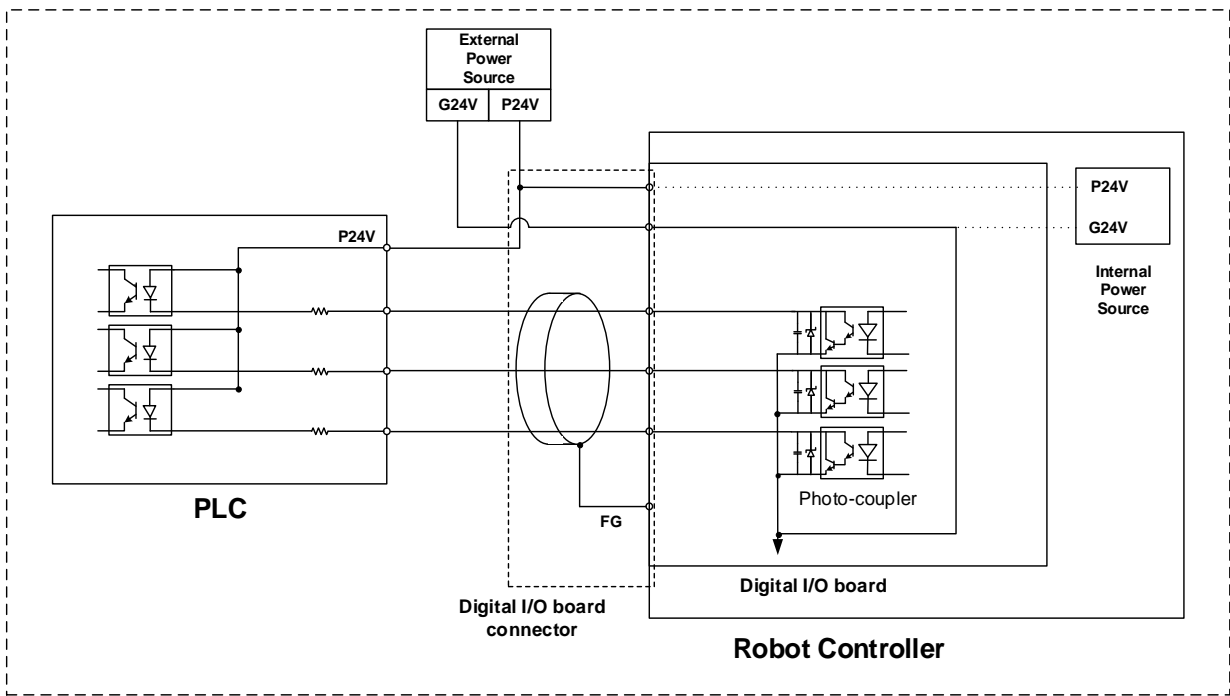
Input Circuit (NPN Type) in Using External Power



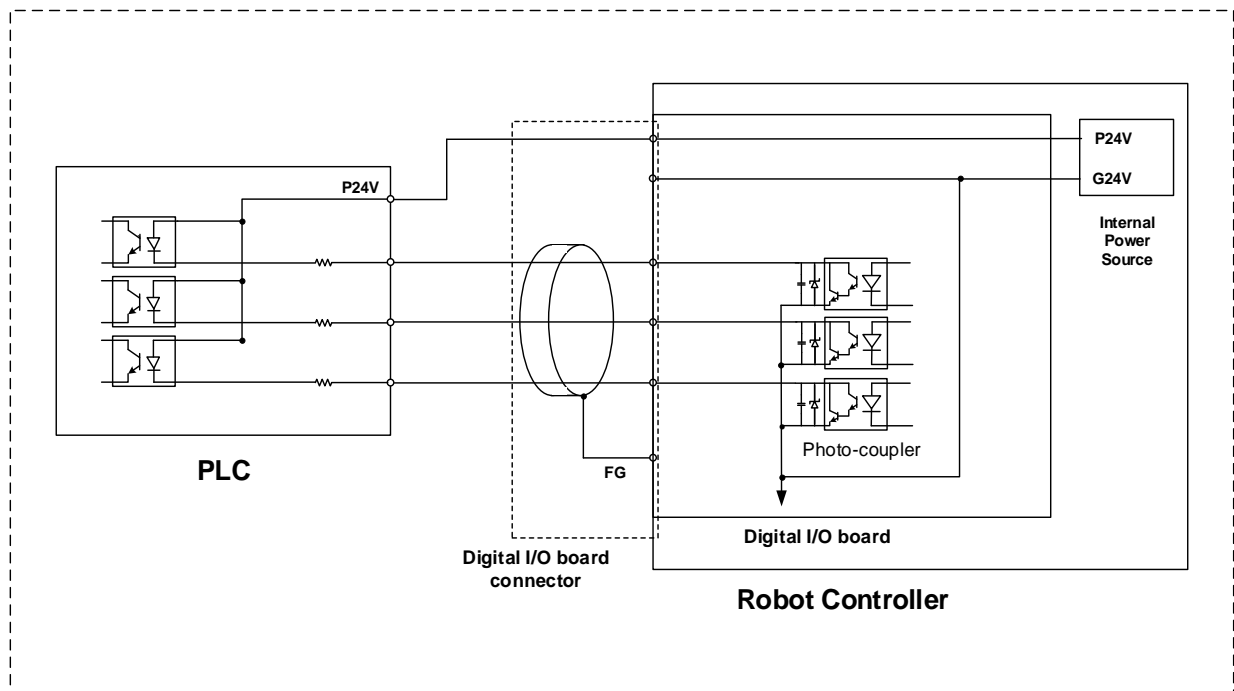
Using Internal Power (NPN Type)

