Robostar Robot Controller

N2S Series

Instruction and handling Manual

Version: N2S-IM-E02

Issued Data: July 10, 2019

Robostar

About Product Warranty

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(2) Failures arising due to improper repair, alteration, redeployment, or other mishandling, under the instruction of you or any third party
(3) Failures as a result of using parts, grease, etc. which have not been designated by Robostar
(4) Failures caused by accidents, such as fire, disaster, earthquake, storms, or other natural disasters
(5) Failures caused in manure, flooding, or other environment
(6) Failure caused by the consumption of consumable parts
(7) Failures arising when not being operated under the instructions listed in the user or instruction manual and the maintenance manual
(8) Damages in cost other than the cost of robot repairing

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Robostar

www.robostar.co.kr

For safe use

I. Safety for robots (General)

Be sure to fully understand the manuals for safe use of this product. Each manual includes the following notations for subjects requiring carefulness necessary for the safe use of this product, and therefore carefully read the manual before using this product

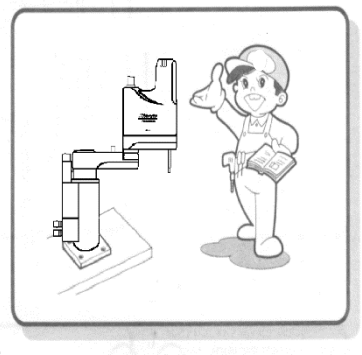
■ Safety Signs

Sign	Meaning
 DANGER	This sign indicates that, if handled incorrectly, the serious life or property damage may be caused.
 WARNING	This sign indicates that, if handled incorrectly, the product failure, malfunction or accident may arise.
 CAUTION	This sign indicates that the product may malfunction or may not work due to incorrect use, and shows a matter requiring attention.
 PROHIBITION	This sign shows the matter that is to be prohibited for normal use of the product. E.g.) Never use a fire. 
 Required	This sign shows the matter that must be performed for normal use of the product. E.g.) Compulsory ground is required. 

Since this robot and robot controller are industrial equipment manufactured with advanced technology, please be sure to observe the following matters in order to prepare for accidents that may occur.

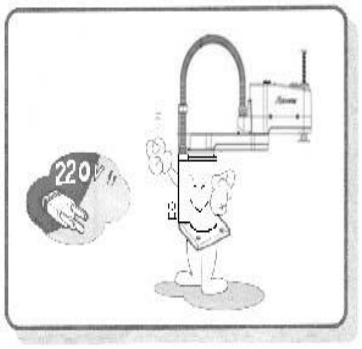
CAUTION

For safe and more efficient use, please operate the robot after reading all the documentations.



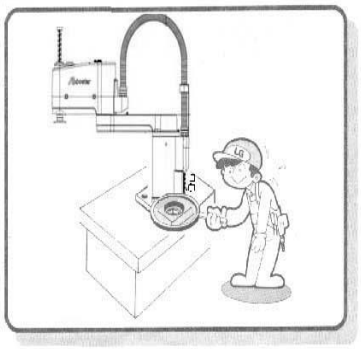
WARNING

All of the load and power must be used within the range of rated load and power spec.
In particular, make sure before use that the input power is AC 220V.



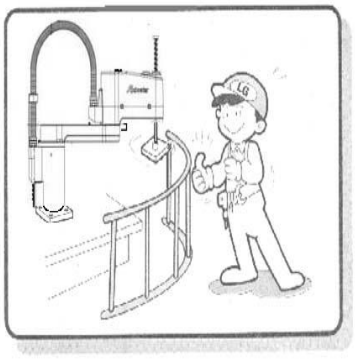
CAUTION

When installed, the robot must be securely fixed so as not to be shaken.



DANGER

For safe operation, a safety net must be installed around the robot.



CAUTION

Make sure to check the wirings of a controller before powering on it. Due to the incorrect wirings, the machine may not work properly.

To prevent electrical shock, be sure to install FG (Frame Ground).

DANGER

Be careful not to move into the range of motion of a robot while the robot is operating or in the operable state.
Please note such subject even if the robot is in stationary state.

DANGER

If many people work at the same time, especially in powering ON/OFF and driving a motor manually, be sure to check the mutual safety before starting the work.

CAUTION

When in maintenance of the robot, be sure to unplug a power cord of the controller

II. Safety for robots (Details)

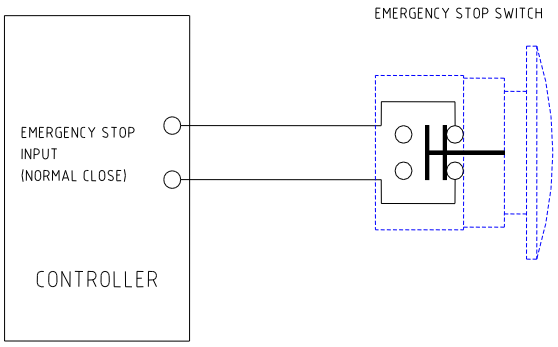
(1) For the safety of workers, be sure to wear a helmet, safety shoes, etc.
(2) When before turn on the power, check that there is no person within the area of robot motion and then operate the robot.
(3) When moving into the area of the robot motion for maintenance or inspection, be sure to power OFF the robot.
(4) If a cable of the robot is installed in a pathway, prevent the cable from damage by using a cover or a duct.
(5) As soon as the cable damage is found, replace it immediately.
(6) Do not operate the robot under the load exceeding nominal weight.
(7) Be sure to fully understand the instruction manual before operating the robot.
(8) In the case of installing a safety net
    ① Give it sufficient strength to withstand reactions that occur during work, or environmental conditions, and do not have it be easily moved, destroyed, or climbed.
    ② Remove the dangerous parts, such as sharp edges or burr.
    ③ Firmly fix it.
    ④ If you are installing a safety net having a door, install a detector or other sensors so that the robot is stopped immediately after the door is opened.
    ⑤ The safety net must be distanced by 40 cm or farther from robot motion area and the robot body.

(9) Emergency Stop Switch

① Mount an emergency stop switch at the place where an operator can easily operate the robot.

② The color of the emergency stop switch is to be red with yellow circumferential band for easy discrimination of its position.

③ Use the emergency stop switch which does not automatically return.



(10) Ground Specification

- Class 3 Ground (Ground resistance is not more than 100Ω.)

(11) Lamp indicating the robot power supplying status

- Install a lamp which indicates whether the power source is being supplied to the robot

Table of Contents

Chapter 1 Controller Overview

1. Features

N2S Series Controller is a high-performance robot controller for a wide variety of applications and has the following features.

- 6 axes Vertical articulated robot
- Controls 4 to 6 axes Cartesian coordinate robot, SCARA robot and semiconductor robot
- Full-digital servo system
- Modularized 2 axes servo amplifiers
- Easy to change various parameters and the gain (changeable by the software)
- Monitoring available while in operation
- Provides rich input-output interfaces
  -System In/Out(20 points/20 points), Option In/Out(32 points/32 points)
- Plenty of robot commands included
- Offers the versatile online program (Unihost)

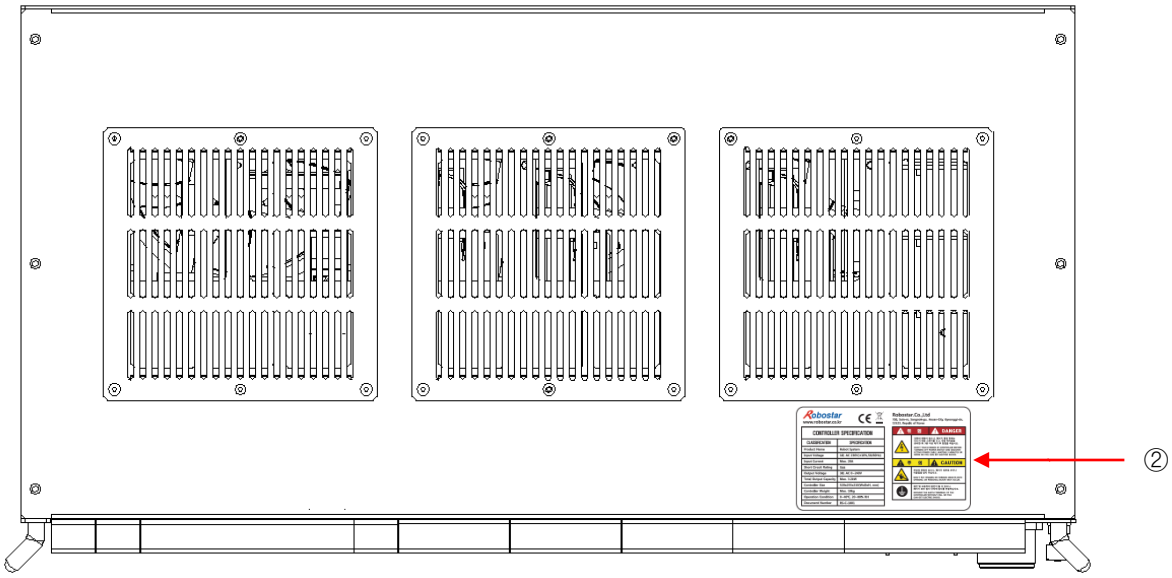
In addition, to improve the robot control functions.

- Palletizing, sealing, etc.
- 2D and 3D interpolation control of the arc, circle, high-speed, and high precision
- Parallel processing of the robot commands while processing the input and output and the movement command depending on the conditions
- Variety of pass motions, such as Position Factor Of Successive Path(PFOS), Factor Of Successive Path(FOS), etc.

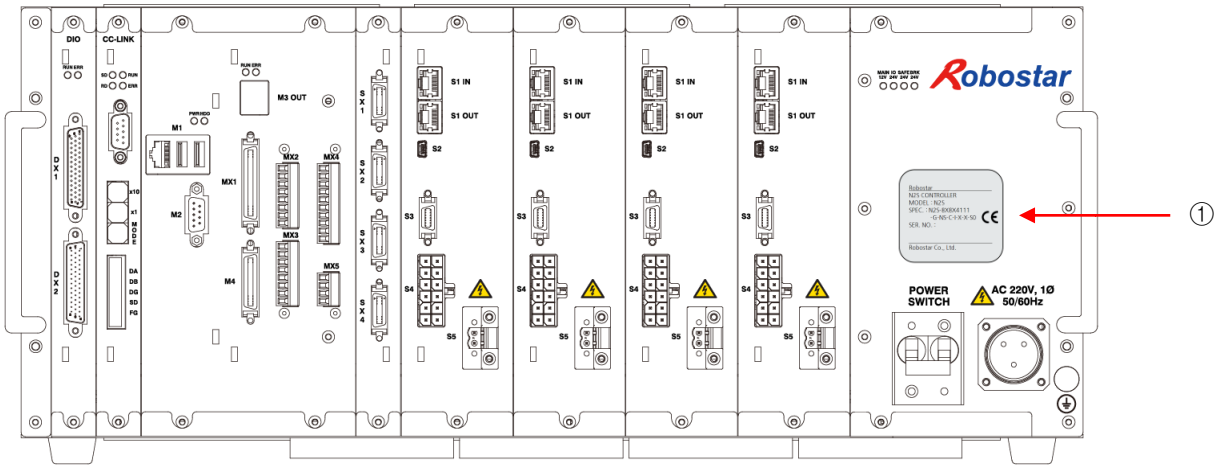
2. Name Plate Configuration

The model name of the controller is written on a name plate or paper which is attached to a front side of the controller as shown below. For identification of the model name, refer to a code table below.

2.1 Locations of Name Plate



〈Top〉



〈Front〉

2.2 Name Plates

CE Certified

① Standard Name plate

-. Controller Only

Robostar
N2S CONTROLLER
MODEL : N2S
SPEC. : N2S-8X8X4111
-G-NS-C-I-X-X-S0
SER. NO. :

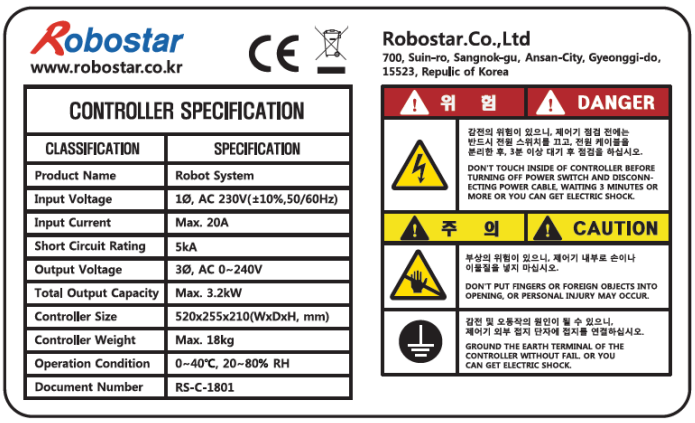
Robostar Co., Ltd.

-. With Robot

Robostar
N2S CONTROLLER
MODEL : N2S-RA007
SPEC. : N2S-8X8X4111
-G-NS-C-I-X-X-S0
SER. NO. :

Robostar Co., Ltd.

② Safety name plate



KCs Certified

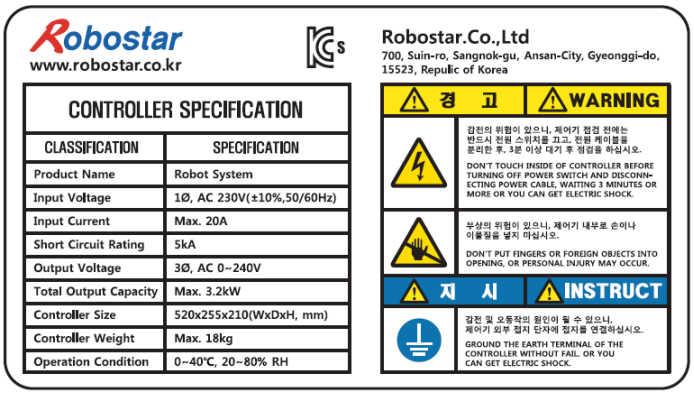
① Standard Name plate

-. With Robot

Robostar
N2S CONTROLLER
MODEL : N2S-RA007
SPEC. : N2S-8X8X4111
-G-NS-C-I-X-X-S0
SER. NO. :

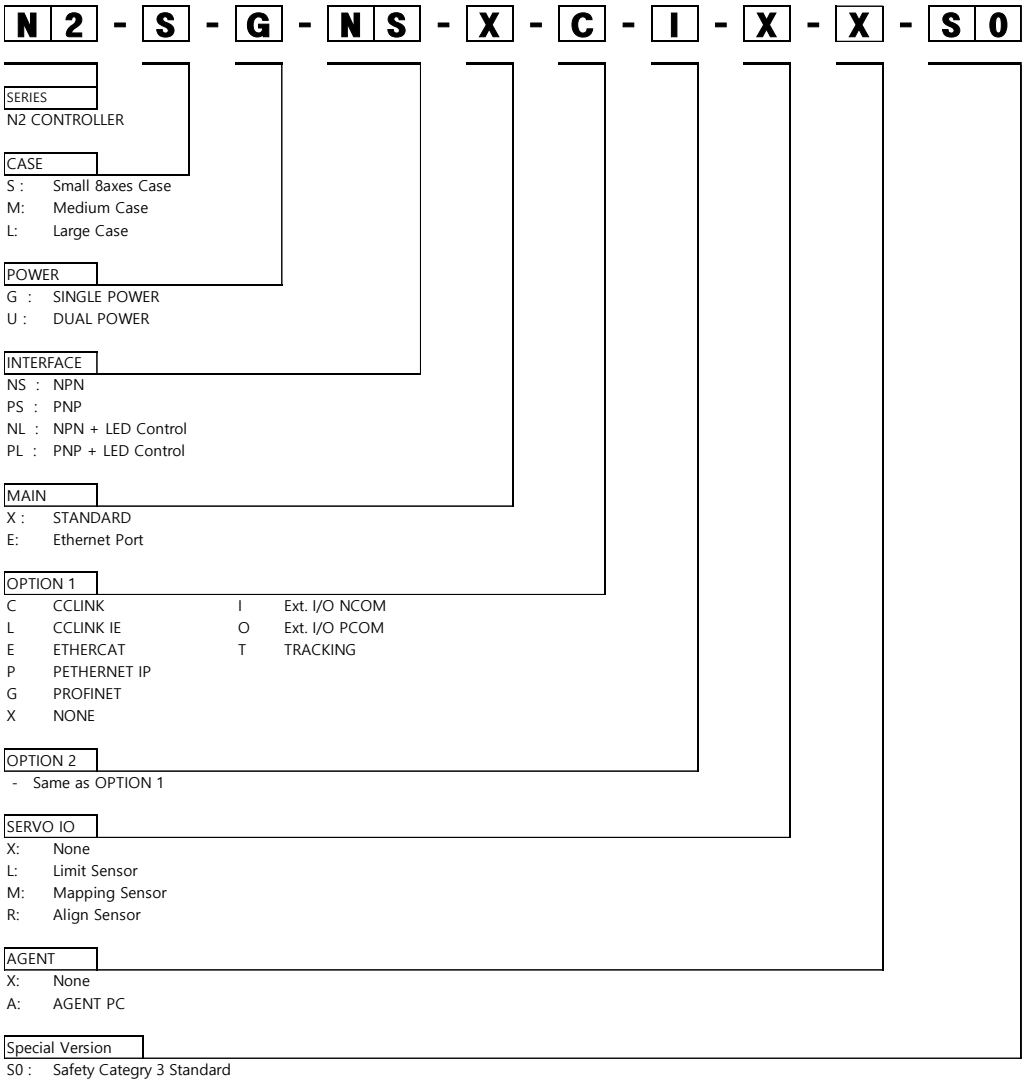
Robostar Co., Ltd.

② Safety name plate



3. N2S Series Controller Product Code

N2 Code Table

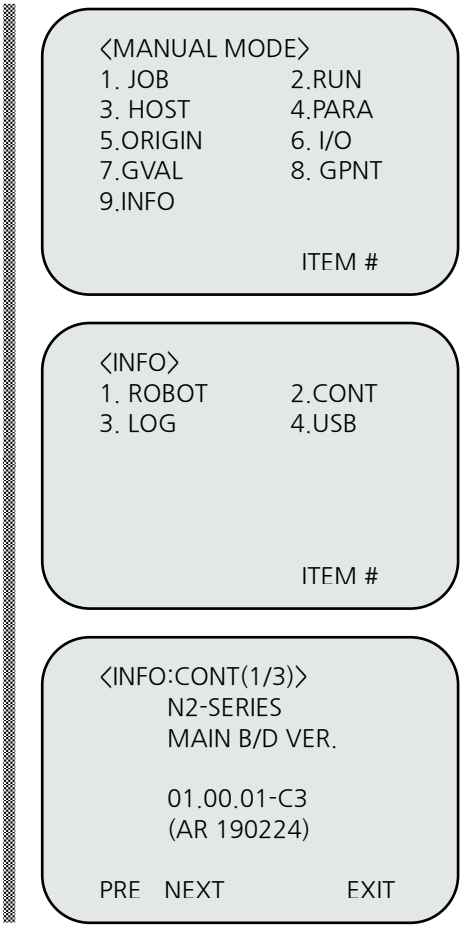


4. Software version

The version of software in the controller can be checked by a teaching pendant, as shown below.

Screen Display

Step 1.