■ Output Interface Structure Diagram



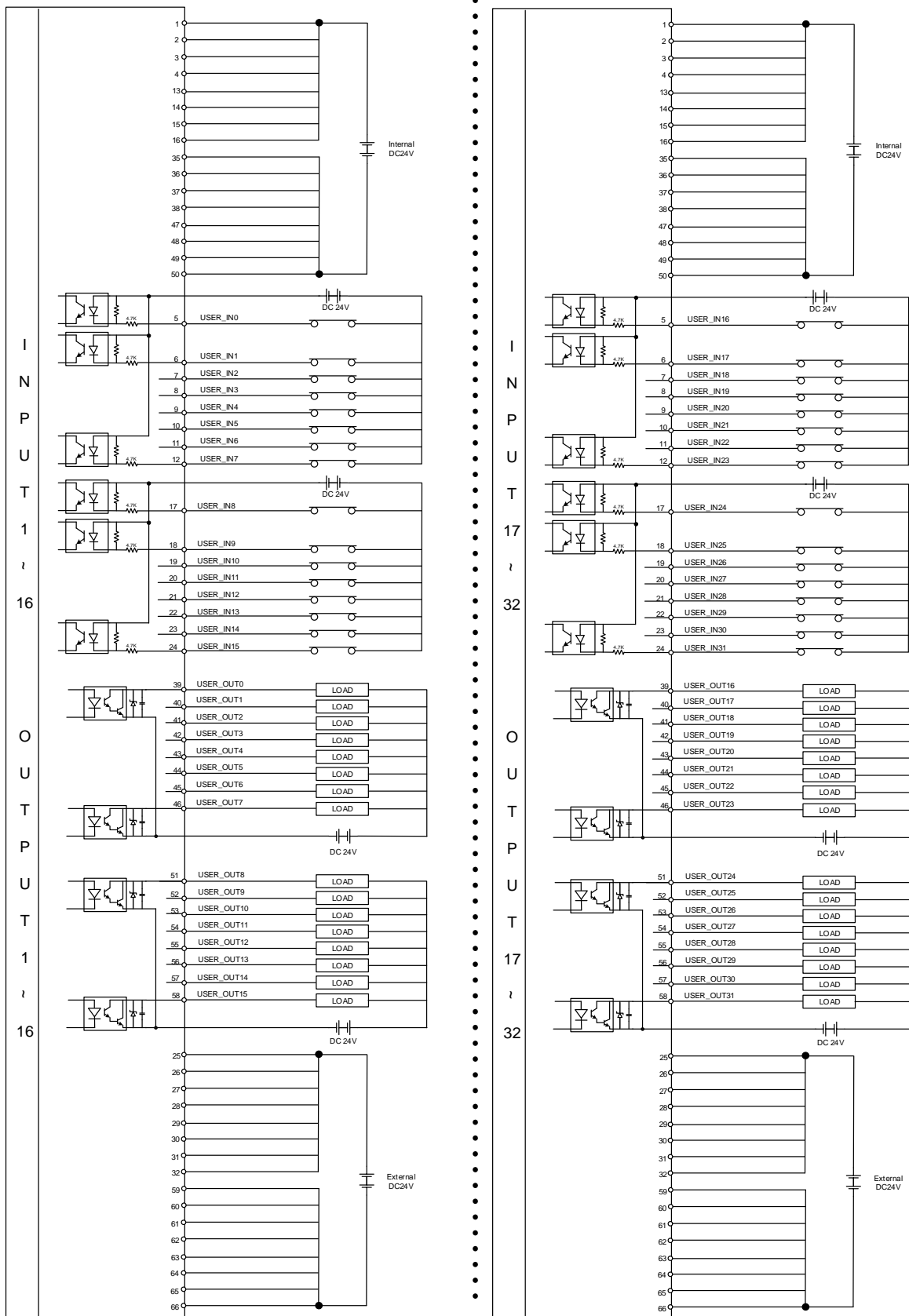


Output Circuit (NPN Type) in Using External Power)



Output Circuit (NPN Type) in Using Internal Power)

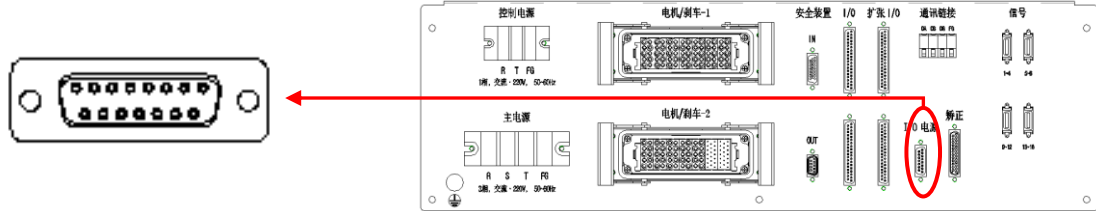
③ Block Diagram of DIO Board Input/Output Whole Circuit



(7) CN12(I/O PW)

Refers to a Robot Sensor power Connector. Be sure to use CN12 when Sensor power capacity is large.

Controller Side Connector	DB-15SS(Misumi)
External Connector	DB-15SP(Misumi)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN12	I/O PW	1	G_P24	Robot Sensor Power (G_DC24V)
		2	G_G24	
		3	G_P24	
		4	G_G24	
		5	-	-
		6	-	-
		7	F_P24	Robot High-capacity Fan Power (F_DC24V)
		8	F_G24	
		9	F_P24	
		10	F_G24	
		11	-	-
		12	-	-
		13	-	-
		14	S_P24	Robot Safety Sensor Power (S_DC24V)
		15	S_G24	



주의

Be sure to use SCREW products for HOOD in cable side connector.

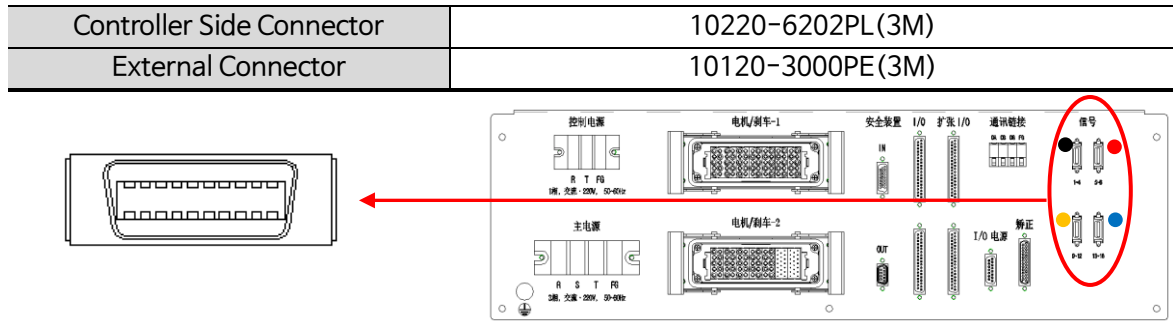
\* Note .

- 1 The mark."-" means an unused pin.
2. I/O power is internal power to controller so external power connection is not allowed.
3. Use SAFETY-related signals only for user SAFETY power.

(8) CN14, CN15, CN16, CN17(ENCODER)

Refers to the interface for Motor Encoder connection.

The battery for Encoder's absolute position backup is attached to the robot mechanism Encoder.



When connecting the external cable to Encoder Connector, the color sticker next to Connector and the color of the shrink tube in the external Cable Connector part should match.