After controller booting is completed, select 9. INFO

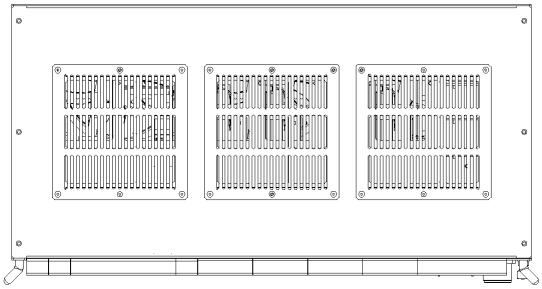
Select 2.CONT

Check Software Version

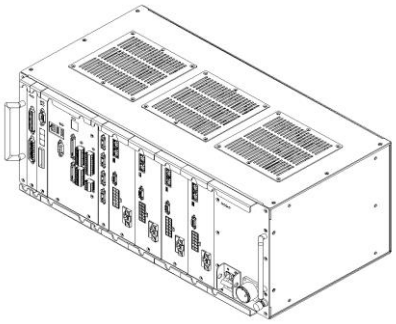
5. Name of Each Part

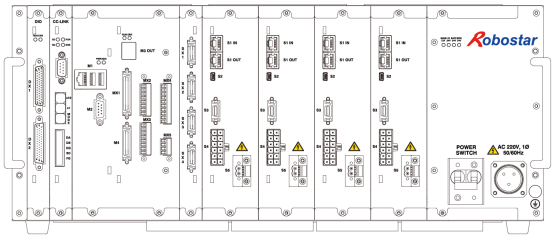
The following shows the names of each part of the appearance of the controller. For more information, see the table below.

5.1 General 8 axes controller appearance

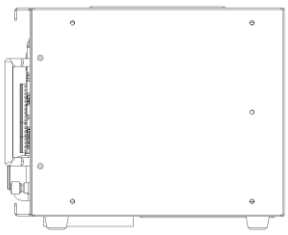


〈Top〉

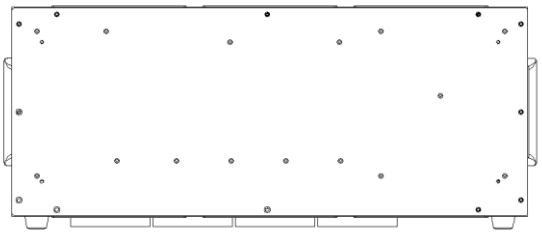




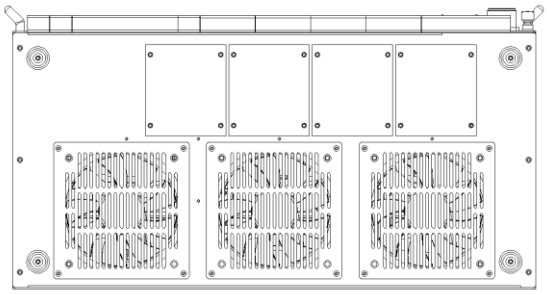
〈Front〉



〈Side〉

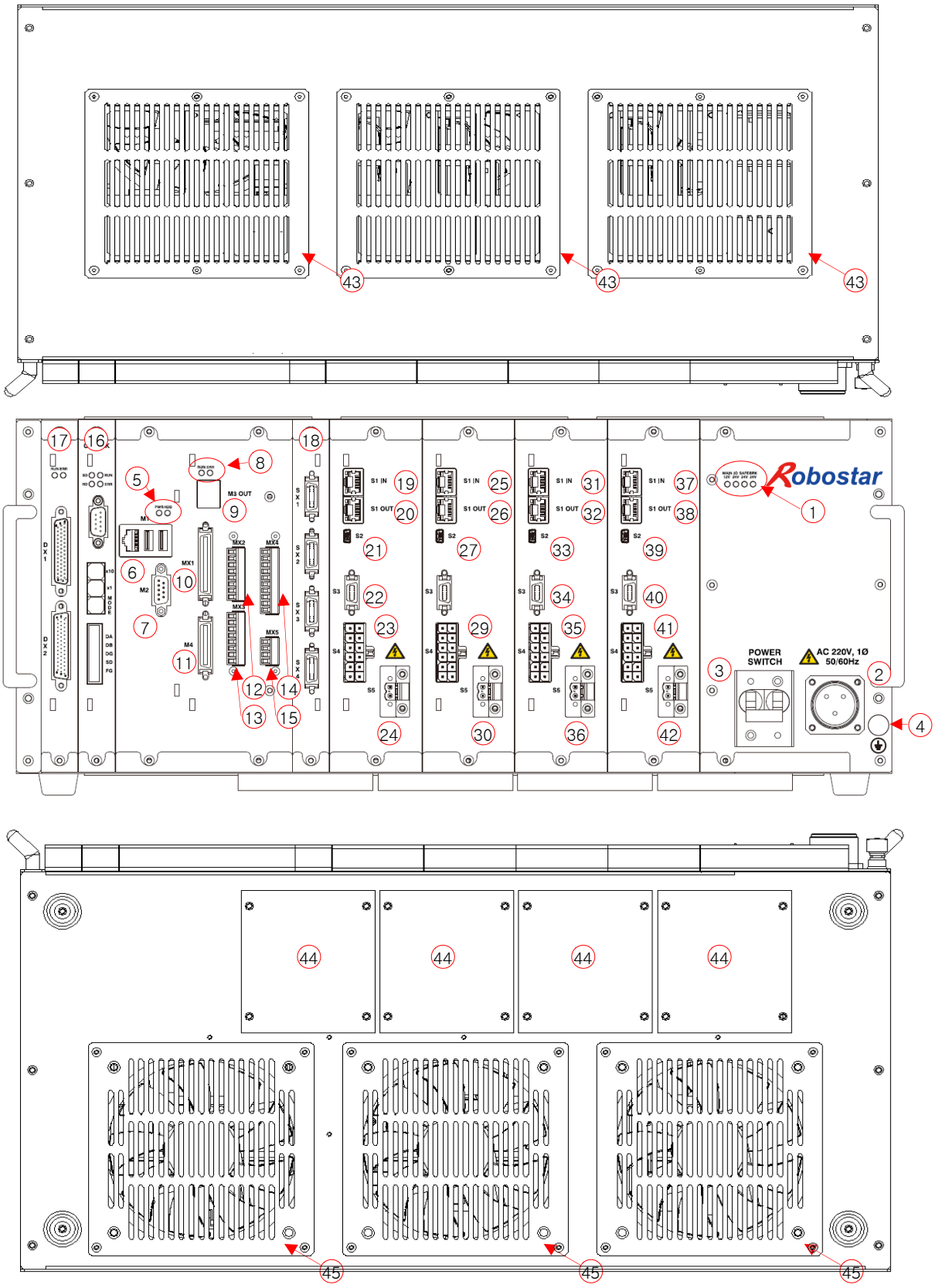


〈Back〉



〈Bottom〉

■ Names and description of each part (General 8 axes controller)



Connector NO	Exterior Marking	Description
1	MAIN 12V/IO24V/SAFE24V/BRK24V	SMPS Status Indicator
2	AC 220V, 1Ø 50/60Hz	AC power input connector
3	POWER SWITCH	AC power input switch
4	⏚	FG (Frame Ground) Connection Terminal
5	PWR/HDD	LED for main board status
6	M1	Ethernet, USB Connector
7	M2	RS-232C Connector
8	RUN/ERR	LED for Interface board status
9	M3 OUT	Field Bus(EtherCAT) output connector(Interface)
10	MX1	User in/out connector
11	M4	Teach pendant connector
12	MX2	Safety Input1 connector
13	MX3	Safety Input2 connector
14	MX4	Safety Output connector
15	MX5	Deadman Mute connector
16	OPTION B/D 1	Extension slot for Option I/O, Field Bus, analog B/D, etc.
17	OPTION B/D 2	Extension slot for Option I/O, Field Bus, analog B/D, etc.
18	SERVO I/O B/D	Extension slot for servo module I/O
19	S1 IN	Field Bus(EtherCAT) input connector (1A, 1B)
20	S1 OUT	Field Bus(EtherCAT) output connector (1A, 1B)
21	S2	Servo module update and monitoring (1A, 1B)
22	S3	Encoder input connector(1A, 1B)
23	S4	Motor power output connector (1A, 1B)
24	S5	Regenerative resistor connector(1A, 1B)
25	S1 IN	Field Bus(EtherCAT) input connector (2A, 2B)
26	S1 OUT	Field Bus(EtherCAT) output connector(2A, 2B)
27	S2	Servo module update and monitoring (2A, 2B)
28	S3	Encoder input connector(2A, 2B)
29	S4	Motor power output connector (2A, 2B)
30	S5	Regenerative resistor connector(2A, 2B)
31	S1 IN	Field Bus(EtherCAT) input connector (3A, 3B)
32	S1 OUT	Field Bus(EtherCAT) output connector(3A, 3B)
33	S2	Servo module update and monitoring (3A, 3B)
34	S3	Encoder input connector(3A, 3B)
35	S4	Motor power output connector (3A, 3B)
36	S5	Regenerative resistor connector(3A, 3B)
37	S1 IN	Field Bus(EtherCAT) input connector (4A, 4B)
38	S1 OUT	Field Bus(EtherCAT) output connector(4A, 4B)
39	S2	Servo module update and monitoring (4A, 4B)
40	S3	Encoder input connector(4A, 4B)
41	S4	Motor power output connector (4A, 4B)
42	S5	Regenerative resistor connector(4A, 4B)
43	Ventilation hole on top	Inhaling ventilation hole and air filter
44	Regenerative resistor	Servo module regenerative resistor
45	Ventilation hole on bottom	Exhausting ventilation hole and fan

6. Specifications

6.1 General Specifications

■ Installation Environment

Item	Description
Supply Power	AC 220V(+10% ~ -15%) , 50 ~ 60Hz, 20A(MAX)
Power Capacity	3.2kVA (Max load)
Encoder Specification	17bit/23bit Encoder (Serial Type)
Ambient temperature for use	0 ~ 40°C
Ambient humidity for use	20 ~ 80% RH (No dew formed)
Ambient temperature for storage	-15 ~ 60°C
Ambient humidity for storage	10 ~ 90% RH (No dew formed)

■ Performance

Item		Description
Withstanding Voltage		AC-FG 1.5kV for 1 min., Primary-Secondary 3kV for 1 min.
Immunity to Source Noise		±2,500Vp-p , 1usec , for COMMON and Normal each, for 1 min.
Noise Immunity	Motor/Encoder	±2,500Vp-p , 1usec , under induced noise for 1 min.
	I/O	±2,500Vp-p , 1usec , under induced noise for 1 min.
Insulation Resistance		Input power-to-FG: 1MΩ or more
Immunity to Instantaneous Power Failure		1/2 cycle per 10 periods of the Input power frequency
Servo Capacity		0.8 kW max for 2 axes module, 3.2 kW max for overall 8 axes module
I/O	Minimum Input Current	5mA/1point
	Maximum Output Current	50mA/1point
Brake Control		24V motor brake drive
Motor Control		AC servo motor drive (Sine wave PWM current control)

■ Specifications

Item		Function
CPU/OS		X86 Quad Core / RTOS
Motion Control Type		PTP , CP
Controllable Axes		8 axes
Servo Drive System		All-axis Full-digital AC Servo
Input/output (I/O)	User	User In/Out(20 pts/20 pts)
	Option	Option In/Out(32 pts/32 pts) , Maximum (64 pts/64 pts)
Teaching Type		Direct Teaching (Teach Pendant) On-Line Teaching (Uni-Host)
Robot Language		RRL 2.0 (ROBOSTAR Robot Language Version 2)
Robot Program Support Standard	Job	Maximum 250 pcs
	Step	Maximum 10,000 steps
	Global Points	Integer 1,000 pts, Real 1,000 pts
External Communication(option)		CC-Link, CC-Link IE, EtherCAT, Ethernet IP, ProfiNet
Error Indication		Teach Pendant
On Line Functions		Job, Point, Parameter Up/Down, Edit, Storage
Protection Functions		IPM Error , Over Current , Over Load , Over Speed , Position Error, etc.
Special Functions		3D Palletizing, In-Out Parallel Processing, Real-time Velocity Control
Cooling Type		Forceful Blowing
Dimension		520 (W) x 255 (D) x 210 (H)
Weight		Max. 18kg

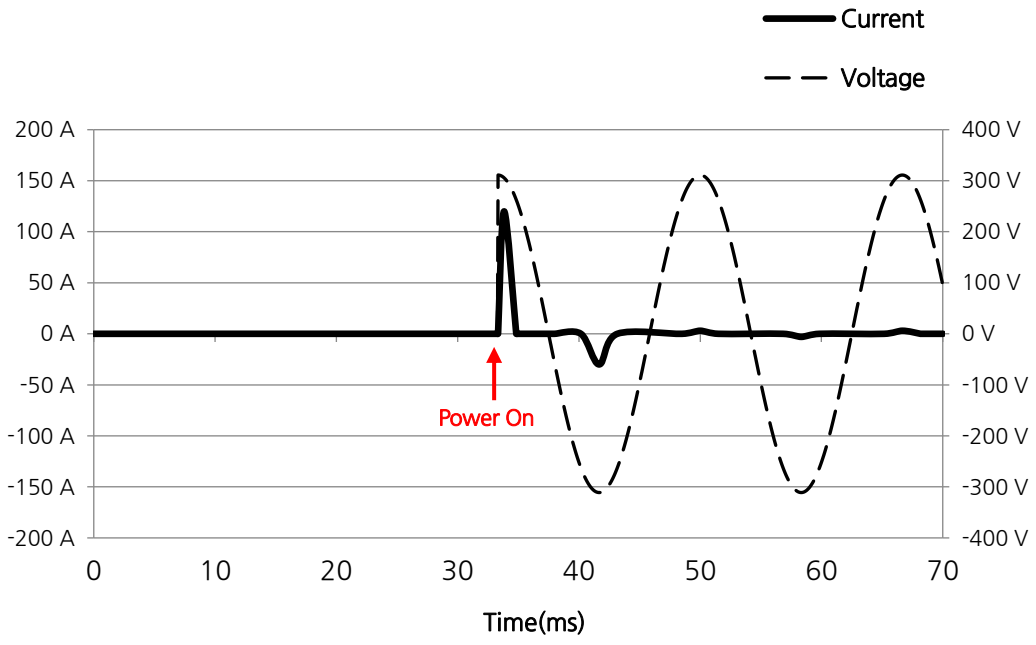
6.2 Specifications of Power Circuit Electrical Parts

■ Specifications of Electrical Parts

Items	Description
MCCB(NFB)	20A Mid Speed Type
Power Input Connector	MS3106B-18-21S(UJC)
Power Input Wire	AWG14(2.5mm^2)
FG Connection Crimp Terminal	AWG14(2.5mm^2), 4R
FG Connection Wire	AWG14(2.5mm^2), Yellow/Green

■ Inrush Current

- At power on, inrush current occurs for 2 ms max. 120 A_{peak}
  - At 1 servo module, 90 A_{peak}
  - At 4 servo modules, 120 A_{peak}
- When designing the input power capacity, select the recommended standard product or inrush current protection type.



< Inrush current @ power on >

CAUTION

- ▶ Connect FG terminal and factory ground.
- ▶ Use 600V, PVC insulated wires.
- ▶ Use the wires conforming to the standard.
- ▶ In case of other special specifications, please use the same or equivalent wires listed.

6.3 Power Supply

The following shows the power consumption under normal conditions when the robot is driven.

Design the capacity of the factory power supply and the capacity of the circuit breaker based on [Chapter 1, Verse 6.2 Specifications of Power Electrical Part] and following tables.

■ Power Consumption by Robot

The current shown in Table [6.3.A] is the RMS value. Table [6.3.A] shows the power consumption when driving the robot with the load ratio as the table.

However, since the current flows at 4-5 times the average current in the acceleration section, Design the capacity so that the transformer or circuit breaker will not saturate and trip during the acceleration section.

Robot Model	Average Load Ratio		Remark
	60%	35%	
RA004	$4A_{rms}$ @220V 880VA	$2.5A_{rms}$ @220V 540VA	Control power included
RA007	$6A_{rms}$ @220V 1320VA	$3.7A_{rms}$ @220V 820VA	Control power included

Table [6.3.A]

■ Estimation of Power Consumption by Motor Capacity

The current shown in Table [6.3.B] is the RMS value. Table [6.3.B] shows consumption current according to motor capacity.

The total current consumption can be estimated by summing the currents shown below proportional to the load factor.

Since there are many variables such as motion, diversity factor, and regenerative motion, errors occur. Please use as reference material.

Motor Capacity	Average Load Ratio		Remark
	60%	35%	
Control Power	$1.3A_{rms}$ @220V 290VA		When all axes servo is on
750W	$1.3A_{rms}$ @220V 290VA	$0.8A_{rms}$ @220V820VA	
400W	$0.7A_{rms}$ @220V 160VA	$0.4A_{rms}$ @220V820VA	
200W	$0.5A_{rms}$ @220V 110VA	$0.3A_{rms}$ @220V820VA	
100W	$0.25A_{rms}$ @220V 60VA	$0.15A_{rms}$ @220V 820VA	
50W	$0.12A_{rms}$ @220V 30VA	$0.07A_{rms}$ @220V 820VA	

Table [6.3.B]

Example)
Condition 1 - RA007 Robot
Condition 2 - J1~J4 Axes Load Ratio 40%
Condition 3 - J5~J6 Axes Load Ratio 60%
Consumption Curr. = Control Curr. + Σ(Consumption Curr. by Axes Load Ratio)
= Control Curr.+ (Consumption Curr. by J1 Axis Load Ratio 60%)*40%/60%
+ (Consumption Curr. by J2 Axis Load Ratio 60%)*40%/60%
+ (Consumption Curr. by J3 Axis Load Ratio 60%)*40%/60%
+ (Consumption Curr. by J4 Axis Load Ratio 60%)*40%/60%
+ (Consumption Curr. by J5 Axis Load Ratio 60%)
+ (Consumption Curr. by J6 Axis Load Ratio 60%)
= 1.3 + (1.3*40%/60%) + (1.3*40%/60%) + (0.7*40%/60%) + (0.25*40%/60%) + 0.25 + 0.25
= 4.17[A]

■ Robot Motor Capacity

Axis	Robot Model		Remark
	RA004	RA007	
J1	400W	750W	High Real Grade
J2	400W	750W	High Real Grade
J3	200W	400W	High Real Grade
J4	50W	100W	High Real Grade
J5	50W	100W	High Real Grade
J6	50W	100W	High Real Grade

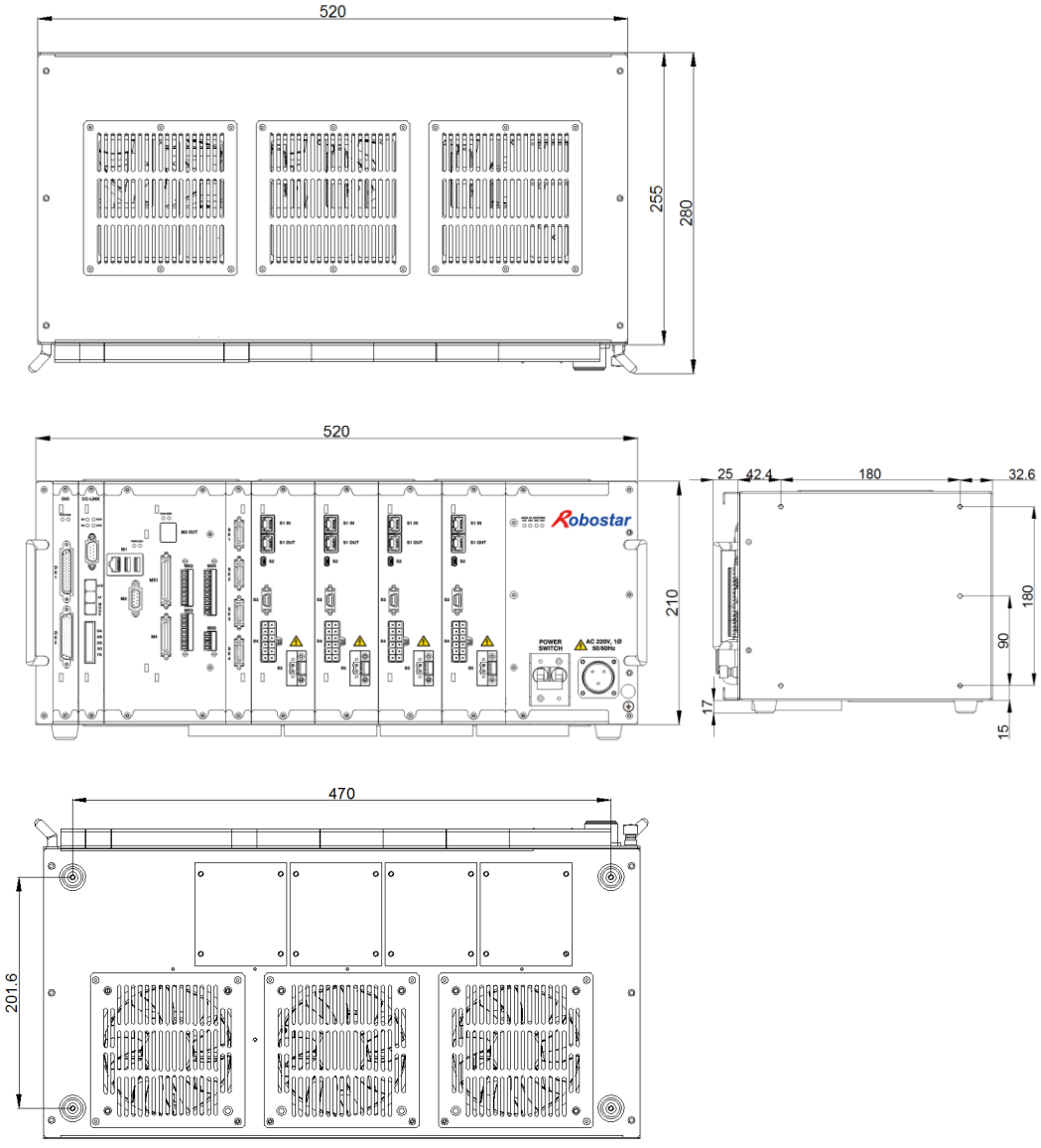
Table [6.3.C]

CAUTION

- ▶ Power consumption may be different depending on usage conditions.
- ▶ Design the power plant considering the safety factor.

6.4 Product Dimension

[Unit: mm]



Item	Size
Controller only	520 (W) x 255 (D) x 210 (H)
Handles included	523 (W) x 280 (D) x 210 (H)

Chapter 2 Installing Method of Controller

1. Getting Proper Installation Environment

1.1 Conditions for installation environment

- Since the robot and the controller are not intended to be of anti-explosion, dust-proof, or drop-proof standard, they cannot be installed at the following places.

(1) Environment where flammable gases, flammable liquids, etc. is used
(2) Environment where conductive materials such as metal processed chip is scattering
(3) Environments with acid or alkali corrosive gas
(4) Environments with the mist such as cutting liquid or grinding liquid
(5) Environments with the mist such as cutting liquid or grinding liquid containing the oil component
(6) Environment close to the electrical noise sources, such as a large inverter, high-power frequency oscillator, a large conductor, welding machine, etc

1.2 Ambient temperature and humidity

- Ambient temperature range in operation is to be 0 to 40 ℃
- Be the humidity 80% RH (MAX) or less
- Make well-ventilated and be less dust, dirt and moisture.

1.3 Vibration

- Install the robot at the place where is away from the environment subjected to excessive vibration and shock.

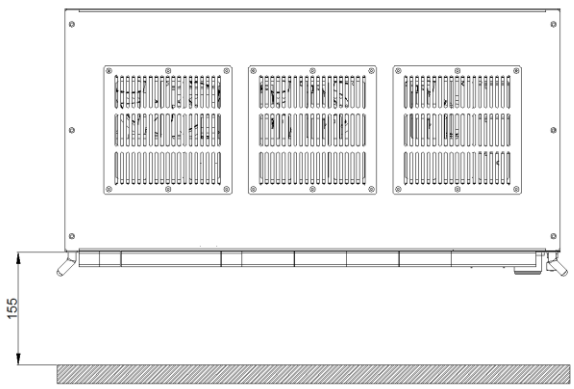
▶ The installation environment for a robot body and a controller unit is very important. Be sure to observe the following installation environment. If the installation environment is not proper, the function and performance may not be fully accomplished, as well as the life of the device may be shortened and unexpected failures may be caused.

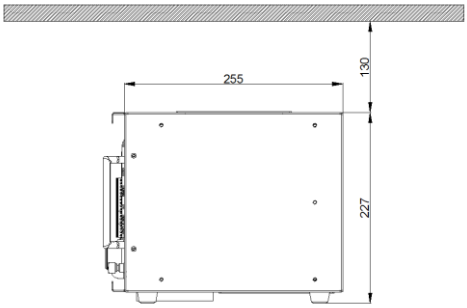
2. Installation Space

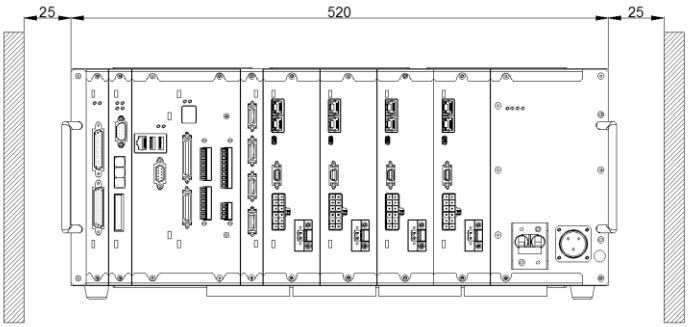
Taking into consideration the robot cable bending, cooling fan interference or the like, secure sufficient space as shown below.

■ Getting installation space

- When fixing the controller, keep more than 155mm of gap from the front panel to connect robot cable.
- Keep more than 130mm gap from the upper part air intake.
- Keep more than 25mm of gap from the right and left side.







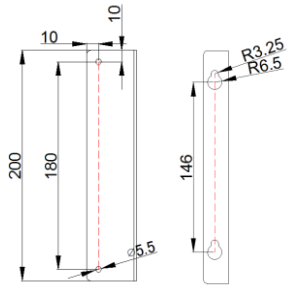
Item	Size
8 axes	520 (W) x 255 (D) x 210 (H)

⚠CAUTION

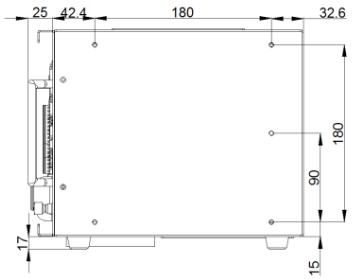
- ▶ The cooling system of the controller is a fan forced ventilation type.
- ▶ Be sure to prepare the space so that the cooling fan is not subjected to the occurrence of interference.

■ Attaching Rack Bracket

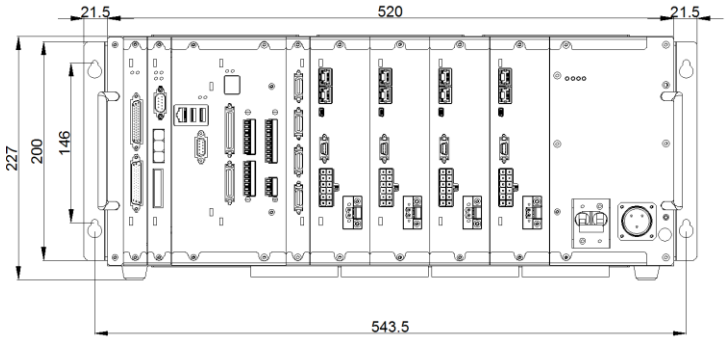
Rack bracket can be attached at holes of right/left side covers of N2S series product.
Secure the attachment hole and space as follows when attaching the rack bracket.

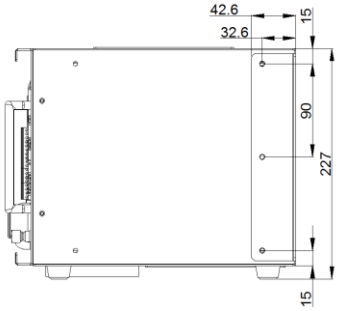


〈Rack Bracket〉



〈Holes for Bracket〉



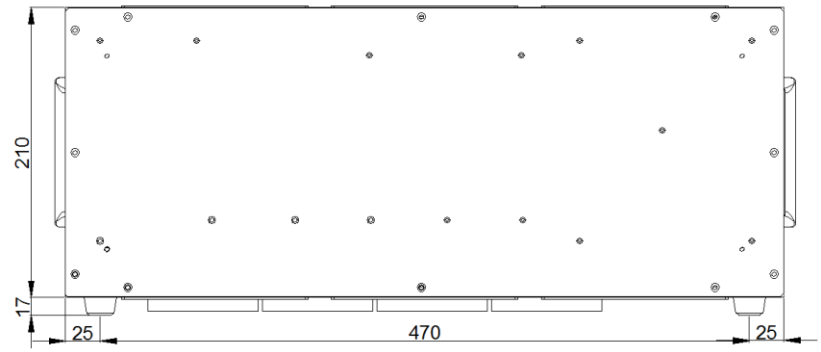


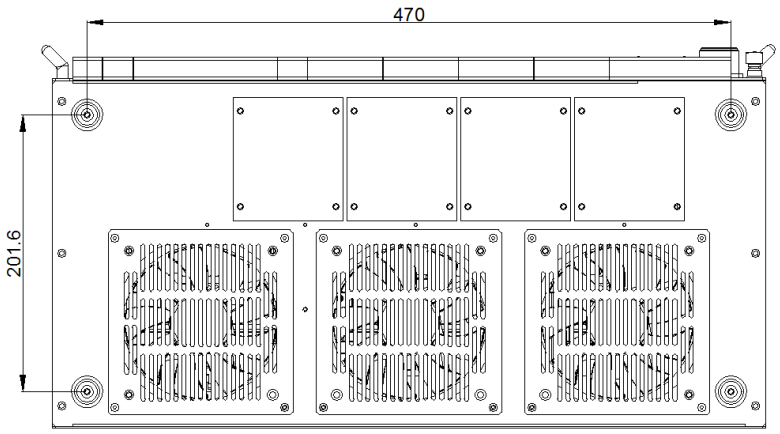
Div.		Hole gap for fixing the controller on the wall
General	8axes	543.5 x 146

■ Attaching Rubber foot

Rubber foot is supplied on the bottom as standard.
Depending on the installation space, the rubber foot can be attached to the bottom, and locations for attachment are as below.

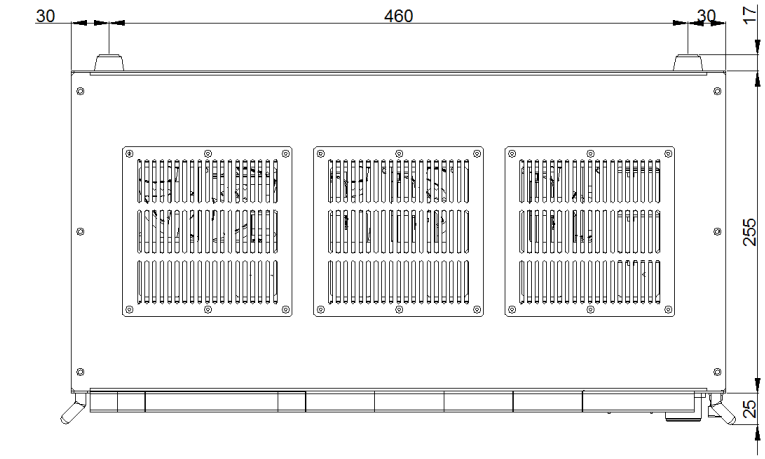
■ When attaching the rubber foot to the bottom

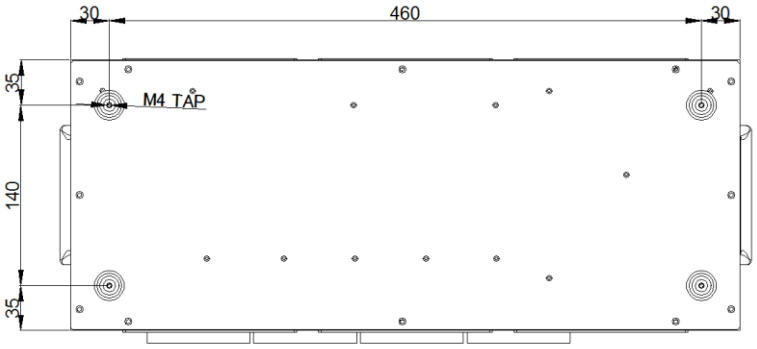




Div.		Gap between rubber foots
General	8 Axes	470(L) x 210.6

■ When attaching the rubber foot to the back side

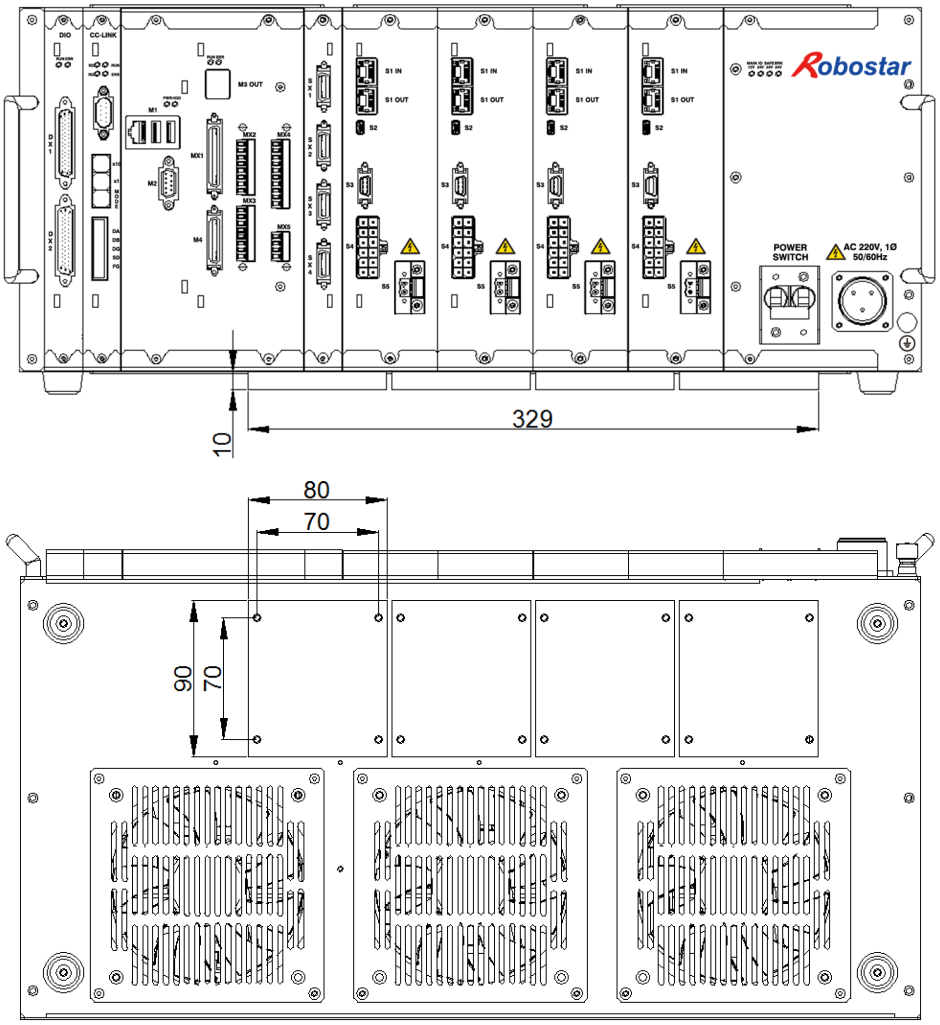




Div.		Gap between rubber foots
General	8 Axes	460(L) x 140

■ Attaching Regenerative resistor

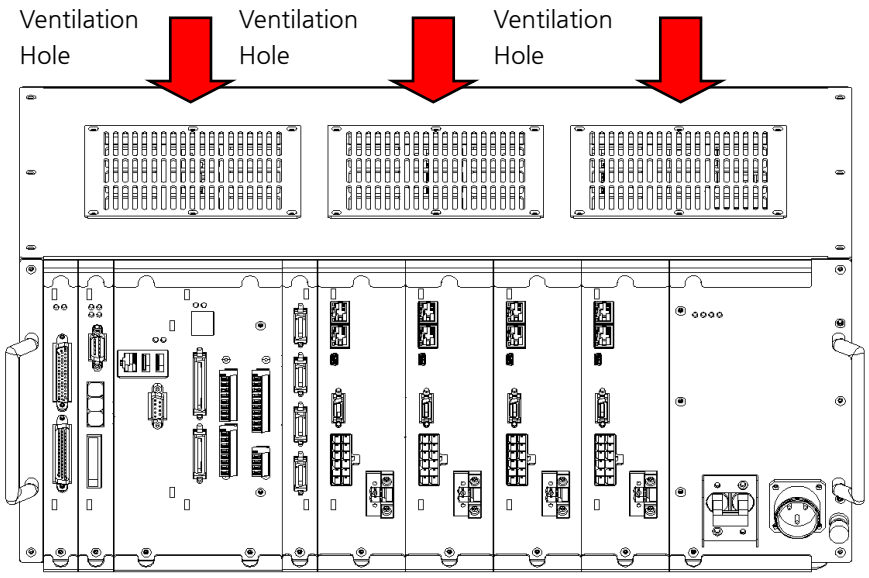
Regenerative resistor can be externally attached, using the bottom of controller as follows.