CN No	External Display (Color Classification)		Pin No	Signal Name	In-depth Description
CN14	ENCODER	1 ~ 4 (Black)	1	P5V(n)	n-axis P5V Power
			2	GND(n)	n-axis G5V Power
			3	PS(n)	n-axis Encoder Input +
			4	/PS(n)	n-axis Encoder Input -
			5	P5V(n+1)	n+1 axis P5V Power
CN15	ENCODER	5 ~ 8 (Red)	6	GND(n+1)	n-axis G5V Power
			7	PS(n+1)	n+1 axis Encoder Input +
			8	/PS(n+1)	n+1 axis Encoder Input -
			9	FG(n+1)	n-axis Motor Encoder Ground
CN16	ENCODER	9 ~ 12 (Yellow)	10	FG(n+1)	n+1 axis Motor Encoder Ground
			11	P5V(n+2)	n+2 axis P5V Power
			12	GND(n+2)	n+2 axis G5V Power
			13	PS(n+2)	n+2 axis Encoder Input +
CN17	ENCODER	13 ~ 16 (Blue)	14	/PS(n+2)	n+2 axis Encoder Input -
			15	P5V(n+3)	n+3 axis P5V Power
			16	GND(n+3)	n+3 axis G5V Power
			17	PS(n+3)	n+3 axis Encoder Input +
			18	/PS(n+3)	n+3 axis Encoder Input -
			19	FG(n+2)	n+2 axis Motor Encoder Ground
			20	FG(n+3)	n+3 axis Motor Encoder Ground



주의

Be sure to use SCREW products for HOOD in cable side connector.

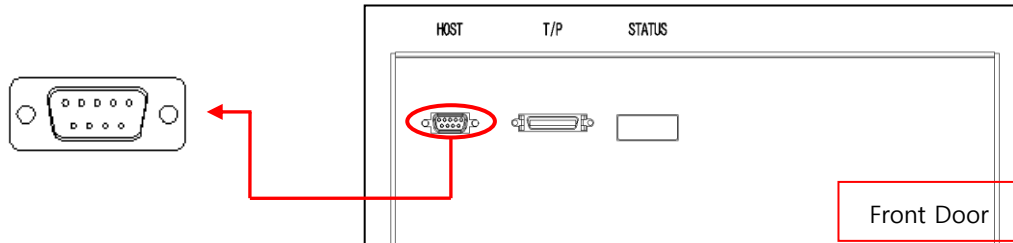
\*Note.

1. Produce an external Cable by using the shrink tube that matches the color of the sticker next to Connector.
2. Depending on Robot specifications, the Cover is installed in CN16, CN17 Connector when using CN14, CN15 only.

(9) CN18(HOST)

Refers to a HOST interface between PC and controller.

Controller Side Connector	RDED-9P-LNA (HIROSE)
PC Side Connector	HDEB -9P (HIROSE)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN18	HOST	1	-	-
		2	RXD	HOST RS 232 Data Reception
		3	TXD	HOST RS 232 Data Transmission
		4	-	-
		5	GND	HOST RS 232 Ground
		6	-	-
		7	RTS	HOST RS 232 RTS
		8	CTS	HOST RS 232 CTS
		9	-	-

\*Note.

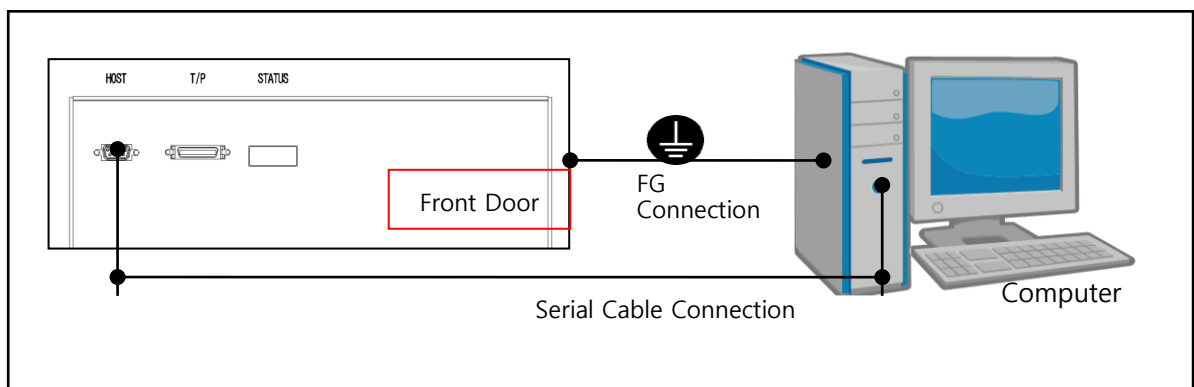
1. The mark "-" means an unused pin.



주의

To connect HOST, it is required to convert T/P to 7.ONLINE mode.

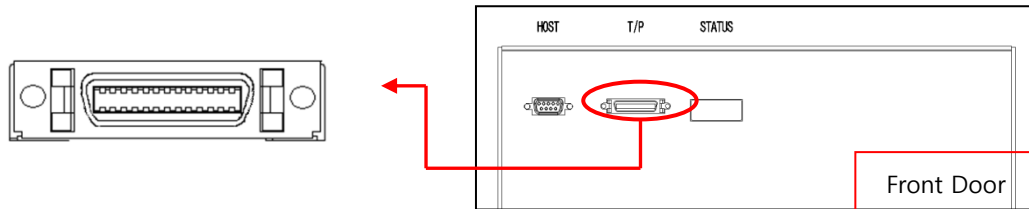
■ Cable Connection Diagram



(10) CN19(T/P)

Refers to the teach pendant interface.

Controller Side Connector	10236-52A2 (3M)
T/P Connector + Hood	10136-3000PE (3M)
T/P Cable Side Hood	10336-52A0-008 (3M)