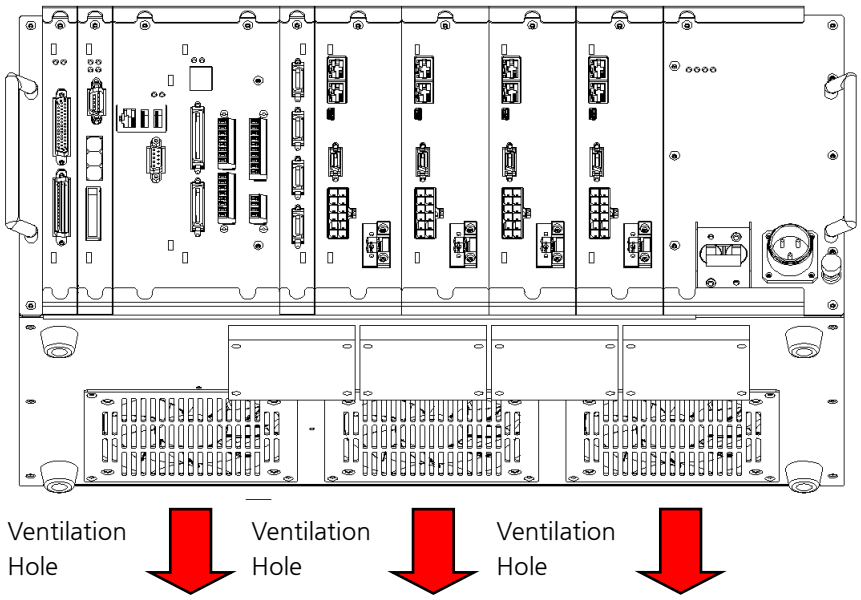
3. Ventilation direction

Ventilation direction of the controller is as follows. Consider it when in controller installation

(1) Outside air in-taken



(2) Inside air exhausted



CAUTION

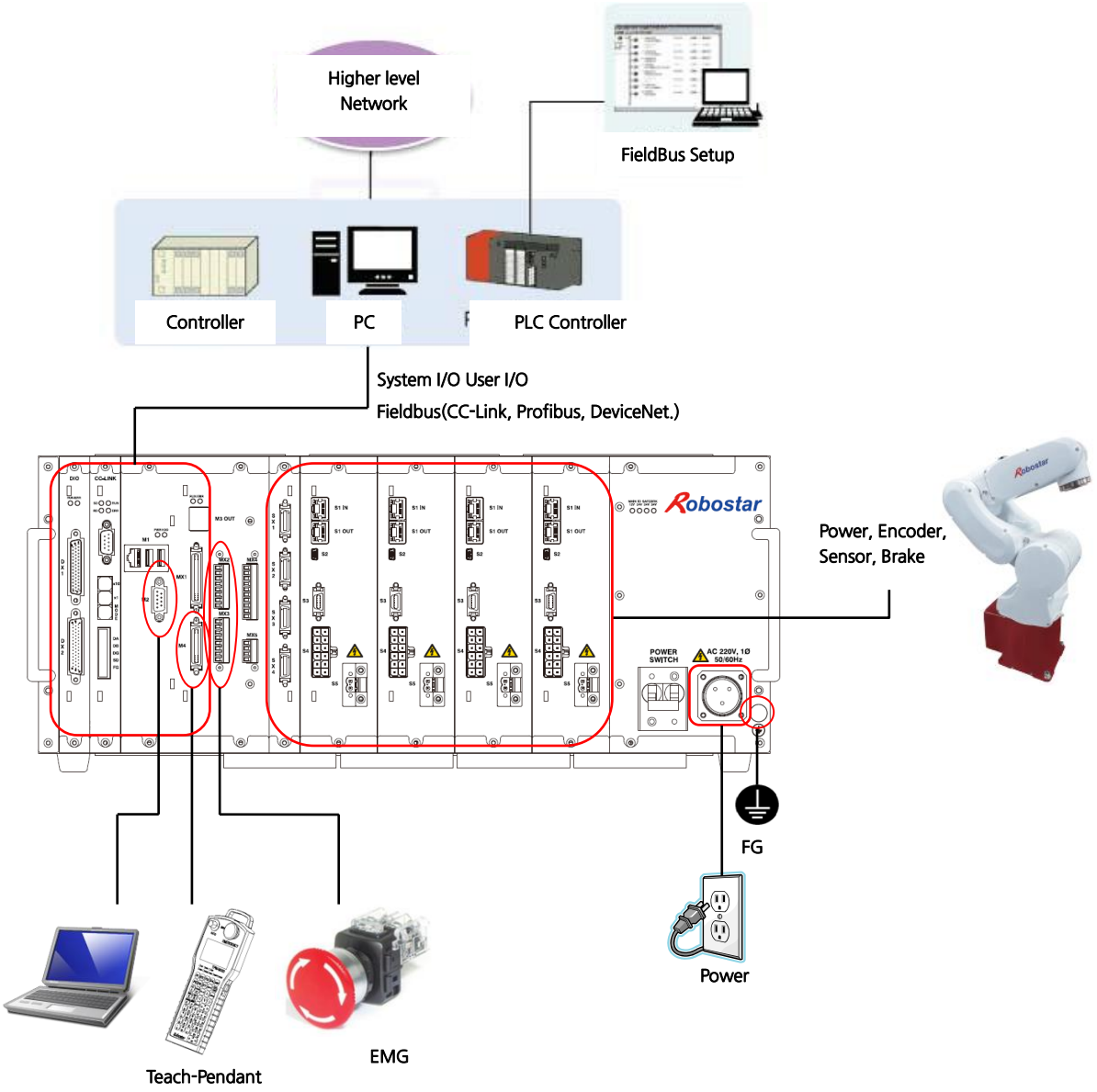
- ▶ An air filter for the top ventilation holes must be replaced from time to time by checking the contaminated state.
- ▶ (Replacement period: 3 months).

Chapter 3 Robot Connection and External Interface

1. Construction of robot system

N2S Series Robot System is constructed as follows. For the interface of each part, see the next chapter.

■ Construction of robot system



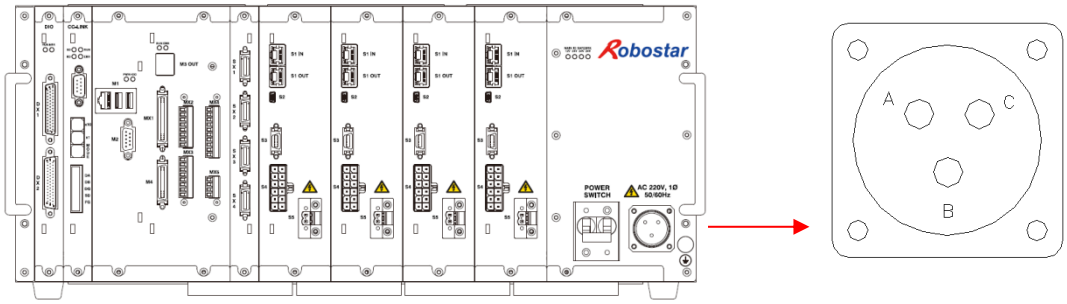
2. Controller Unit Connection Method

2.1 AC Power Cable

Interface for feeding AC power supply to the controller.

■ Controller interface

Connector for Controller	MS3102A-18-21P(UJC)
Connector for Power Cable	MS3106B-18-21S(UJC)



AC Power Connector (Rating : 20A)	
PIN No.	Signal
A	AC230V ±10%, 50-60Hz, Input, L
B	FG
C	AC230V ±10%, 50-60Hz, Input, N

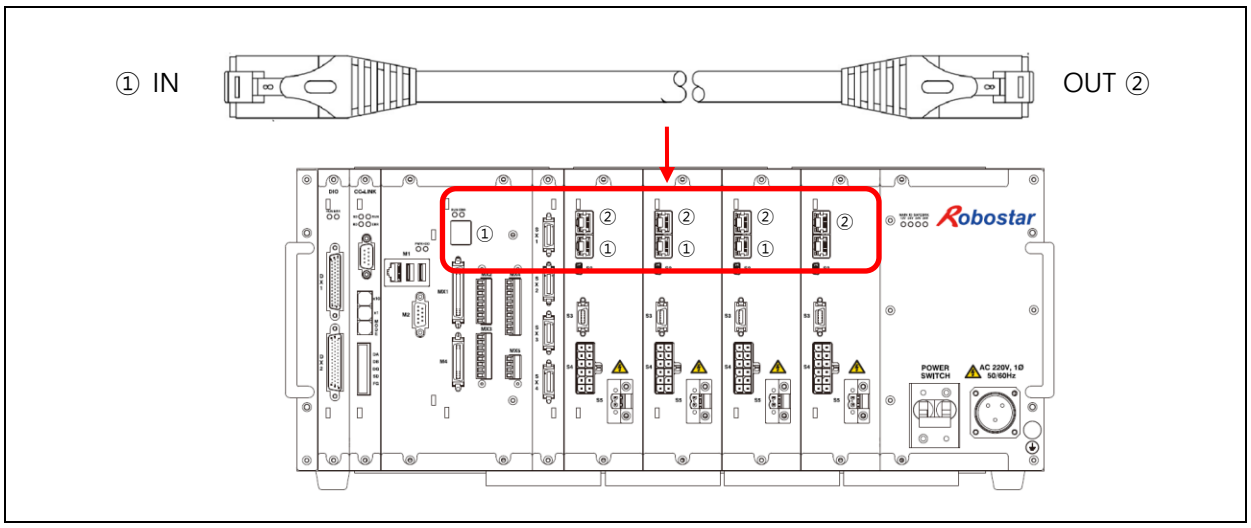
CAUTION

▶ In case the connector of the power cable to robot is wrongly connected, a circuit breaker shuts off or the inside of the controller may be damaged.

3.1.1 EtherCAT Interface

The figure below shows how to connect an EtherCAT cable.

See the description below for connector specifications and pinmap.

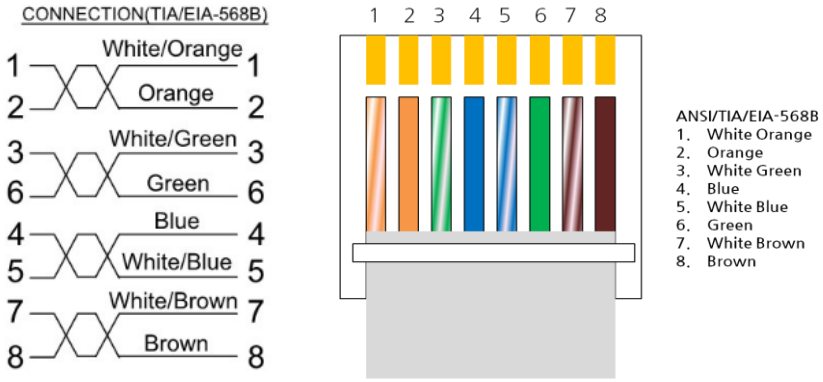


■ Cable Specification

Cable	SFTP CAT.7, 27AWG, NETmate
Connector	RJ45(8P8C) Male, Pin Gold-Plated 50u

■ Pinmap of Connector

Connector pinmap is TIA/EIA-568B compliant.

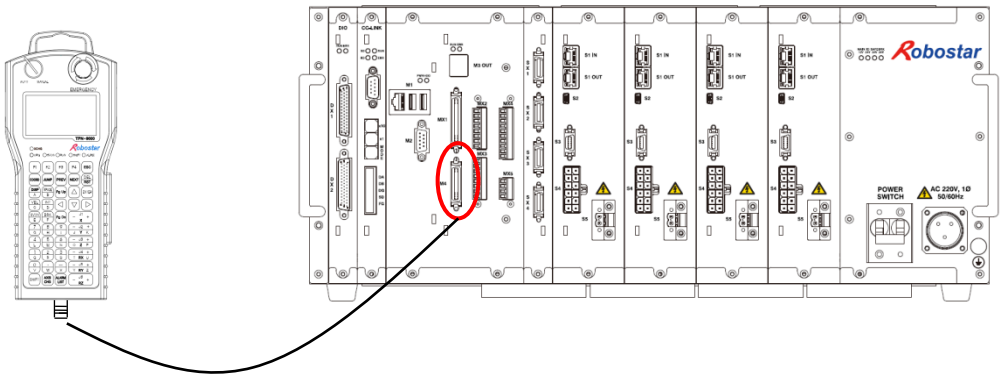


〈Connector and cable connection〉

2.2 Teach Pendant Interface

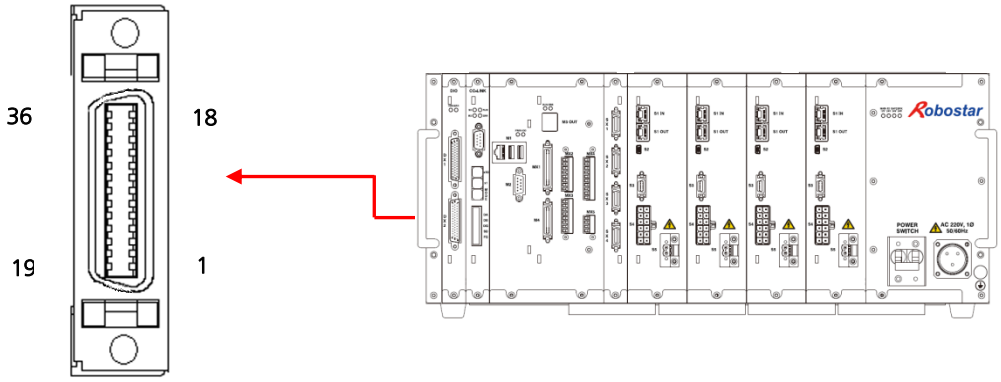
The picture below shows how to connect the Teach Pendant.
Refer to the table below for connector specifications and pin-map.

Teach pendant



■ T/P Connector

Controller Connector	10236-5212PC (3M)
T/P Connector	10136-3000PE (3M)
T/P Cable Hood	10368-52A0-008 (3M)



CAUTION

▶ Be sure to make screw-lock when connecting the connector. If the connector is disconnected, controller status will be emergency stop.

■ T/P Connector Interface Description

Pin No.	Signal Name	Description
1	G12V	T/P Power GND
2	G12V	T/P Power GND
3	G12V	T/P Power GND
4	GND	RS232 GND
5	GND	RS232 GND
6	-	-
7	T/P Open	T/P Connection Status Input
8	T/P Mode	T/P Mode Input
9	T/P DeadMan	T/P DeadMan Input
10	T/P EMG	T/P Emergency NO contact
11	DeadMan NC 11	T/P DeadMan InterLock NC contact 11
12	DeadMan NC 12	T/P DeadMan InterLock NC contact 12
13	DeadMan NC 21	T/P DeadMan InterLock NC contact 21
14	DeadMan NC 22	T/P DeadMan InterLock NC contact 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	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	T/P RX	T/P RS232 Data receive
28	T/P TX	T/P RS232 Data transmit
29	-	-
30	-	-
31	-	-
32	-	-
33	EMG NC 11	T/P Emergency NC contact 11
34	EMG NC 12	T/P Emergency NC contact 12
35	EMG NC 21	T/P Emergency NC contact 21
36	EMG NC 22	T/P Emergency NC contact 22

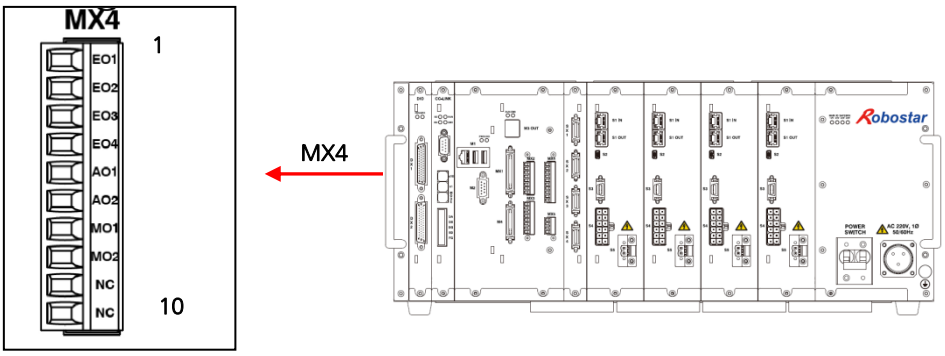
■ '-'sign means the unused pins.

2.3 Machine Safety Circuit Interface

This indicates how to connect machine safety input/output interfaces.
It is possible to construct safety circuit(more than 3 of Safety Category) through machine safety input/output interfaces

■ Machine Safety Output Connector (MX4)

Controller Connector	ECH381V-10P(Dinkle)
Output Cable External Connector	EC381V-10P(Dinkle)



■ Description of Machine Safety Output Interface (MX4)

Pin No.	Mark	Signal Names	Description
1	EO1	SYS EMG OUT NC11	User emergency output NC contact 11
2	EO2	SYS EMG OUT NC12	User emergency output NC contact 12
3	EO3	SYS EMG OUT NC21	User emergency output NC contact 21
4	EO4	SYS EMG OUT NC22	User emergency output NC contact 22
5	AO1	MODE OUT NC1	User mode output NC contact 1
6	AO2	MODE OUT NC2	User mode output NC contact 2
7	MO1	MODE OUT NO1	User mode output NO contact 1
8	MO2	MODE OUT NO2	User mode output NO contact 2
9	NC	-	-
10	NC	-	-

■ '-' sign means the unused pin.

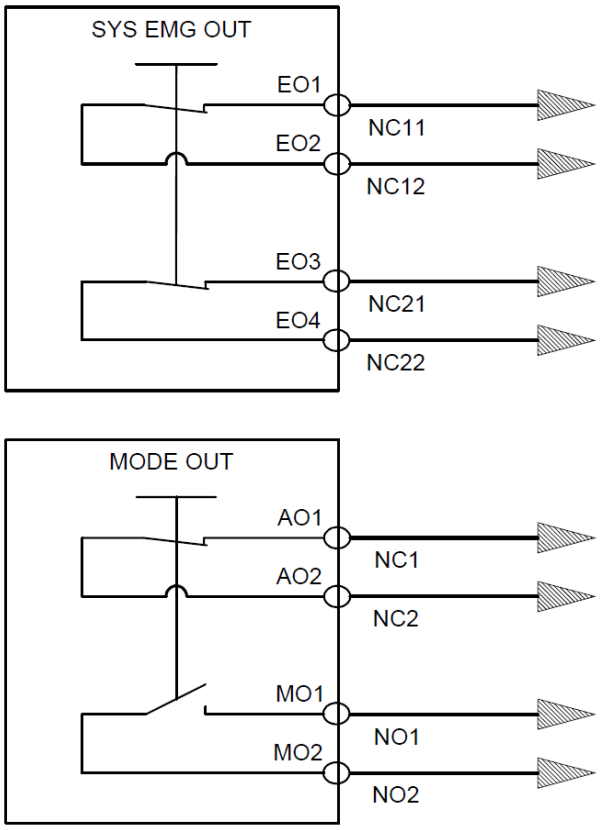
■ SYS EMG Output Signal (2NC)

In case of Emergency situation of the controller and alarm occurrence, it is possible to configure the safety circuit so that the external emergency circuit can be connected in serial with duplex to shut off the power of other robot and motor.

■ MODE Output Signal (1NO, 1NC)

This is a signal outputting status of controller, outputting the status of controller to external device with contact.

Controller active mode	NC Contact	NO Contact
MANUAL	OPEN	CLOSE
AUTO(SYSTEM)	CLOSE	OPEN



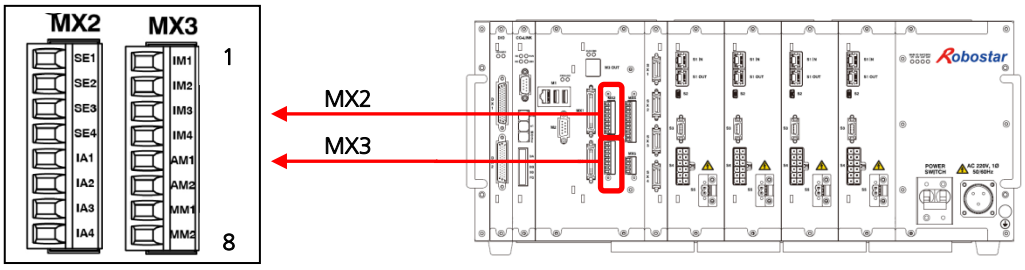
<Machine safety Output Signal>

CAUTION

- ▶ NC contact is an abbreviation of Normally Close, which means that the contact is closed when it is in the default condition.
- ▶ NO contact is an abbreviation of Normally Open, which means that the contact is opened when it is in the default condition.

■ Machine Safety Input Connector(MX2, MX3)

Controller Connector	ECH381V-08P(Dinkle)
Input Cable Connector	EC381V-08P(Dinkle)



CAUTION

- ▶ Make sure that Safety Input Jumper must be connected unless higher level emergency is used.
- ▶ The contacts 11,12 and 21,22 must operate simultaneously.

■ Description of Machine Safety Input Interface

■ MX2

No	Mark	Signal Names	Description
1	SE1	SYS EMG NC11	User Emergency Stop NC contact 11
2	SE2	SYS EMG NC12	User Emergency Stop NC contact 12
3	SE3	SYS EMG NC21	User Emergency Stop NC contact 21
4	SE4	SYS EMG NC22	User Emergency Stop NC contact 22
5	IA1	INTERLOCK A NC11	Interlock Auto-mode NC contact 11
6	IA2	INTERLOCK A NC12	Interlock Auto-mode NC contact 12
7	IA3	INTERLOCK A NC21	Interlock Auto-mode NC contact 21
8	IA4	INTERLOCK A NC22	Interlock Auto-mode NC contact 22

■ MX3

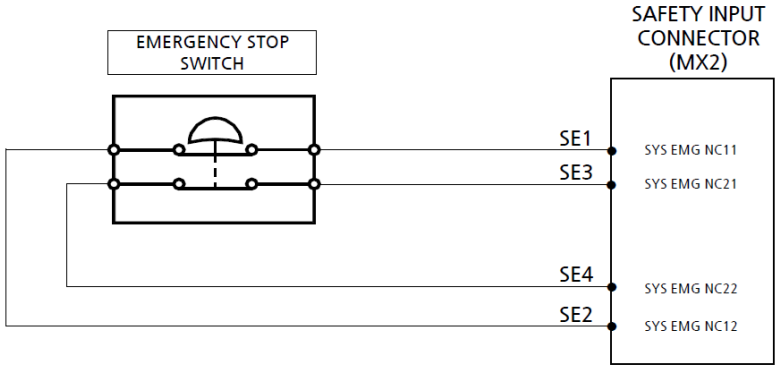
No	Mark	Signal Names	Description
1	IM1	INTERLOCK M NC11	Interlock Manual-mode NC contact 11
2	IM2	INTERLOCK M NC12	Interlock Manual-mode NC contact 12
3	IM3	INTERLOCK M NC21	Interlock Manual-mode NC contact 21
21	IM4	INTERLOCK M NC22	Interlock Manual-mode NC contact 22
5	AM1	INDEX MODE NC1	External Operation Mode NC contact 1
6	AM2	INDEX MODE NC2	External Operation Mode NC contact 2
7	MM1	INDEX MODE NO1	External Operation Mode NO contact 1
8	MM2	INDEX MODE NO2	External Operation Mode NO contact 2

■ SYS EMG Input Signal (2NC)

SYS EMG input is safety circuit for blocking the power for motor when emergency status.

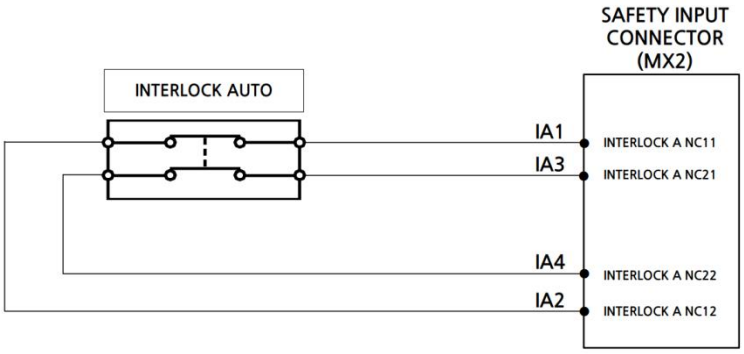
Connect two lines of EMG switch with contact(2NC).

If one contact is open, a System Emergency alarm turn on and motor will be shut off.



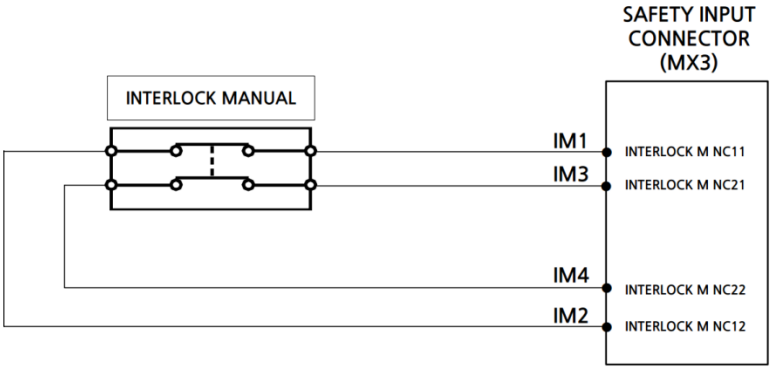
■ INTERLOCK A input signal(2NC)

It is an emergency stop signal in automatic(system) mode. The customer have to input NC when normal state. If an alarm occurs, the customer has to input NO. If the signal is NO, Interlock Auto alarm turns on and motor will be shut off.



■ INTERLOCK M input signal(2NC)

It is emergency stop signal in manual mode. The customer have to input NC when normal state. If an alarm occurs, the customer has to input NO. If the signal is NO, Interlock Manual alarm turn on and motor will be shut off.



⚠CAUTION

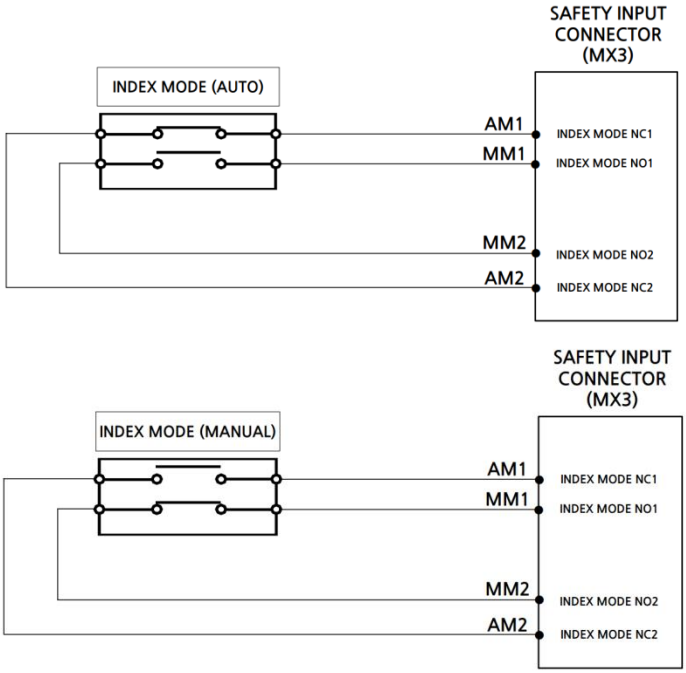
- ▶ NC 11 ↔ NC 12, NC 21 ↔ NC 22
- ▶ The contacts must be ON-OFF simultaneously. (2B / 2B-1A contact applied)
- ▶ Normal state : Normal Close signal input
  Alarm state : Normal Open signal input

■ External operation mode input signal (1NC, 1NO)

Signal to input status of external device. Status of the controller must be matched to perform normal operation. Operation mode of the controller can be converted into AUTO when controller MODE is SYSTEM (AUTO) MODE and external device signal input is AUTO as well.

(1) External operation mode input

External operation mode input	NC contacts	NO contacts
MANUAL	OPEN	CLOSE
AUTO(SYSTEM)	CLOSE	OPEN



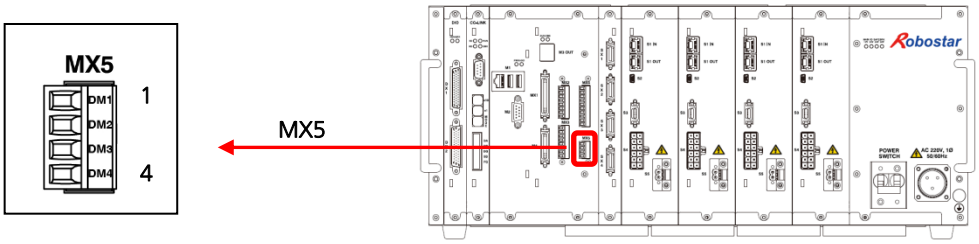
(2) Controller mode

Controller (T/P) mode	External operation mode	Controller active mode
MANUAL	MANUAL	MANUAL
AUTO(SYSTEM)	MANUAL	MANUAL
MANUAL	AUTO	MANUAL
AUTO(SYSTEM)	AUTO	AUTO(SYSTEM)

⚠ CAUTION mode input contact, NC and NO signals must be entered simultaneously.

■ Manufacturer-used Connector

Controller Connector	ECH381V-04P, Dinkle
Input Cable Connector	EC381V-04P, Dinkle



Manufacturer-used Connector Pinmap(MX5)			
PIN No.	Mark	Signal	Description
1	DM1	DEADMAN NC11	Manufacturer DEADMAN NC contact 11
2	DM2	DEADMAN NC12	Manufacturer DEADMAN NC contact 12
3	DM3	DEADMAN NC21	Manufacturer DEADMAN NC contact 21
4	DM4	DEADMAN NC21	Manufacturer DEADMAN NC contact 22

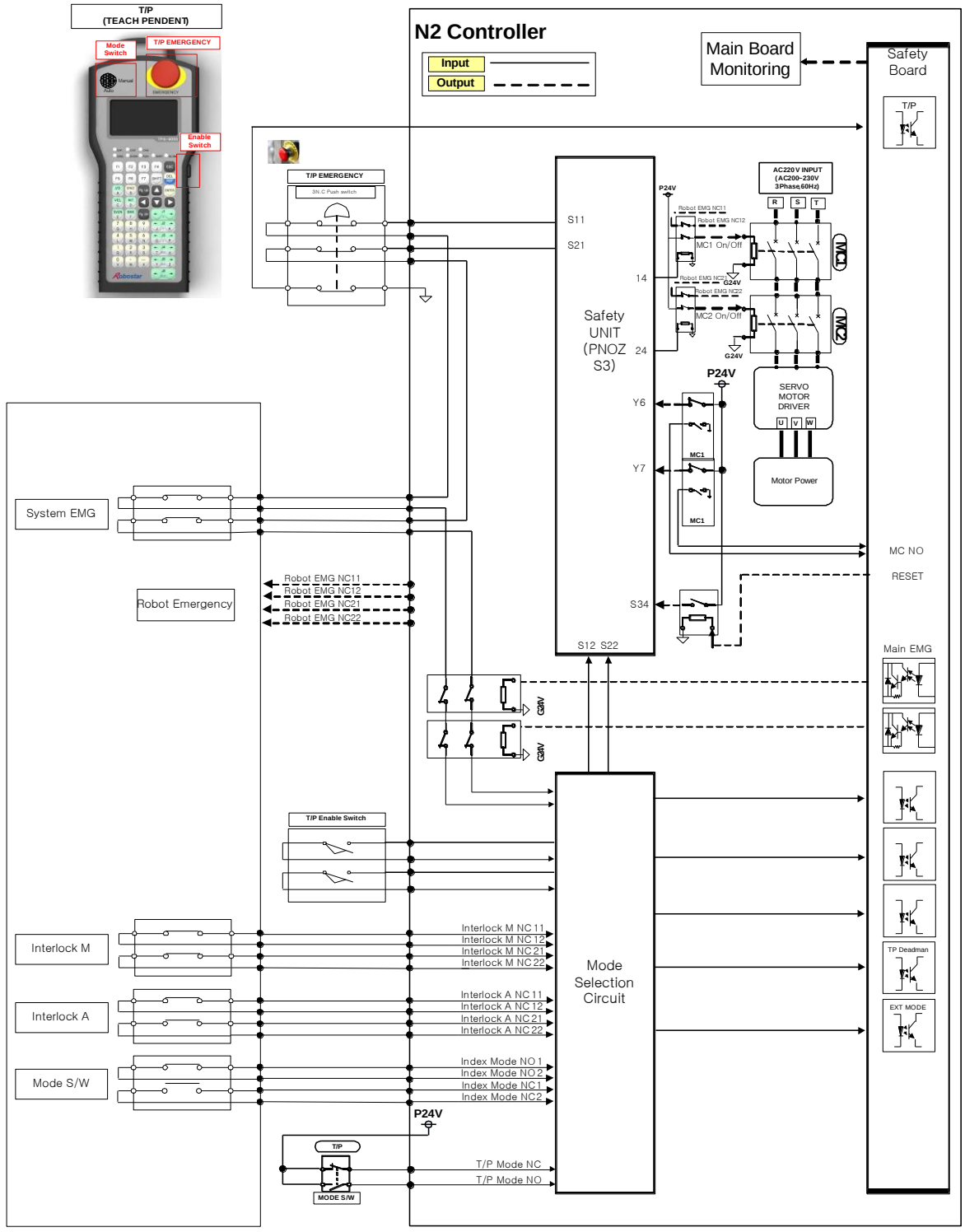
■ DEADMAN Machine Safety contacts (2NC)

Machine safety DEADMAN signal monitoring contact of Teach pendant. The user should not use this signal to construct a safety circuit.

⚠ CAUTION

- ▶ Safety level is not recognized when used as an interface used in the robot manufacturing process.
- ▶ The user must use the contact with the contact open.

2.4 Controller Safety circuit block diagram



CAUTION

- ▶ Emergency consists of 'T/P Emergency' and 'System Emergency'.
- ▶ The contacts of SYS EMG NC 11 ↔ SYS EMG NC 12, SYS EMG NC 21 ↔ SYS EMG NC 22 N.C의 must be ON/-OFF.. (Use 2B or 2B-1A contact)
- ▶ Use after connecting teach pendant, as, if not, 'T/P Emergency Alarm' is generated.

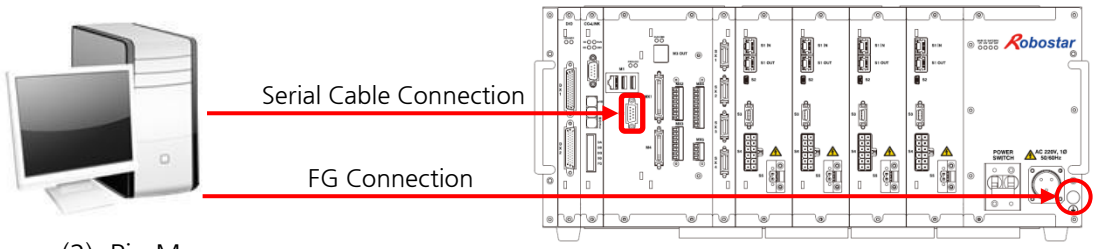
3. Online Connection

■ Using the serial (RS-232C) communication with Host Computer, the robot can automatically operate.

■ For more information about the operation, see 'Instruction Manual for Unihost'.

■ Before using Host Mode, set up the parameters of the controller by using a teaching pendant and then set up the parameters of the computer identically.

(1) General 8 axes controller



(2) Pin Map

Computer			Controller	
Signal Name	Pin No.		Signal Name	Pin No.
RXD	2		2	RXD
TXD	3		3	TXD
GND	5		5	GND

(3) Cable specification

■ Use a cable with a shield whose minimum core wire diameter is 0.3mm^2 or more.

■ Connect both lateral shields (Controller and Computer) of a case with each other.

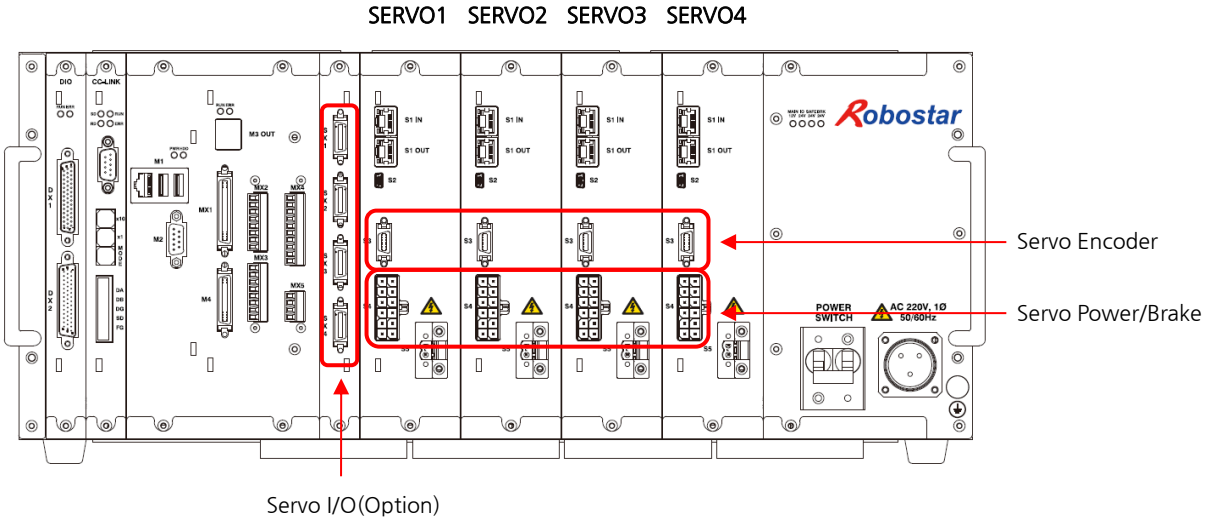
■ Have FG(Frame Ground) Level of the Controller be the same as that of the Host Computer. (Using a wire 2mm^2 or more, connect the FG terminal of the controller with the FG terminal of the host computer.)

■ Use a serial cable not longer than 10m.

■ Connector Spec.: D-Sub 9s (Socket Type)

4. Robot connection

The robot and the controller are connected with each other by using a robot cable. The robot cable is composed of a motor power cable, and an encoder cable, a brake cable, and a sensor cable, all of which are separated to one another



■ Location of Robot Cable Connection

Robot Model	Slot No. of Servo module			
	SERVO1	SERVO2	SERVO3	SERVO4
RA004(4kgf)	J1,J2	J3,J4	J5,J6	X
RA007(7kgf)	J1	J2	J3,J4	J5,J6

⚠CAUTION

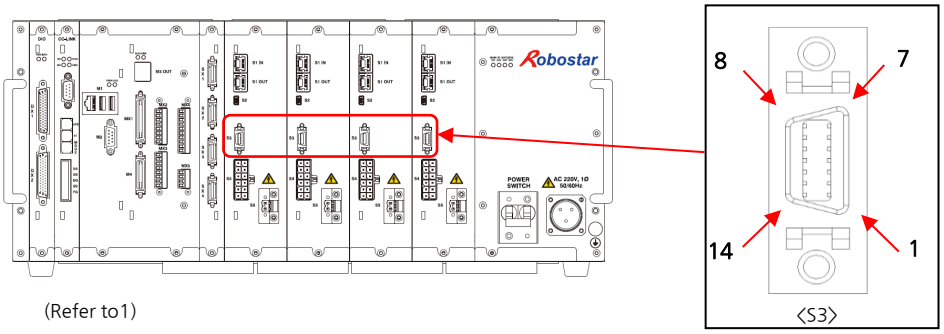
- ▶ After connecting the robot cable, make sure that housing locks (a connector locking device) of the controller-side connector are completely engaged with each other.
- ▶ Controller labels are subject to change depending on the robot

4.1 Encoder, Sensor and Brake Interface

An interface for wiring the encoder, sensor, and brake.