CN No	External Display	Pin No	Signal	In-depth Description
CN9	T/P	1	G12V	T/P Power Ground
		2	G12V	T/P Power Ground
		3	G12V	T/P Power Ground
		4	GND	RS232 Ground
		5	GND	RS232 Ground
		6	Graphic T/P Open	Graphic T/P Connection Input
		7	T/P Open	T/P Connection Input
		8	T/P Mode	T/P Mode Change Input
		9	T/P DeadMan	T/P Deadman Input
		10	T/P EMG	T/P Emergency Stop NO Contact
		11	DeadMan 11	T/P Deadman Interlock NCContact 11
		12	DeadMan 12	T/P Deadman Interlock NCContact 12
		13	DeadMan 21	T/P Deadman Interlock NCContact 21
		14	DeadMan 22	T/P Deadman Interlock NCContact 22
		15	Mode NC 1	T/P Mode NC Contact 1
		16	Mode NC 2	T/P Mode NC Contact 2
		17	Mode NO 1	T/P Mode NO Contact 1
		18	Mode NO 2	T/P Mode NO Contact 2
		19	P12V	T/P Power 12V
		20	P12V	T/P Power 12V
		21	P24V	Graphic T/P Power 24V
		22	P24V	Graphic T/P Power 24V
		23	P24V	Graphic T/P Power 24V
		24	G24V	Graphic T/P Power Ground
		25	G24V	Graphic T/P Power Ground
		26	G24V	Graphic T/P Power Ground
		27	T/P RX	T/P RS232 Data Reception
		28	T/P TX	T/P RS232 Data Transmission
		29	Graphic T/P RD+	Graphic T/P Ethernet Data Reception +
		30	Graphic T/P RD-	Graphic T/P Ethernet Data Reception -
		31	Graphic T/P TD+	Graphic T/P Ethernet Data Transmission +
		32	Graphic T/P TD-	Graphic T/P Ethernet Data Transmission -
		33	EMG NC 11	T/P Emergency Stop NC Contact 11

	34	EMG NC 12	T/P Emergency Stop NC Contact 12
	35	EMG NC 21	T/P Emergency Stop NC Contact 21
	36	EMG NC 22	T/P Emergency Stop NC Contact 22

\*Note.

1. The mark “-” means an unused pin.



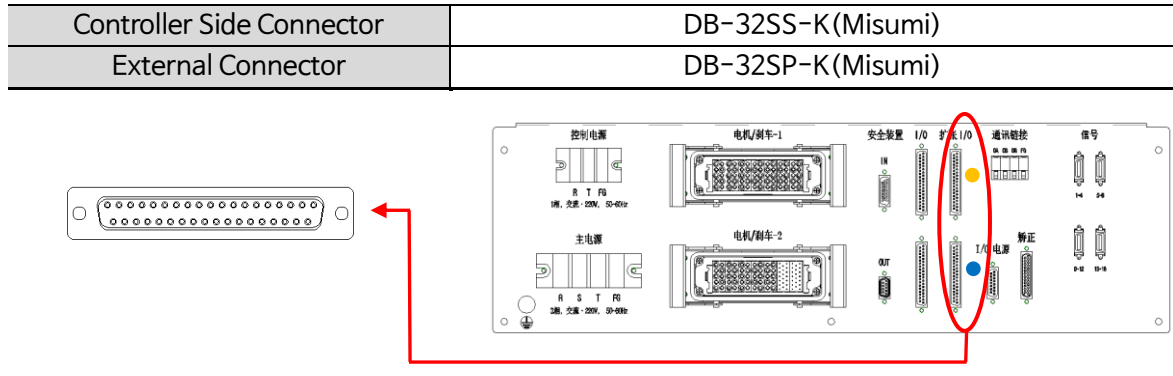
주의

▶ When the controller boots and T/P Connector is removed, the controller power should be OFF→ON. (Applies in installing Safety Module.)

### 4.2.3Option

(1) CN9, CN10(EXT\_IO)

Refers to the interface for an extension robot I/O(Sensor) connection. Provided for use when basic I/O is insufficient. Extension I/O includes providing CN14, CN15(Input 16 points, Output 16 points per Connector).



Extension I/O(CN9, CN10) is all the same as basic I/O(CN7, CN8), Pin Map and power setting method and structure.

For pin Map, setting method and structure, refer to [4.2.2CN7, CN8\(I/O\)](#).

CN No	External Display	Sticker Color
CN9	IO	Yellow
CN10		Blue



Be sure to use SCREW products for HOOD in cable side connector.

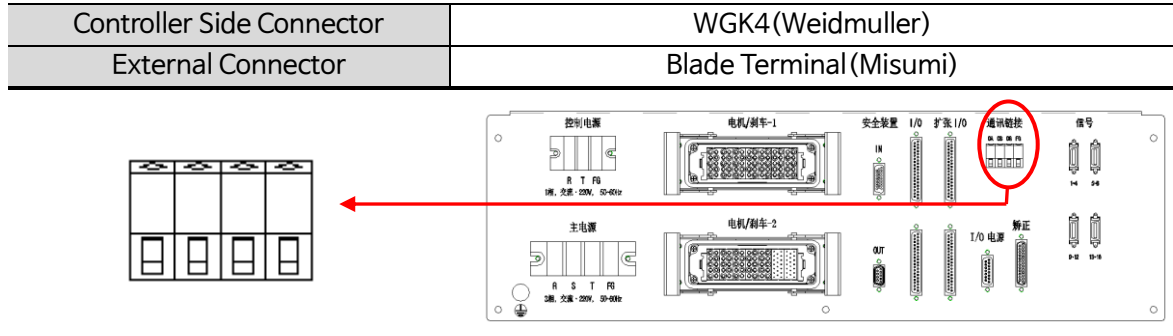
\* Note .

1. The mark "-" means an unused pin
2. For user I/O power (Internal DC24V), use small-capacity Sensor power. (ex. Detect Sensor).
3. When using external power, user I/O power (Internal DC24V) power is not allowed to be used.
4. I/O basically utilizes internal(controller) power. For use of external power, refer to 'Ch.2. Interface IO Board Setting Description.
5. Produce an external Cable by using the shrink tube that matches the color of the sticker next to Connector as an identifier.



(2) CN11(CCLINK)

Refers to the interface that communicates with upper control (PC, PLC). It is required to use a dedicated cable. (Attach a CC-Link Option Card to a controller's PCI optional slot for use.)



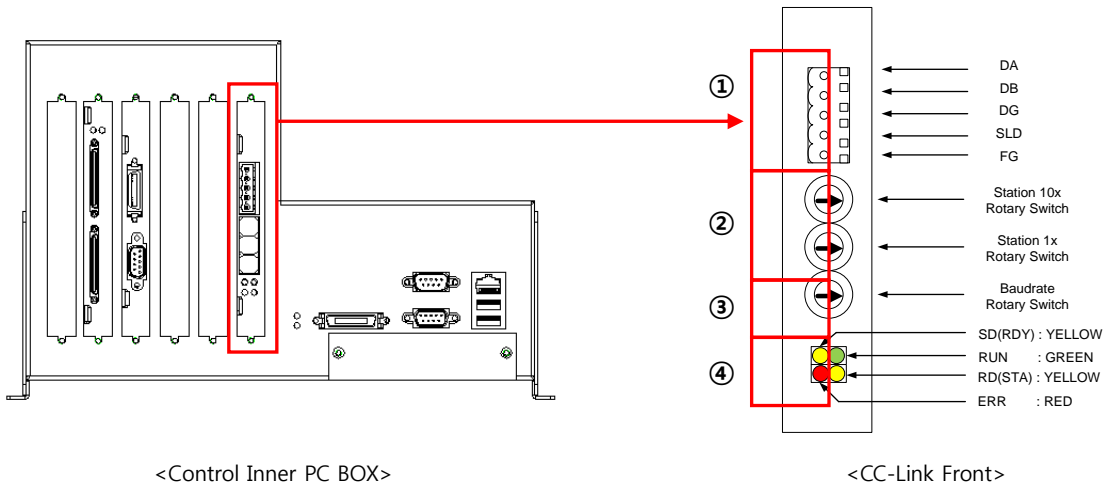
■ CC-Link Interface Description

CN No	External Display	Signal Name	In-depth Description (Cable Color)
CN11	CCLINK	DA	Blue
		DB	White
		DG	Yellow
		FG	Shield