■ Controller Interface

Controller Connector (Encoder)	6321-014RDS1MWA01, WCON
Robot Connector (Encoder)	6320-014TIS0MNT01, WCON



(Refer to1)

Reference 1) Connected 1:1 to pins of a robot cable-side connector

Encoder			
No.	Signal	No.	Signal
1	P5V(B)	14	G5V(B)
2	/SD(B)	13	-
3	SD(B)	12	-
4	-	11	-
5	/SD(A)	10	-
6	SD(A)	9	-
7	P5V(A)	8	G5V(A)
-	-	CASE	FG

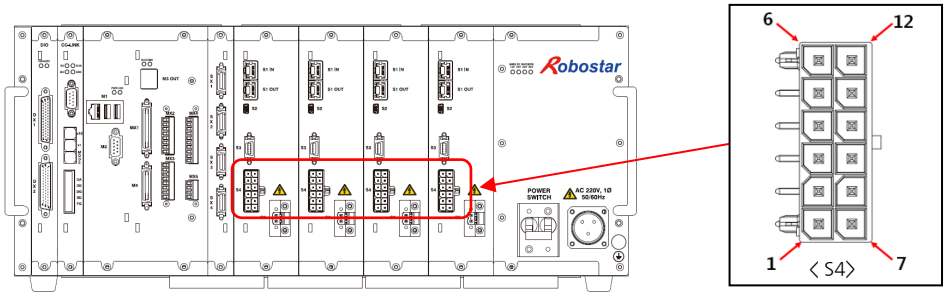
■ '-'sign means the unused pin.

4.2 Motor Power Interface

Interface for Motor Power Connection.

■ Controller Interface

Controller Connector(Power)	76825-0012 Molex
Robot Connector (Power)	171692-0012, Molex



Power			
Pin No.	Signal	Pin No.	Signal
1	FG(B)	7	W(B)
2	BRK-(B)	8	V(B)
3	BRK+(B)	9	U(B)
4	FG(A)	10	W(A)
5	BRK-(A)	11	V(A)
6	BRK+(A)	12	U(A)

5. Input/output Connection

In/Out (I/O) Connection Method for a higher level controller to an external device will be explained. After accurately checking the pin numbers of each I/O, connect them correctly

CAUTION

▶ Pay particular attention that incorrect connection could damage the controller, as well as the peripherals.

5.1 Input/output Assignment

■ I/O for N2S-Series is composed of User I/O (20 points/20 points), Extension User I/O 32 points /32 points).

■ User I/O Assignment is used in a teaching pendant as follows.

■ The detailed information can be obtained from “Operation Manual”.

Teach pendant menu	MAIN MENU → 6. I/O → 1. GPIO	
User I/O assignment	0	Basic I/O(20/20)
	1	Option I/O (32/32) Ref 1)
	2	Option I/O (32/32) Ref 1)

Ref. 1) It is possible to extend to Option I/O(64/64) point when using max 2 of Option I/O (32/32).

5.2 Input/output Specification

Item		User Input	User Output
I/O Voltage rating		DC 24V (External Power source)	
I/O Current rating		Min. 5mA / 1 contact	Max. 50mA / 1contact
Insulation		Photo-coupler	
Input resistance		4.7kΩ	-
No. of I/O Contacts	User I/O	20pts	20pts
Controller Connector		MDR 10250-52A2PL, 3M	
External Connector		MDR 10250-3000PE, 3M	

CAUTION

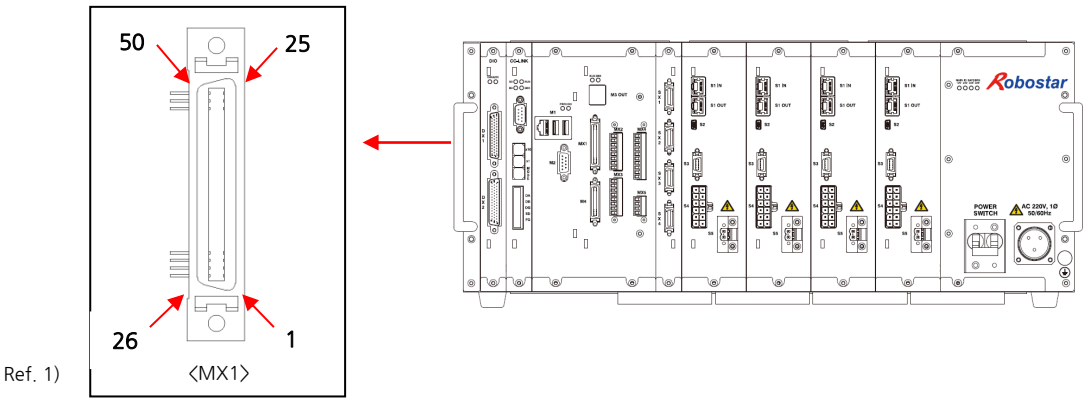
▶ N2S-Series does not provide internal power source for I/O.

▶ Be sure to use the external power source.

5.3 I/O Interface

■ I/O Connector

Controller I/O Connector(User)	MDR 10250-52A2PL, 3M
Cable I/O Connector(User)	MDR 10250-3000PE, 3M



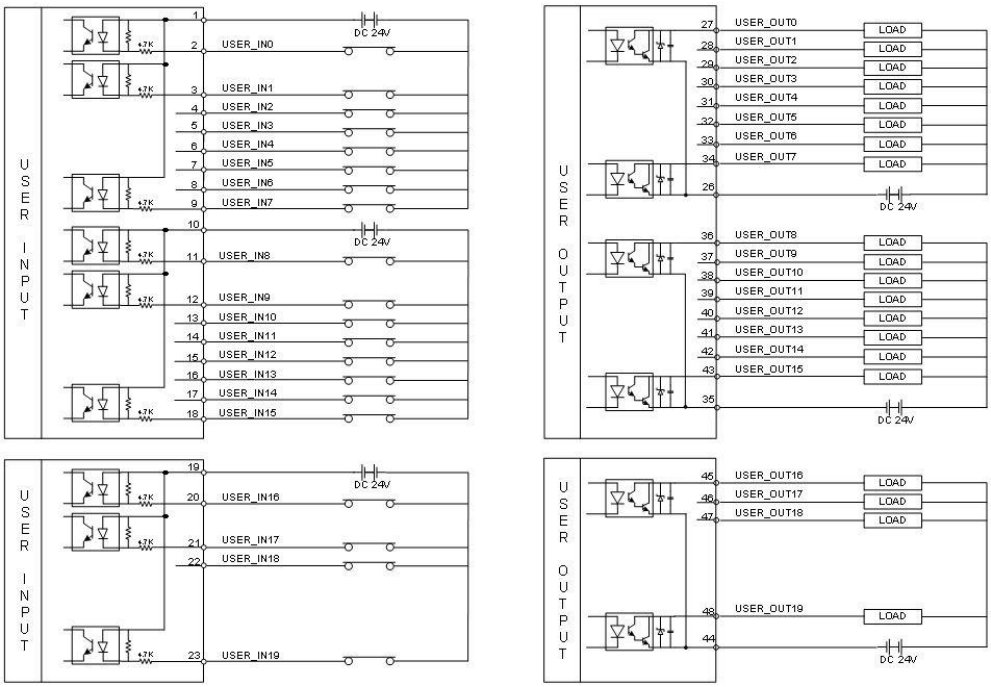
Ref. 1) Connected 1:1 to the pins of I/O cable connector

⚠CAUTION

- ▶ If I/O marking on a controller model name is 'N' (N-TYPE)
  Input → Positive Common (24V+) and Output → Negative Common (24V-);
- ▶ If I/O marking on a controller model name is 'P' (P-TYPE)
  Input → Negative Common (24V-) and Output → Positive Common (24V+)
- ▶ Connect the power supply N • P type distinctly. Incorrect wiring may cause damage to the controller

5.4 User I/O Circuit Diagram

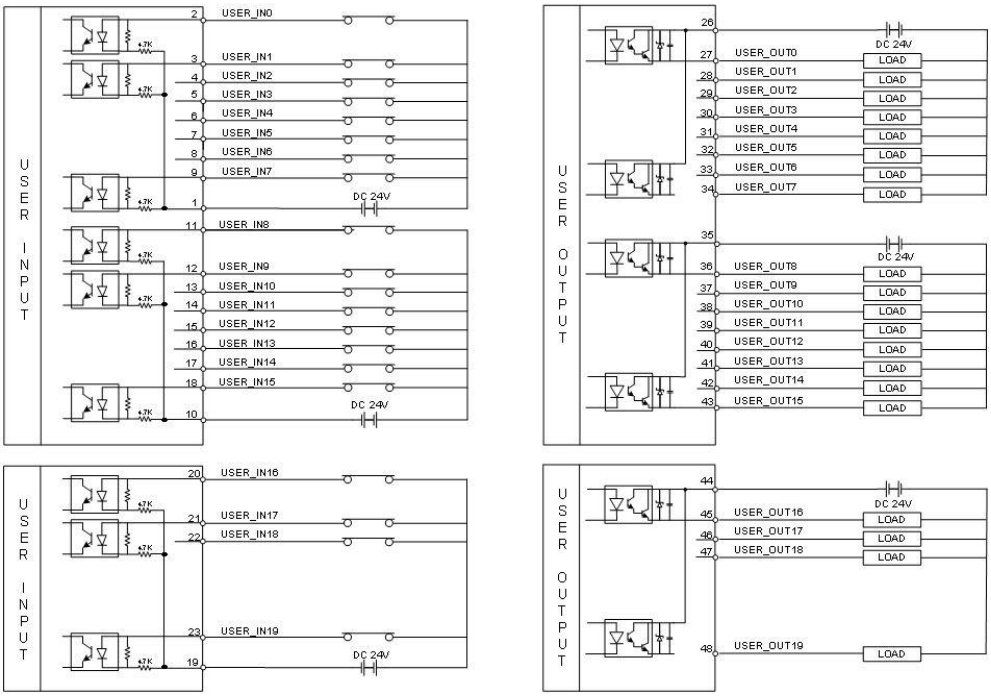
■ N-type user I/O Circuit diagram(Input: PCOM, Output: NCOM)



⚠CAUTION

- ▶ When wiring the power source, confirm that the connection polarity of DC 24V is correct.
- ▶ Mis-wiring may cause the internal parts to be destroyed. Pay special attention to the polarity of the common contacts.
- ▶ The external supply voltage has to be DC 24V±10%
- ▶ When soldering connector pins, provide pins with tubes to prevent short-circuit of pins.

■ P-type User I/O Circuit diagram(Input: NCOM, Output: PCOM)



※. Product to be released) P type USER I/O Interface B/D

⚠ CAUTION

- ▶ When wiring the power source, confirm that the connection polarity of DC 24V is correct.
- ▶ Mis-wiring may cause the internal parts to be destroyed. Pay special attention to the polarity of the common contacts.
- ▶ The external supply voltage has to be DC 24V±10%
- ▶ When soldering connector pins, provide pins with tubes to prevent short-circuit of pins.

5.5 User I/O connector Specification and Circuit Diagram

■ User I/O pin function and pin map

Pin No.	Division	Description
1	IN_COM0	N type: VCC Common for USER INPUT P type: GND Common for USER INPUT (Ref.1)
2	USER IN 0	User Input Contact 0
3	USER IN 1	User Input Contact 1
4	USER IN 2	User Input Contact 2
5	USER IN 3	User Input Contact 3
6	USER IN 4	User Input Contact 4
7	USER IN 5	User Input Contact 5
8	USER IN 6	User Input Contact 6
9	USER IN 7	User Input Contact 7
10	IN_COM1	N type: VCC Common for USER INPUT P type: GND Common for USER INPUT(Ref.1)
11	USER IN 8	User Input Contact 8
12	USER IN 9	User Input Contact 9
13	USER IN 10	User Input Contact 10
14	USER IN 11	User Input Contact 11
15	USER IN 12	User Input Contact 12
16	USER IN 13	User Input Contact 13
17	USER IN 14	User Input Contact 14
18	USER IN 15	User Input Contact 15
19	IN_COM2	N type: VCC Common for USER INPUT P type: GND Common for USER INPUT(Ref.1)
20	USER IN 16	User Input Contact 16
21	USER IN 17	User Input Contact 17
22	USER IN 18	User Input Contact 18
23	USER IN 19	User Input Contact 19
24	-	-
25	-	-

■ '-' sign means the unused pin.

Ref 1) Refer to 5.4 User I/O circuit diagram

Pin No.	Division	Description
26	OUT_COM0	N type: GND Common for USER Output P type: VCC Common for USER Output (Ref.1)
27	USER OUT 0	User Output Contact 0
28	USER OUT 1	User Output Contact 1
29	USER OUT 2	User Output Contact 2
30	USER OUT 3	User Output Contact 3
31	USER OUT 4	User Output Contact 4
32	USER OUT 5	User Output Contact 5
33	USER OUT 6	User Output Contact 6
34	USER OUT 7	/User Output Contact 7
35	OUT_COM1	N type: GND Common for USER Output P type: VCC Common for USER Output (Ref.1)
36	USER OUT 8	User Output Contact 8
37	USER OUT 9	User Output Contact 9
38	USER OUT 10	User Output Contact 10
39	USER OUT 11	User Output Contact 11
40	USER OUT 12	User Output Contact 12
41	USER OUT 13	User Output Contact 13
42	USER OUT 14	User Output Contact 14
43	USER OUT 15	User Output Contact 15
44	OUT_COM2	N type: GND Common for USER Output P type: VCC Common for USER Output (Ref.1)
45	USER OUT 16	User Output Contact 16
46	USER OUT 17	User Output Contact 17
47	USER OUT 18	User Output Contact 18
48	USER OUT 19	User Output Contact 19
49	-	-
50	-	-

■ '-' sign means the unused pin.

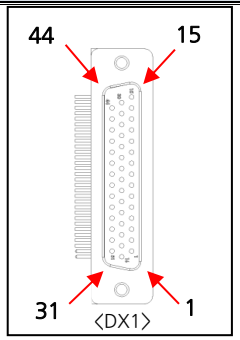
Ref 1) Refer to 5.4 User I/O circuit diagram

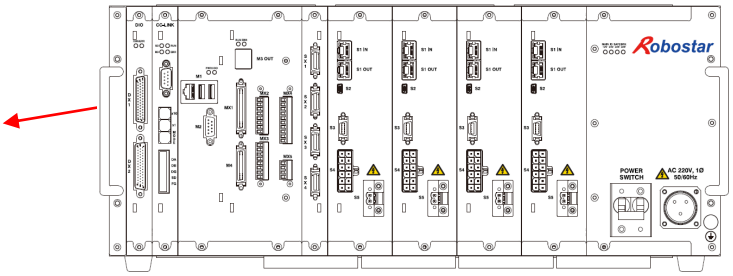
5.6 Extension user I/O Interface

■ Input connector

Controller connector(Option)	5510-44S-02A-01(NELTRON)
I/O cable connector(Option)	5508-44P-02A-01(NELTRON)

(Refer to 1)



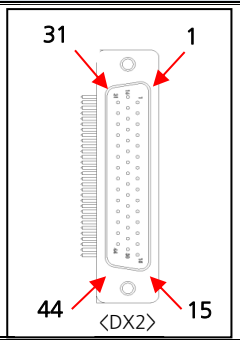


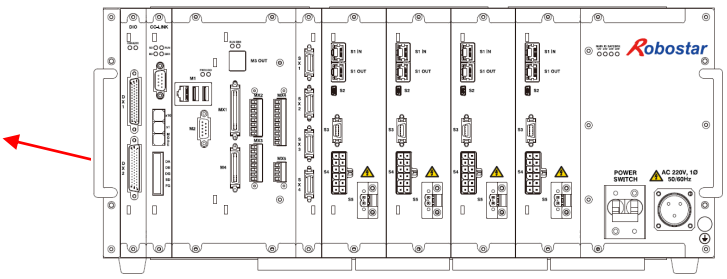
Ref. 1) Connected 1:1 to the pins of I/O cable connector

■ Output connector

Controller connector(Option)	5510-44P-02A-01(NELTRON)
I/O cable connector (Option)	5508-44S-02A-01(NELTRON)

(Refer to 2)





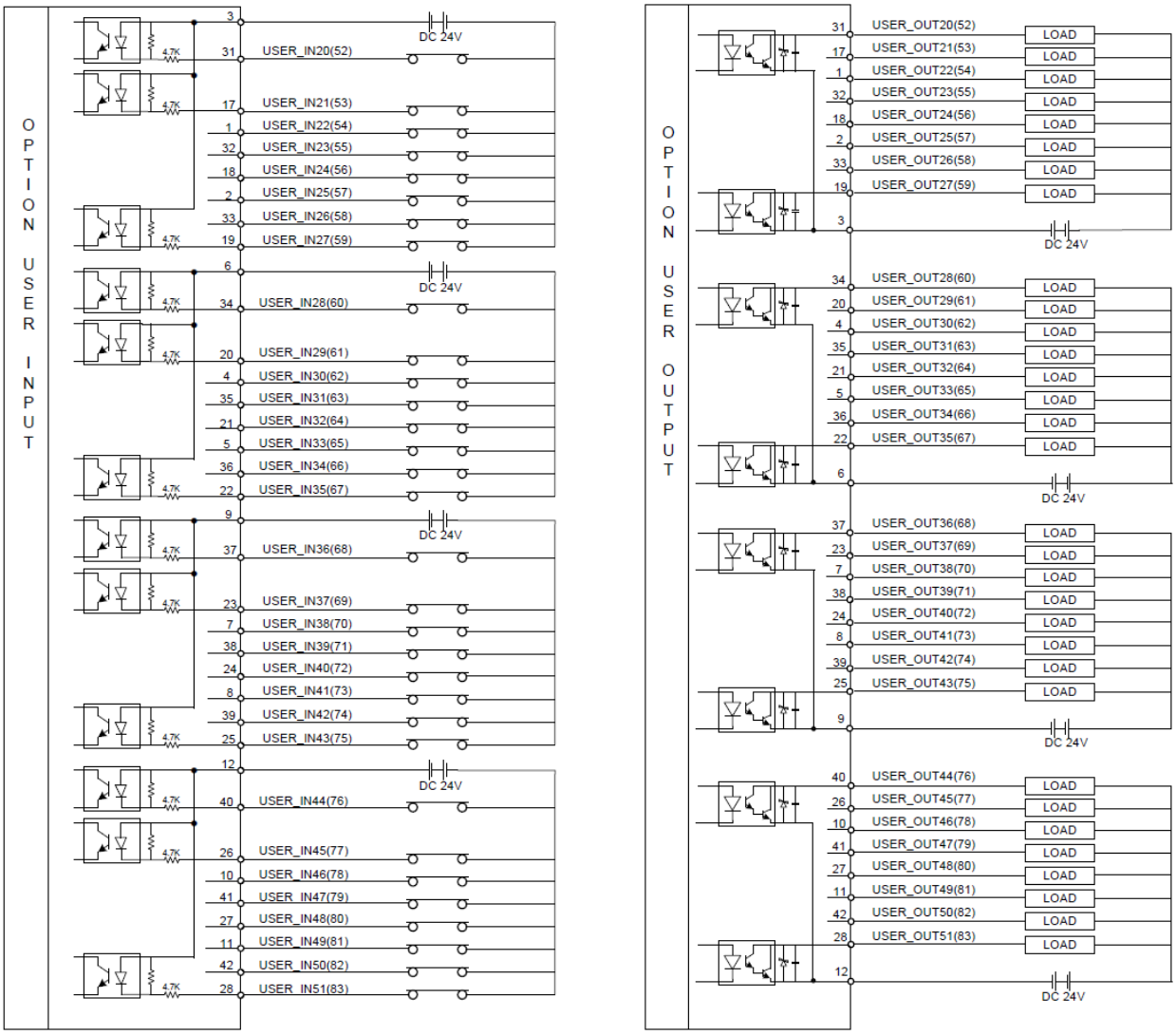
Ref. 2) Connected 1:1 to the pins of I/O cable connector

⚠CAUTION

- ▶ If I/O marking on a controller model name is 'N' (N-TYPE)
  Input → Positive Common (24V+) and Output → Negative Common (24V-);
- ▶ If I/O marking on a controller model name is 'P' (P-TYPE)
  Input → Negative Common (24V-) and Output → Positive Common (24V+)
- ▶ Connect the power supply N • P type distinctly.
- ▶ Incorrect wiring may cause damage to the controller

5.7 Extension User I/O Circuit Diagram

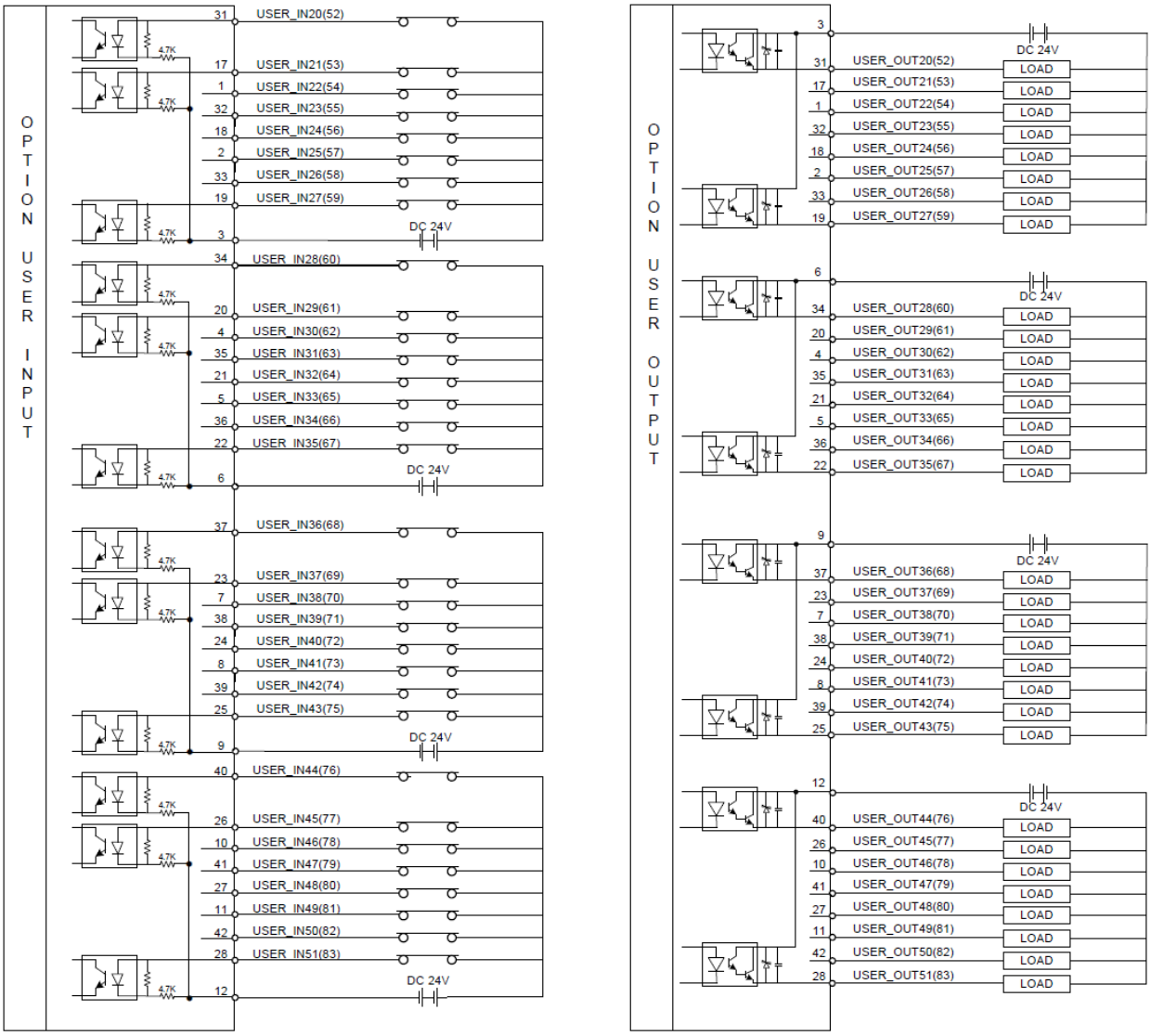
■ N-type Extension user I/O Circuit diagram(Input: PCOM, Output: NCOM)



⚠CAUTION

- ▶ When wiring the power source, confirm that the connection polarity of DC 24V is correct.
- ▶ Mis-wiring may cause the internal parts to be destroyed. Pay special attention to the polarity of the common contacts.
- ▶ The external supply voltage has to be DC 24V±10%
- ▶ When soldering connector pins, provide pins with tubes to prevent short-circuit of pins.

■ P-type Extension User I/O Circuit diagram(Input: NCOM, Output: PCOM)



CAUTION

- ▶ When wiring the power source, confirm that the connection polarity of DC 24V is correct.
- ▶ Mis-wiring may cause the internal parts to be destroyed. Pay special attention to the polarity of the common contacts.
- ▶ The external supply voltage has to be DC 24V±10%
- ▶ When soldering connector pins, provide pins with tubes to prevent short-circuit of pins.

5.8 Extension User I/O Connector Specification and Circuit Diagram

■ Extension user input function and pin map

Pin No.	Division	Description	Pin No.	Division	Description
3	IN_COM0	N type : VCC Common P type : GND Common (Ref. 1)	9	IN_COM2	N type : VCC Common P type : GND Common (Ref. 1)
31	USER IN 20(52)	Extended User Input Contact 20(52)	37	USER IN 36(68)	Extended User Input Contact 36(68)
17	USER IN 21(53)	Extended User Input Contact 21(53)	23	USER IN 37(69)	Extended User Input Contact 37(69)
1	USER IN 22(54)	Extended User Input Contact 22(54)	7	USER IN 38(70)	Extended User Input Contact 38(70)
32	USER IN 23(55)	Extended User Input Contact 23(55)	38	USER IN 39(71)	Extended User Input Contact 39(71)
18	USER IN 24(56)	Extended User Input Contact 24(56)	24	USER IN 40(72)	Extended User Input Contact 40(72)
2	USER IN 25(57)	Extended User Input Contact 25(57)	8	USER IN 41(73)	Extended User Input Contact 41(73)
33	USER IN 26(58)	Extended User Input Contact 26(58)	39	USER IN 42(74)	Extended User Input Contact 42(74)
19	USER IN 27(59)	Extended User Input Contact 27(59)	25	USER IN 43(75)	Extended User Input Contact 43(75)
6	IN_COM1	N type : VCC Common P type : GND Common (Ref. 1)	12	IN_COM3	N type : VCC Common P type : GND Common (Ref. 1)
34	USER IN 28(60)	Extended User Input Contact 28(60)	40	USER IN 44(76)	Extended User Input Contact 44(76)
20	USER IN 29(61)	Extended User Input Contact 29(61)	26	USER IN 45(77)	Extended User Input Contact 45(77)
4	USER IN 30(62)	Extended User Input Contact 30(62)	10	USER IN 46(78)	Extended User Input Contact 46(78)
35	USER IN 31(63)	Extended User Input Contact 31(63)	41	USER IN 47(79)	Extended User Input Contact 47(79)
21	USER IN 32(64)	Extended User Input Contact 32(64)	27	USER IN 48(80)	Extended User Input Contact 48(80)
5	USER IN 33(65)	Extended User Input Contact 33(65)	11	USER IN 49(81)	Extended User Input Contact 49(81)
36	USER IN 34(66)	Extended User Input Contact 34(66)	42	USER IN 50(82)	Extended User Input Contact 50(82)
22	USER IN 35(67)	Extended User Input Contact 35(67)	28	USER IN 51(83)	Extended User Input Contact 51(83)
13	-	-	29	-	-
14	-	-	30	-	-
15	-	-	43	-	-
16	-	-	44	-	-

■ '-' sign means the unused pin.

■ The numbers in '( )' is applied when using 2 Ext. user I/O board.

Ref 1) Refer to 5.7 User I/O circuit diagram

■ Extension user output function and pin map

Pin No.	Division	Description	Pin No.	Division	Description
31	USER OUT 20(52)	Extended User Output Contact 20(52)	37	USER OUT 36(68)	Extended User Output Contact 36(68)
17	USER OUT 21(53)	Extended User Output Contact 21(53)	23	USER OUT 37(69)	Extended User Output Contact 37(69)
1	USER OUT 22(54)	Extended User Output Contact 22(54)	7	USER OUT 38(70)	Extended User Output Contact 38(70)
32	USER OUT 23(55)	Extended User Output Contact 23(55)	38	USER OUT 39(71)	Extended User Output Contact 39(71)
18	USER OUT 24(56)	Extended User Output Contact 24(56)	24	USER OUT 40(72)	Extended User Output Contact 40(72)
2	USER OUT 25(57)	Extended User Output Contact 25(57)	8	USER OUT 41(73)	Extended User Output Contact 41(73)
33	USER OUT 26(58)	Extended User Output Contact 26(58)	39	USER OUT 42(74)	Extended User Output Contact 42(74)
19	USER OUT 27(59)	Extended User Output Contact 27(59)	25	USER OUT 43(75)	Extended User Output Contact 43(75)
3	OUT_COM0	N type : GND Common P type : VCC Common (Ref. 1.)	9	OUT_COM2	N type : GND Common P type : VCC Common (Ref. 1.)
34	USER OUT 28(60)	Extended User Output Contact 28(60)	40	USER OUT 44(76)	Extended User Output Contact 44(76)
20	USER OUT 29(61)	Extended User Output Contact 29(61)	26	USER OUT 45(77)	Extended User Output Contact 45(77)
4	USER OUT 30(62)	Extended User Output Contact 30(62)	10	USER OUT 46(78)	Extended User Output Contact 46(78)
35	USER OUT 31(63)	Extended User Output Contact 31(63)	41	USER OUT 47(79)	Extended User Output Contact 47(79)
21	USER OUT 32(64)	Extended User Output Contact 32(64)	27	USER OUT 48(80)	Extended User Output Contact 48(80)
5	USER OUT 33(65)	Extended User Output Contact 33(65)	11	USER OUT 49(81)	Extended User Output Contact 49(81)
36	USER OUT 34(66)	Extended User Output Contact 34(66)	42	USER OUT 50(82)	Extended User Output Contact 50(82)
22	USER OUT 35(67)	Extended User Output Contact 35(67)	28	USER OUT 51(83)	Extended User Output Contact 51(83)
6	OUT_COM1	N type : GND Common P type : VCC Common (Ref. 1.)	12	OUT_COM3	N type : GND Common P type : VCC Common (Ref. 1.)
13	-	-	29	-	-
14	-	-	30	-	-
15	-	-	43	-	-
16	-	-	44	-	-

■ '-' sign means the unused pin.

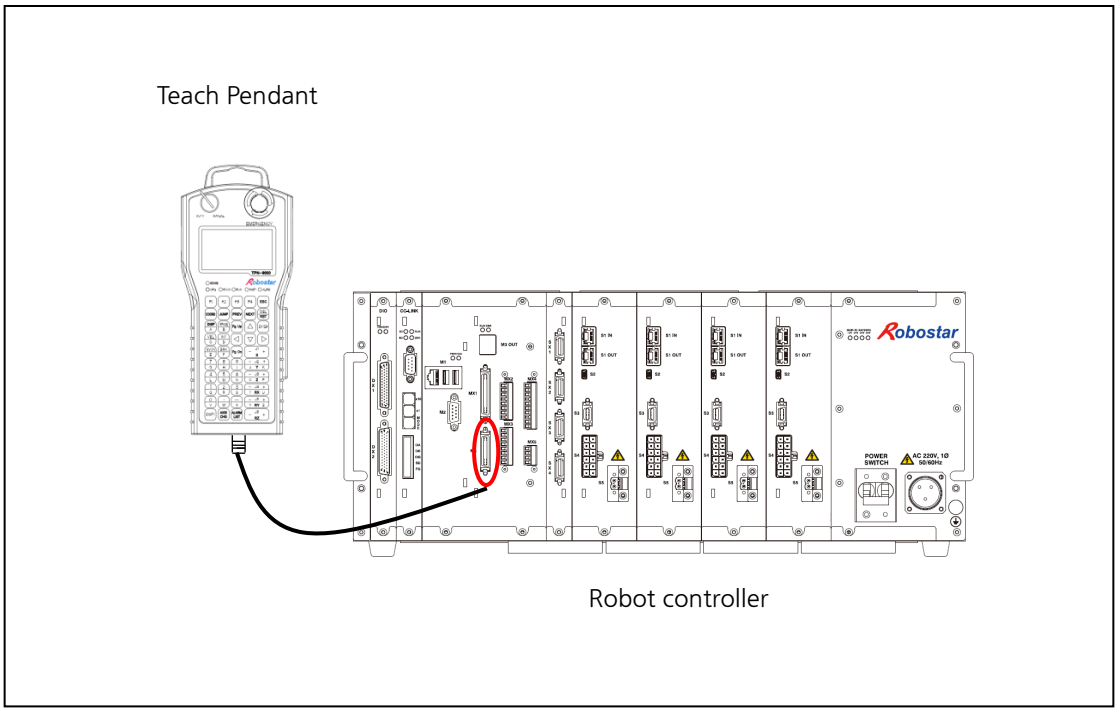
■ The numbers in '( )' is applied when using 2 Ext. user I/O board.
Ref 1) Refer to 5.7 User I/O circuit diagram

Chapter 4 About Teach Pendent

1. Connection of Teach Pendent

As shown below, connect T/P connector of the robot controller to the teaching pendant.

(3) General 8 axes controller



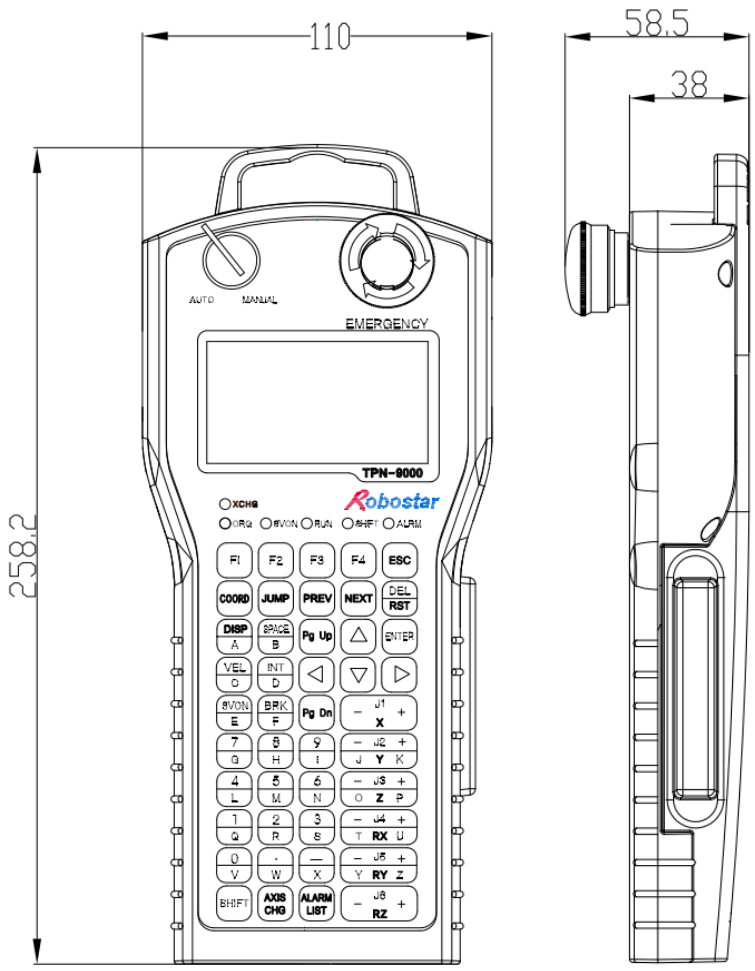
Connection with teach pendant

⚠CAUTION

- ▶ After connector connection, be sure to engage a screw-lock of the connector.
- ▶ If the connector is unexpectedly separated, the controller will fall into the emergency state.

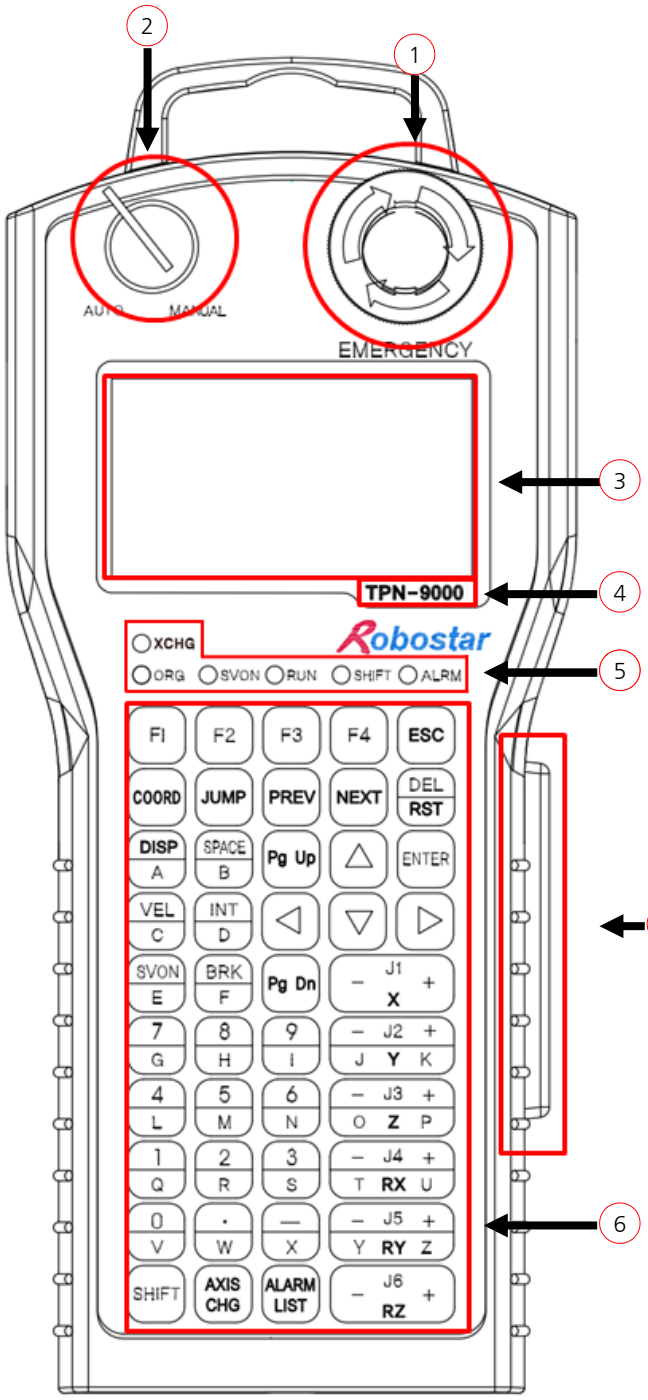
2. Appearance and How to Operate

2.1 Size



Item	Size
TPN-9000	110 (W) x 258.2 (D) x 38 (H)

2.2 Construction of Operation Keys



① : Emergency stop switch

② : Mode select switch

③ : LCD display

④ : Model name of teach pendant

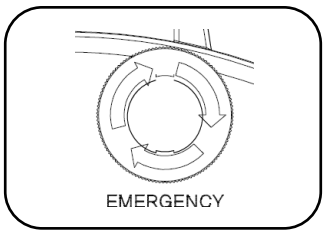
⑤ : LED indicator

⑥ : Function key

⑦ : Deadman switch

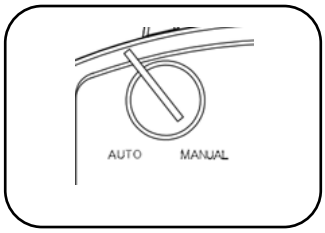
2.3 Functions of Operation Keys

(1) Emergency Stop Switch



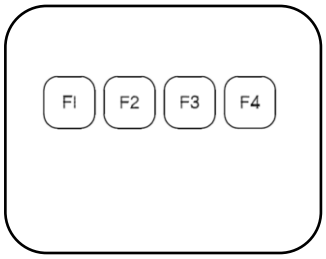
- In emergency situation, the robot operation is stopped.
- Power source for a motor is shut down.