■ CC-Link Specifications

Function	Description
Station Type	- Remote device station
Response Version	- Ver 1.1
Number of Stations Possessed	- 4 stations
Access	- Dual port memory
Max Transfer Rate	- 10Mbps
Interface	-RS485
Plug	-Combicon 5-pin
Communication Controller	-MFP3
Data Connection	- Polling
Data	- Max 128 points I/O data -16 word I/O
Configuration	- From jumper or application program
LED Display	-RDY, RUN, STA, ERR
Power Consumption	5V ±5% / 500mA
External Dimension	134 x 107 x 20mm
Operating Temperature	0~50°C

■ CC-Link Setting (Bus Address and Baudrate)



■ CC-Link Interface Connector

- Connected to CN11.

■ Bus Address Setting

Switch	Valid Value
Bus address(1,2)	1 ~ 64
Baud rate(3)	0 ~ 4

( Station occupied: 4 stations)

■ Baudrate Setting

External Display	Switch	Baudrate
BAUD	0	156Kbps
	1	625Kbps
	2	2.5Mbps
	3	5Mbps
	4	10Mbps
	5~E	Invalid
	F	Baud rate is taken over from the configuration file

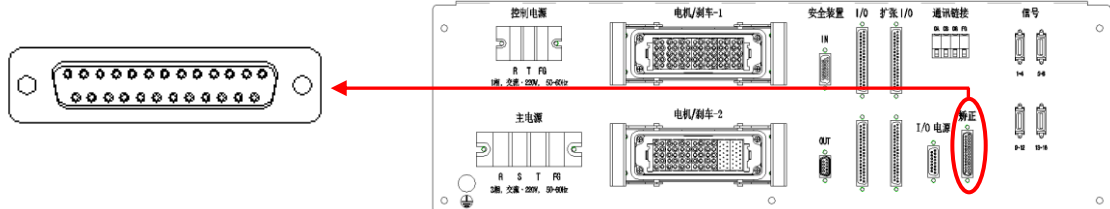
■ Status Display

- Refer to CC-Link Manual.

(3) CN13(LATCH)

Refers to the interface for Latch functions such as robot Align, Mapping.  
This is an option so make a request when deciding specifications.

Controller Side Connector	DB-25SS (Misumi)
External Connector	DB-25SP (Misumi)



CN No	External Display	Pin No	Signal Name	In-depth Description
CN13	LATCH	1	P24_AL	User Sensor power (Internal DC 24V)
		2	G24_AL	User Sensor power (Internal DC 24V)
		3	-	-
		4	L/AL 1	L Align Signal 1
		5	L/AL 2	L Align Signal 2
		6	-	-
		7	-	-
		8	R/AL 1	R Align Signal 1
		9	R/AL 2	R Align Signal 2
		10	-	-
		11	-	-
		12	T/AL 1	T Align Signal 1
		13	T/AL 2	T Align Signal 2
14~25	-	-	-	



주의

Be sure to use SCREW products for HOOD in cable side connector.

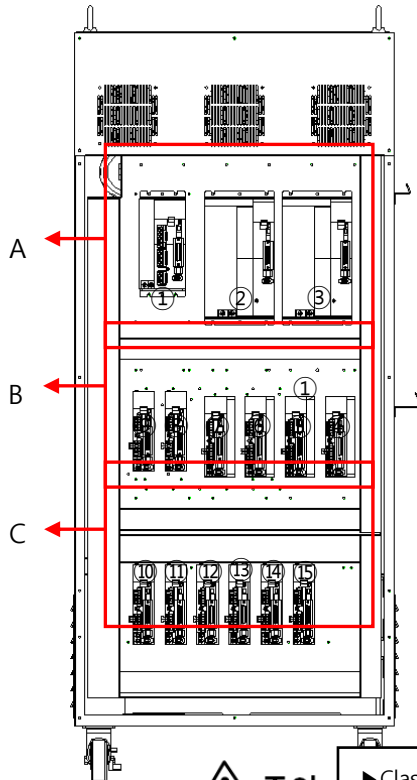
\* Note .

- 1 The mark "-" means an unused pin.
2. Use user Sensor power in Latch-related Sensor.
3. User Sensor power is internal (controller) power.  
The sensor using external power cannot be used.

### 4.2.4 Servo Driver Capacity and Arrangement

Refers to examples of Servo Driver capacity and arrangement for Q4 Robot (15axes). Servo Driver capacity and arrangement vary depending on Robot specifications.

## Q4 Robot Controller



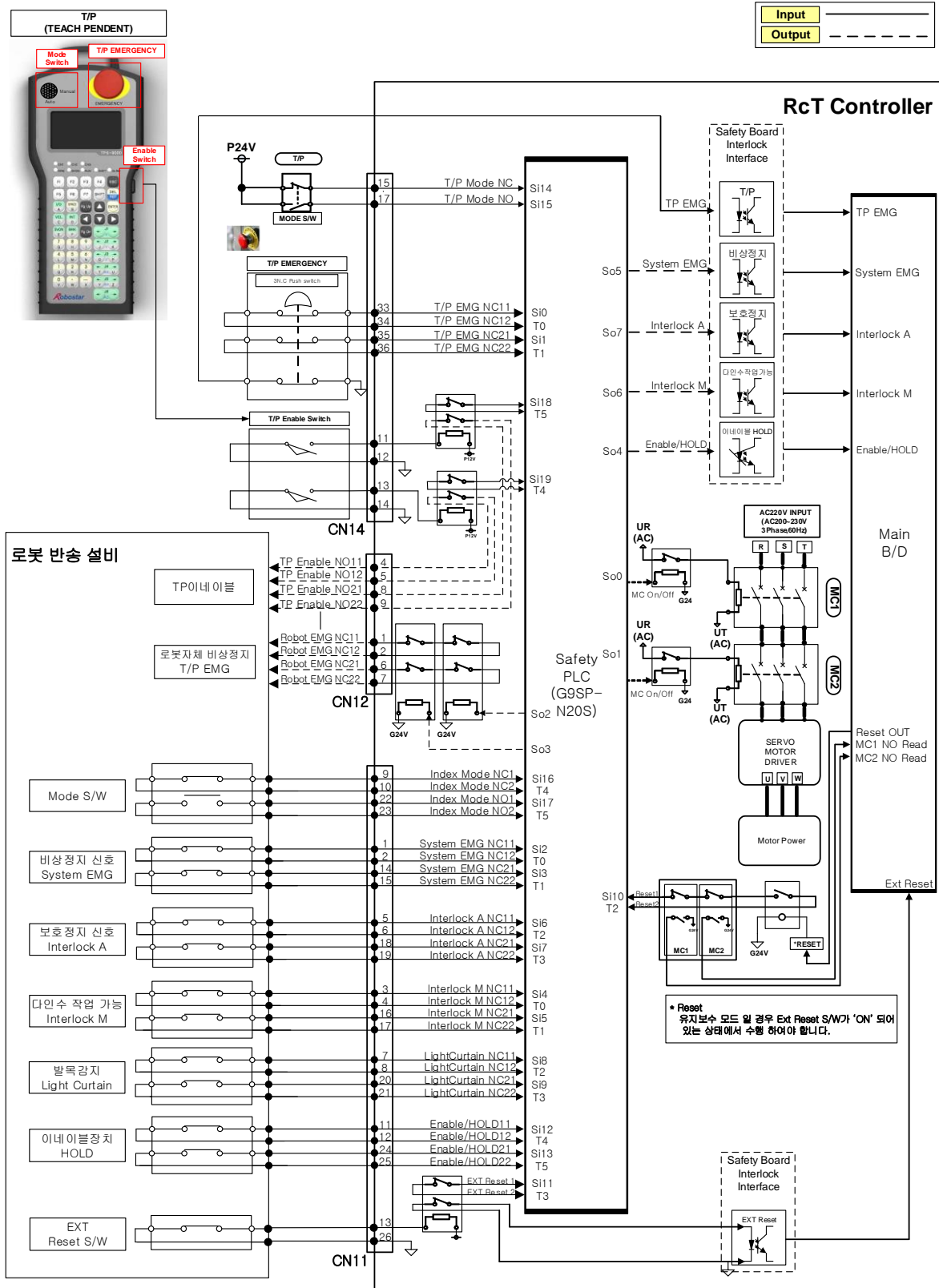
Classification	No	Classification	Description	Capacity
A	①	1 Axis(T)	Rotation Axis	2kW
	②	2 Axis(Z)	Up, down axis	4kW
	③	5 Axis(X)	Driving Axis	5kW
B	④	3 Axis(R1)	Arm 1	400W
	⑤	4 Axis(R2)	Arm 2	400W
	⑥	6 Axis(R3)	Arm 3	400W
	⑦	7 Axis(R4)	Arm 4	400W
	⑧	8 Axis(Q1)	R1 Variable	100W
	⑨	9 Axis(V1)	R1 Hand Variable	100W
	⑩	10 Axis(Q2)	R2 Variable	100W
C	⑪	11 Axis(V2)	R2 Hand Variable	100W
	⑫	12 Axis(Q3)	R3 Variable	100W
	⑬	13 Axis(V3)	R3 Hand	100W



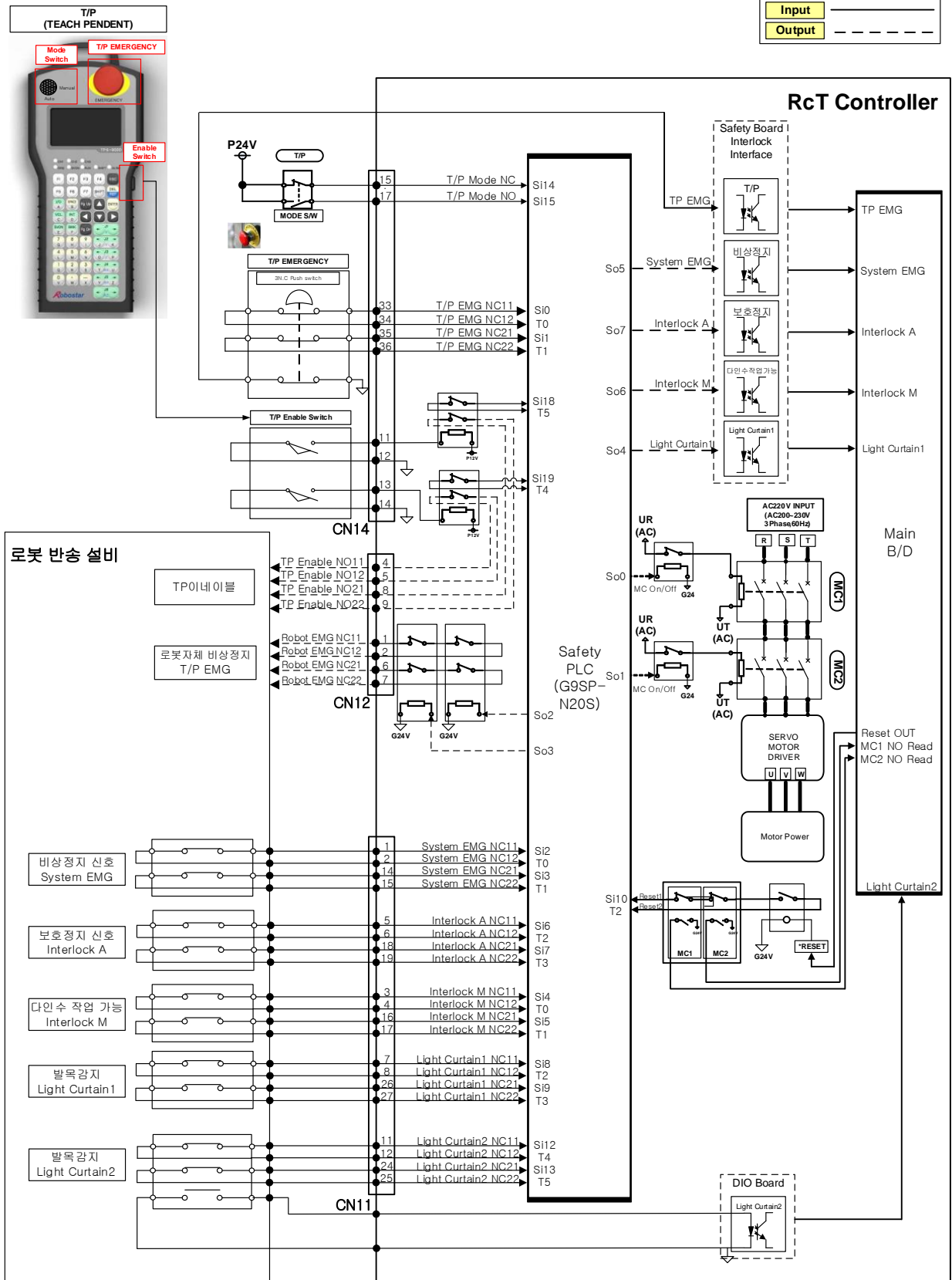
- ▶ Classification A enables installation up to 7.5kW.
- ▶ Classification B enables installation up to 7.5kW.
- ▶ Classification C enables installation up to 2kW.
- ▶ Make an inquiry before applying a Robot with new specifications.

# 4.3 Safety Interface Option (Common)

## 4.3.1 SD Version



4.3.2LD Version

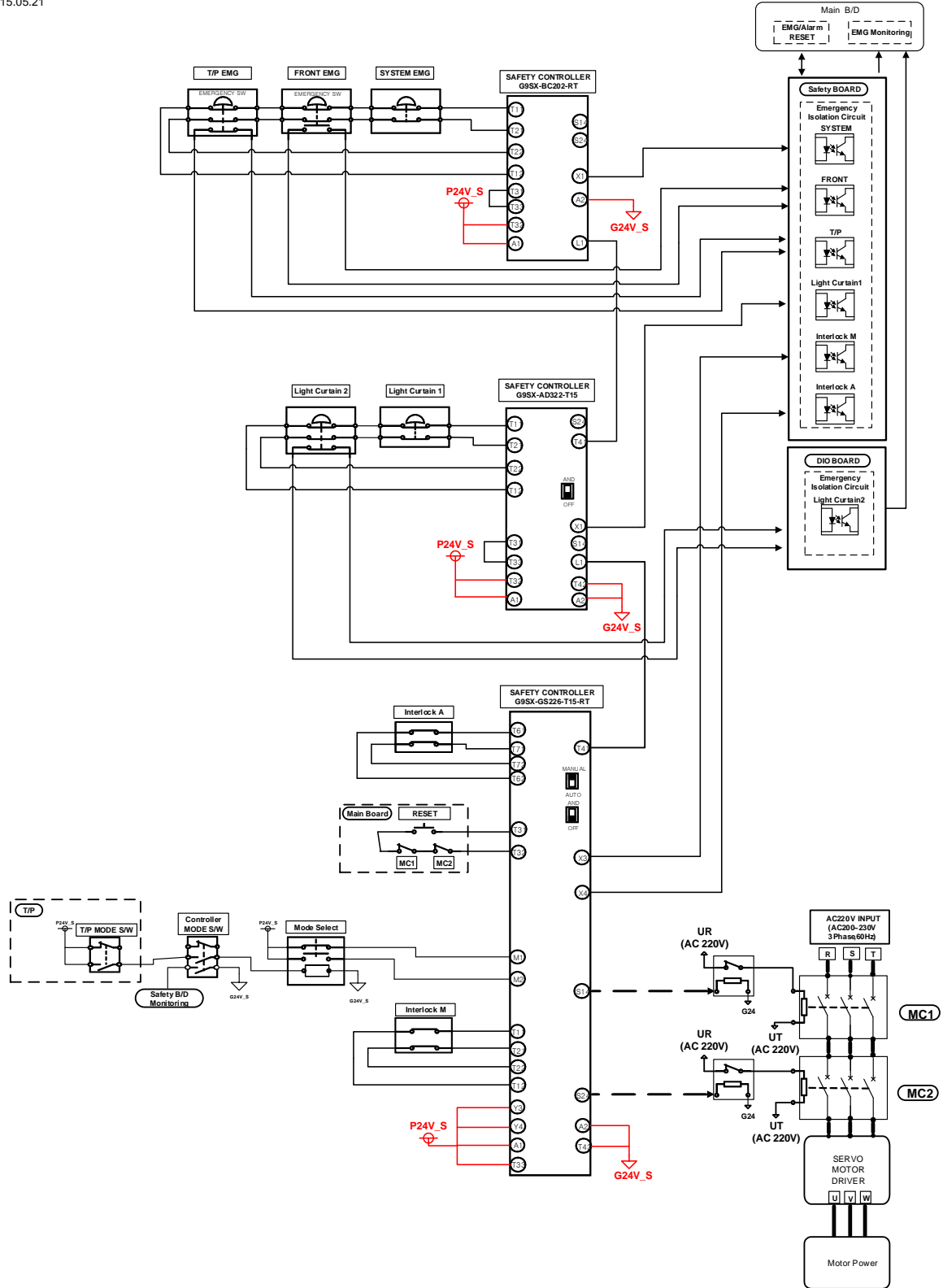


4.3.3CS Version(Safety Unit Ver.)

RcT CSOT Safety Block Diagram

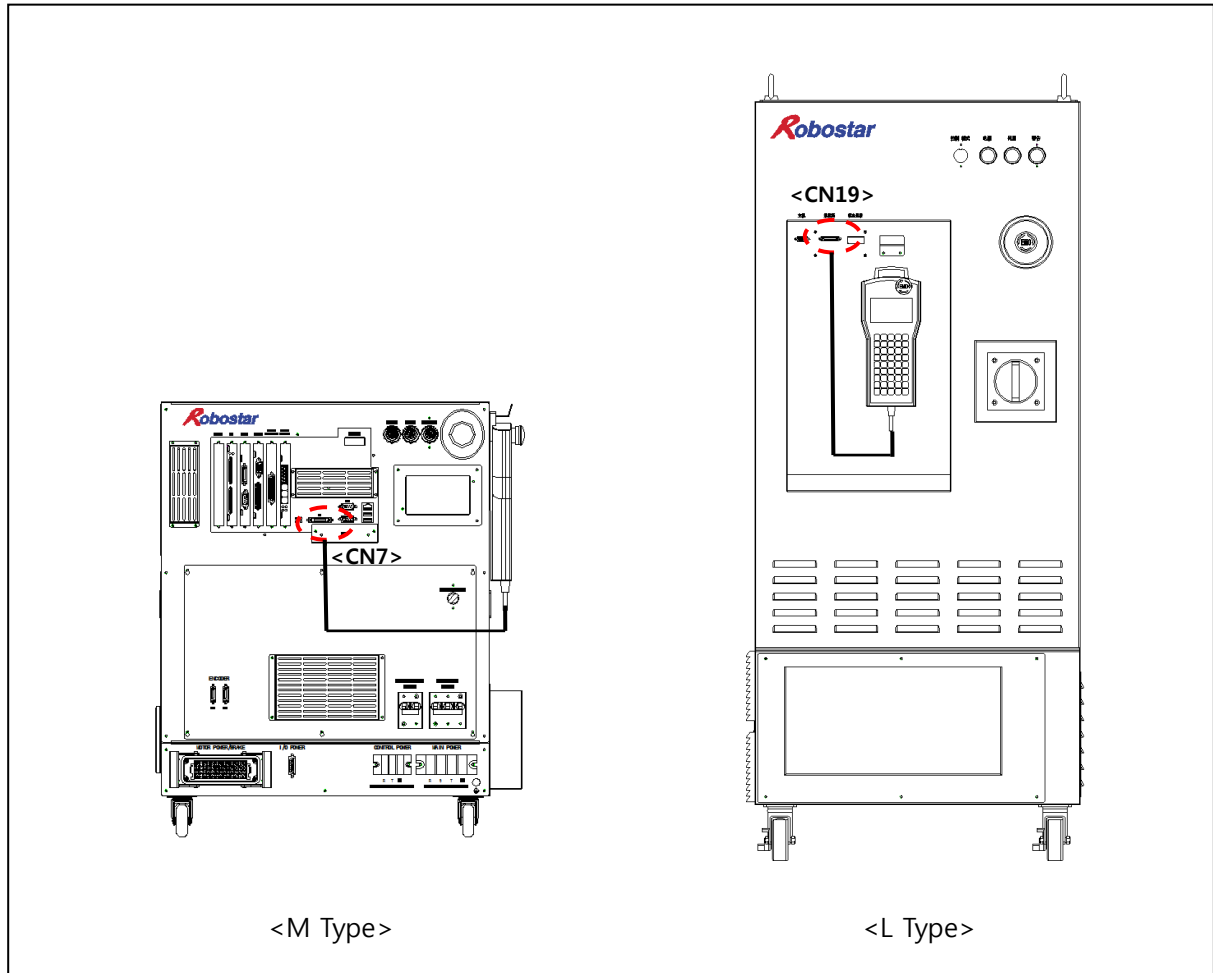
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ROBOSTAR Co.,Ltd.  
Robot Controller Development Team  
2015.05.21



# Ch.5 Teach Pendant(T/P)

## 5.1 How to Connect T/P



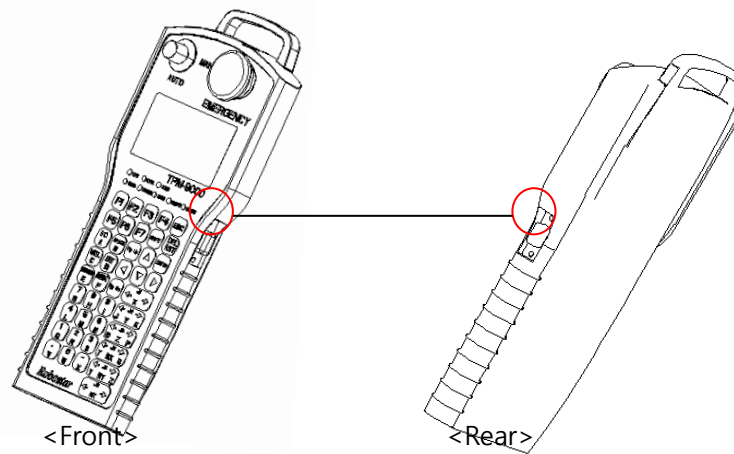
주의

- ▶ After connecting to Connector, be sure to connect Connector's Screw-Lock. The controller turns into emergency stop when the Connector is removed.
- ▶ The controller is not reset after removing the Connector. The power should be off→on.



## 5.2 How to Use Deadman

Operate the robot by using the T/P and press the part shown below when Teaching.

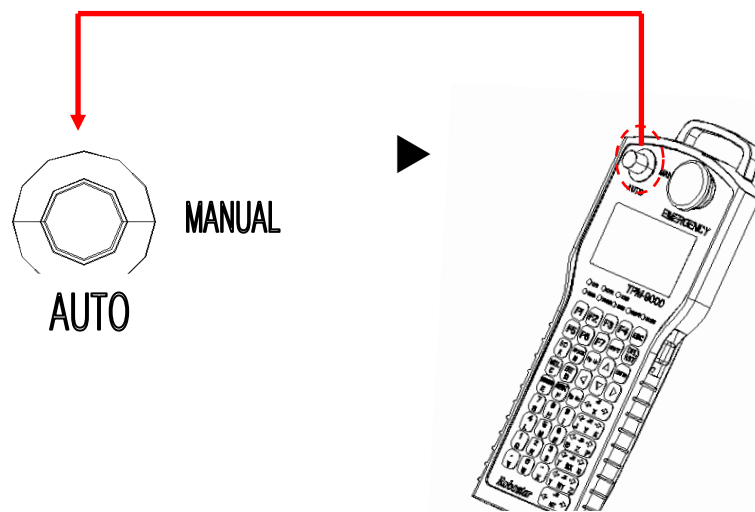


A deadman switch is used to stop the robot automatically and safely when unable to run the robot precisely due to unexpected situations, such as a power failure, an electric discharge or an emergency situation, while operating the robot in the jog mode with a teach pendant. If any of these situations takes place, the user can stop the robot by adjusting a force applied to pressing the deadman switch. The deadman switch has the three operating conditions as shown below.

Push Intensity	Switch Condition	Robot Operation
When the switch is not pushed or a push intensity is weak	OFF	X
When a switch push intensity is at an appropriate level	ON	O
When a switch push intensity is too high	OFF	X

Note : When turning OFF the deadman switch, the robot dies not operate or the robot in motion comes to a stop.

## 5.3 Mode Switch



- ▶ The mode selection switch sets the mode for robot operation.

Mode	Handling Key Function
'Auto' Mode	Operates the robot by giving commands from top. Edit-related keys does not operate when setting Auto mode.
'Manual' Mode	Enables the operator to do robot's point teaching and program editing.



- ▶ Key lock mode operates in a mode identical to Auto mode.
- ▶ Enter a Password in converting a mode.

ROBOSTAR TRANSFER CONTROLLER R<sub>c</sub>T SERIES

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# **CONTROLLER MANUAL**

FIRST EDITION OCTOBER 2015

ROBOSTAR CO, LTD

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