(2) Mode Select Switch



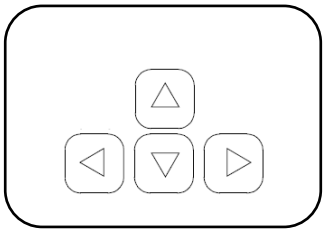
- MANUAL : Manual mode is the mode for setup work.
- AUTO : Automatic mode is only permissible for system control. Edit key doesn't work at the mode.(System Mode)

(3) Function Key



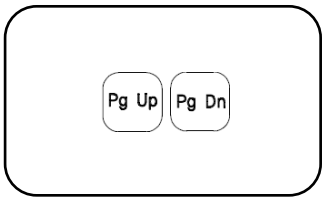
- Menus on a screen(LCD) are selected.
- A menu is changed according to a mode. For menu selection and its function, refer to 'Program Manual'.

(4) Direction Key



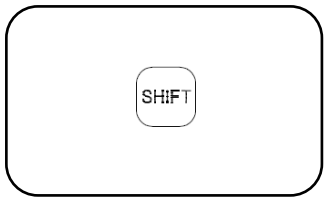
- A cursor on a screen is moved in the direction of arrow.
- How to use the direction key depends on a mode.
  Ex.) When to write a robot program in JOB mode
- Only four commands can be displayed on 1 screen and so, if the direction key is used when more than 4 commands are necessary, other commands can be shown.

(5) Page Up/Down Key



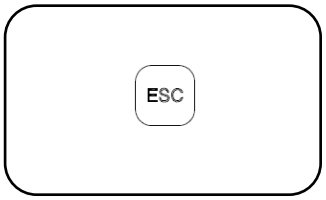
- A cursor can be moved to screen unit.
- 'Pg Up' key moves up a screen, and 'Pg Dn' key moves down a screen. If these keys are used in point teaching, the point number can be increased or decreased.

(6) Shift Key



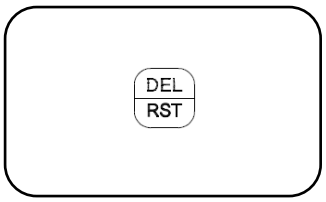
- This key enables 1 key to perform 2 functions.
- If this key is pressed, LED at the upper right of the teaching pendant lights up.
- When in lit state the bottom function of the key is executed. (E.g., entering Alphabet)
- When in turned off state the upper function of the key is executed.

(7) Escape Key



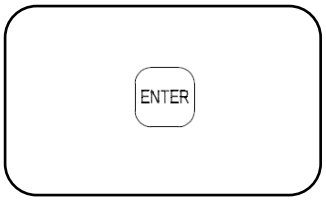
- Used to escape from the state displayed on LCD screen to the previous state or mode.

(8) Reset/Delete Key



- RST - Reset the alarmed state.
- DEL - Delete the wrong used letter, number, and commands

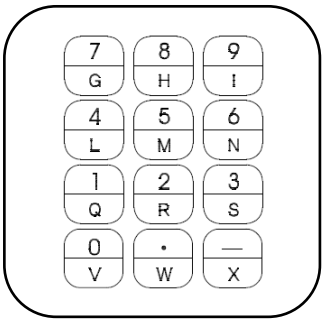
(9) Enter Key



- Used to input the desired data.
- Usage is dependent on a mode.

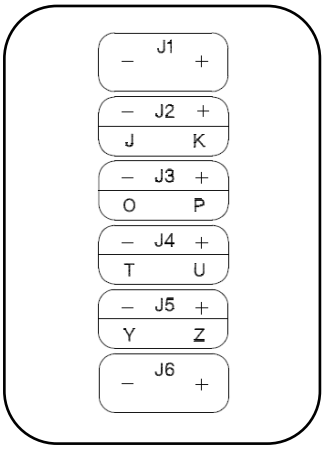
ex.) Parameter mode→ The sign changes when this key is pressed.
JOB mode→ This key is used to input the command when writing a program.

(10) Number & Sign Key



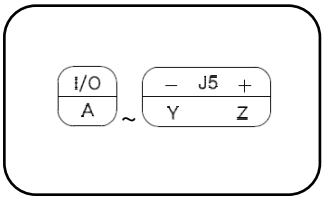
- Used to enter the numerals.
- Used to select a mode or for MDI teaching, in which this key is used to enter the numerals among the command.
- When 16-ary number is used in commands or when the output contact is checked, numerals 0 to F are used.

(11) Axis Moving Key



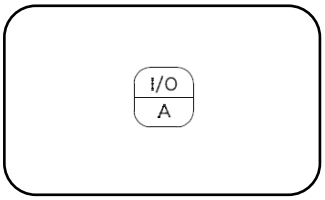
- Used to move each axis of the robot.
- When these keys are pressed in an initial menu screen or on a point teaching (CURR) screen, the axis moves in the direction of the arrow
- JOG movement and INCH movement can be performed.

(12) Character Key

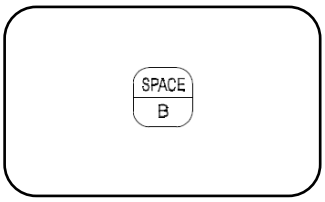


- Used to enter the characters.
- Used to type JOB name, or to enter variable name, label name, sub-execution sentence name in commands

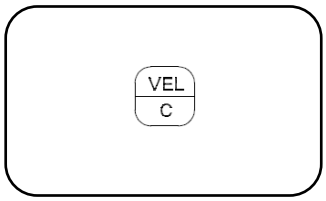
(13) Special Function Key



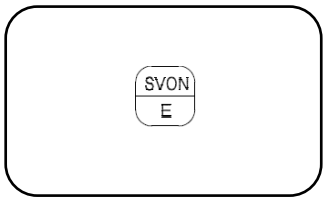
- On a point teaching (CURR) screen, I/O (In/Out) state can be seen.
- While in operation, I/O and internal contact is monitored.



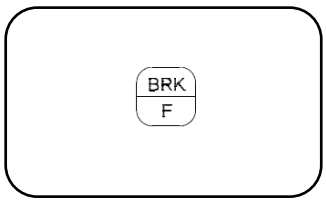
- Block setting function when the program is corrected, deleted, and moved.
- On a point teaching (CURR) screen, JOG movement and INCH movement are selected.



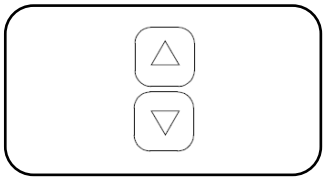
- On a point teaching (CURR) screen, the velocity of the axis moving key is set up in 3 steps.
- In INCH movement, the moving distance is set up, and in point checking (Forward), the moving velocity is set up.



- While in operation, the velocity (RPM) of a motor of each axis is checked.
- On a point teaching (CURR) screen, Servo ON/OFF can be done.



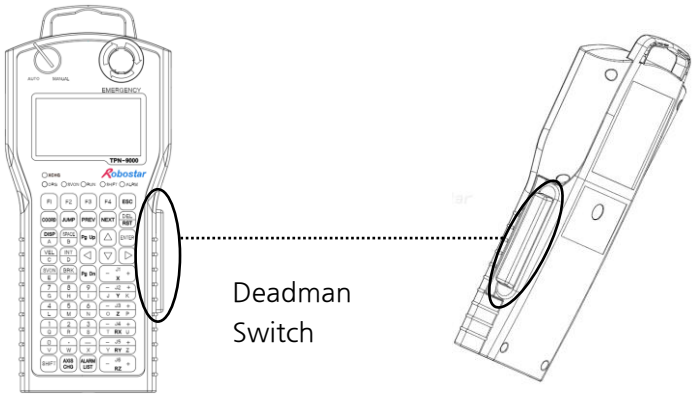
- On a point teaching (CURR) screen, the brake of each axis can be turned on/off.



- While in operation (RUN mode), robot moving speed is increased.
- While in operation (RUN mode), robot moving speed is decreased.

2.4 Deadman Switch

When performing teaching using a teaching pendant, press the following shown part and then operate the robot.



<<Front>> << Side>>

Deadman Switch is used to automatically, safely stop the robot, when the robot cannot normally operate due to the unexpected situations, such as power failure, full discharge, or other emergency situation, during a manual mode (Jog mode) of robot operation based on the teaching pendant. If such situation occurs, a user can stop the robot operation by changing the pressure pressing the deadman switch.

Deadman Switch has the following three behavior conditions.

Pressing Strength	Switch State	Robot Operation
When the switch is not pressed, or weakly pressed	OFF	X
When the moderate pressure is applied to the switch	ON	O
When too strong pressure is applied to the switch	OFF	X

If the Deadman Switch is turned OFF, the robot does not operate or stops while in operation.

Chapter 5 Controller Alarm Code

For details, refer to N2S-AM-E01 (Alarm and Maintenance Manual).

1. Alarm Summary List

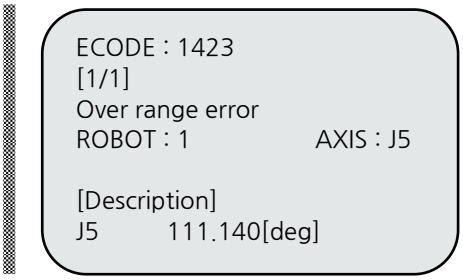
NO	Code	Alarm message	Description
1	1003	Out of Memory	Controller internal program memory allocation failure.
2	1021	Job step info error	JOB program line count mismatch.
3	1091	FAN error	Fan or fan cable abnormal.
4	1092	FBUS Mismatch error	Fieldbus type does not match the parameter value.
4	1104	Servo On Error	Fail to switch to servo ON.
5	1105	Servo Off Error	Fail to switch to servo OFF.
6	1107	ORIGIN FAIL	Failed to perform function with set Origin method.
7	1108	Not Completed Org	Execute JOB program without Origin complete.
8	1178	MC OFF error	When the controller is in the emergency stop state, MC is in the ON state.
9	1179	Safety relay fault	Safety relay contact is not attached.
10	1186	In range error	Robot axis position is out of range
11	1199	DEADMAN error	Dead Man switch is disconnected during robot operation in manual mode.
12	1204	Not Teaching Point	Using teaching points not taught in advance when using commands related to robot movement.
13	1219	Range Over error	Teaching point value deviates setting range.
14	1236	Interpreter error	Error when executing JOB program.
15	1237	Invalid ThreadID	Thread ID allocation error occurs in JOB program.
16	1315	Compile error	JOB program grammar error.
17	1414	ik isnan error	When the computed value of the robot inverse kinematics is not a number.
18	1415	ik position error	Coordinate conversion error occurred in inverse kinematics analysis of robot.
19	1422	Time Sched. error	Motion command time planning failure.
20	1423	Over Range error	Position command exceeds RANG (SW-Limit) setting range.
21	1424	Over Speed error	Speed command exceeds tolerance range.
22	1425	Over Accel. error	Acceleration command exceeds tolerance range.

23	1426	Inposition error	Position error exceeds tolerance range.
24	1427	TG TimeOut error	The calculation time of the position command exceeds the execution cycle.
25	1428	TG Mode error	Switch to parameter edit screen with servo ON.
26	1429	ENC Count error	The feedback pulse variation exceeds the tolerance range.
27	1430	REF Count error	The command pulse variation exceeds the tolerance range.
28	1431	Servo ON/OFF TimeOut	The number of using axes and the number of axes on which servo ON / OFF is completed are inconsistent.
29	1434	Over Trq error	Torque is exceeded the setting limit value.
30	2101	T/P emergency	Emergency stop by T/P emergency stop switch.
31	2102	Front emergency	Emergency stop by front emergency stop switch.
32	2103	System emergency	Emergency stop by system emergency stop switch.
33	2104	Auto emergency	Emergency stop by InterlockA emergency stop switch at auto mode.
34	2105	Manual emergency	Emergency stop by InterlockM emergency stop switch at manual mode.
35	2108	Mode mismatch error	Mode selection input signals are inconsistent.
36	2115	Main Board Tmp error	Motherboard temperature is higher than setting temperature.
37	4210	IPM fault	An error occurred at IPM.
38	4211	IPM temperature	Over temperature at IPM.
39	4214	Over current	An overcurrent occurs at the motor.(S/W)
40	4215	Current offset	Abnormal current offset
41	4216	Current limit exceed	An overcurrent occurs at the motor.(H/W)
42	4221	Continuous overload	Continuous overload occurs.
43	4222	Driver temperature 1	Over temperature 1 at servo driver.
44	4223	Regeneration overload	Regeneration overload occurs.
45	4224	Motor cable open	Motor cable disconnection.
46	4225	Driver temperature 2	Over temperature 2 at servo driver.
47	4226	Encoder temperature	Over temperature at encoder.
48	4227	Motor temperature	Over temperature at motor. (overload)
49	4230	Encoder comm err	Encoder communication error.
50	4231	Encoder cable open	Encoder cable disconnection.
51	4232	Encoder data err	Encoder data error.
52	4233	Motor ID setting	Setting an undefined motor ID.

53	4234	Z phase open err	Z phase disconnection.
54	4235	Low battery err	Encoder battery voltage is low.
55	4236	Sin ENC amplitude	Amplitude error of encoder sine wave.
56	4237	Sin ENC frequency	Friquency error of encoder sine wave.
57	4238	Encoder setting	Encoder setting error.
58	4240	Under voltage	Under voltage occurs at DC-Link
59	4241	Over voltage	Over voltage occurs at DC-Link
60	4242	Main power fail	Main power condition error.
61	4243	Control power fail	Control power condition error.
62	4244	DC Fan Trip	Driver fan does not work.
63	4250	Over speed limit	Speed exceeds the tolerance range.
64	4251	POS following	An error between command position and current position exceeds the tolerance range.
65	4253	Excessive SPD deviation	An error between command speed and current speed exceeds the tolerance range.
66	4263	Parameter checksum	Driver parameter data error
67	4271	Factory setting	Factory initialed driver parameter data error
68	4501	Ethercat stop	Completely disconnected EtherCAT communication
69	4502	Ethercat Comm fail	An error occurred during EtherCAT communication
70	5001	Socket hung up	Communication between the graphic T/P and the controller is disconnected
71	5002	GTP timeout	Timeout occurs during communication between graphic T/P and controller

2. How to clear Alarms and Warnings

In general, if the alarm can be released by simple action without shutting down the controller, release the alarm in the following sequence.



Example at over range alarm

① If the alarm LED is lit or blinking, press the Up or Down key to see the full message of the alarm or warning.

② Refer to Chapter 3 Alarm List to find the cause of the alarm and take appropriate action.

③ To display the Alarm List window, press the Alarm List key. In most cases, the alarm list key is activated first.

④ After confirming the contents of the alarm and warning, press the reset button to release the alarm or warning.

⑤ If the alarm is not released, the alarm message is occurred again.

⑥ When the alarm release is completed, the alarm message window disappears and the alarm LED is turned off, and the controller and the robot can be driven normally.

Chapter 6 Maintenance

1. Inspection and troubleshooting

Be sure to perform regular inspection in the table below.

No.	Part	Points	Daily	3 Montly	Remarks
1	Environment	Check if the environment is proper for installing controller.	○		
2	Input power	Check if input power is normal.	○		
3	Internal power	check status of internal power by checking SMPS LED indication lamp in the front	○		
4	Controller appearance	Check for fastening status of screws on connecting parts (connector, terminal block, etc.)		○	
5	Cables	Check insulation status or deterioration		○	
6	Internal status	Check for inflow of dust, mist or others		○	Clean using air
7	Cooling system	Check for cleaning status of the top air filter, operation status of the bottom fan		○	

2. Parts Replacement

Deterioration of the parts below can occur as hours of use pass. Regularly check the consumables. If any error is found, replace the relevant part.

No.	Parts Name	Standard Parts	Standard Replacement Period	Remarks
1	Cooling fan	4710KL-05W-B49-E00	5 years	
2	Air filter	11.5 x 11.5 for N2S	3 months	
3	RTC battery	CR2032 3V	3 years	

For installation location and replacement method for robot encoder battery, refer to relevant robot instruction manual.

(General replacement period under conditions of operation for 8 hours a day is 3 years.)

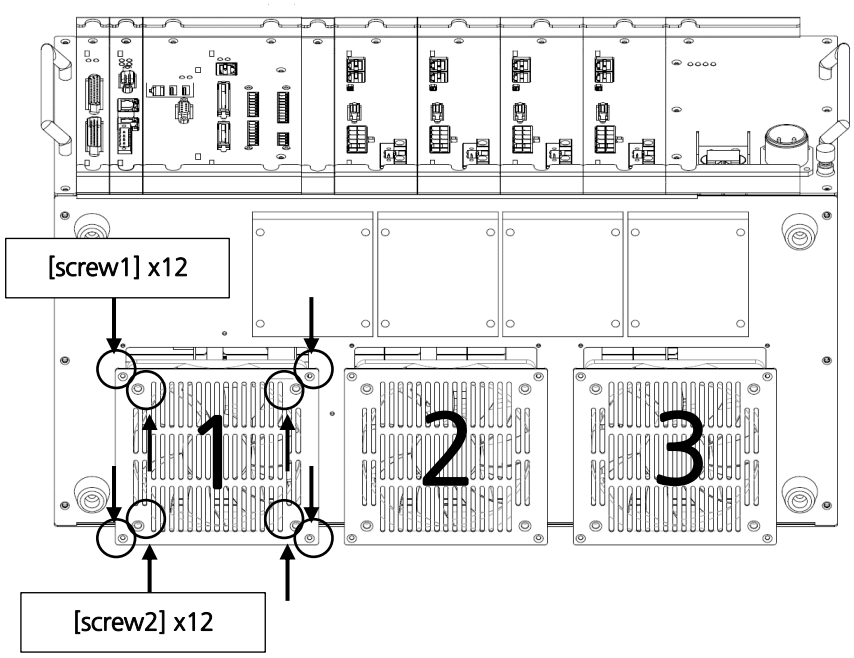
⚠CAUTION

▶ To replace parts, be sure to shut OFF power.

2.1 Inspection and replacement method for cooling fan

■ 3 cooling fans are installed on the bottom exhaust of the controller.
■ If the cooling fan does not normally operate, it can cause deterioration due to generation of internal heat.
■ If the cooling fan does not normally operate, the alarm message below will display. Check and replace it according to the method below.

Code	1091	Message	FAN error
Description	FAN fault occurrence		

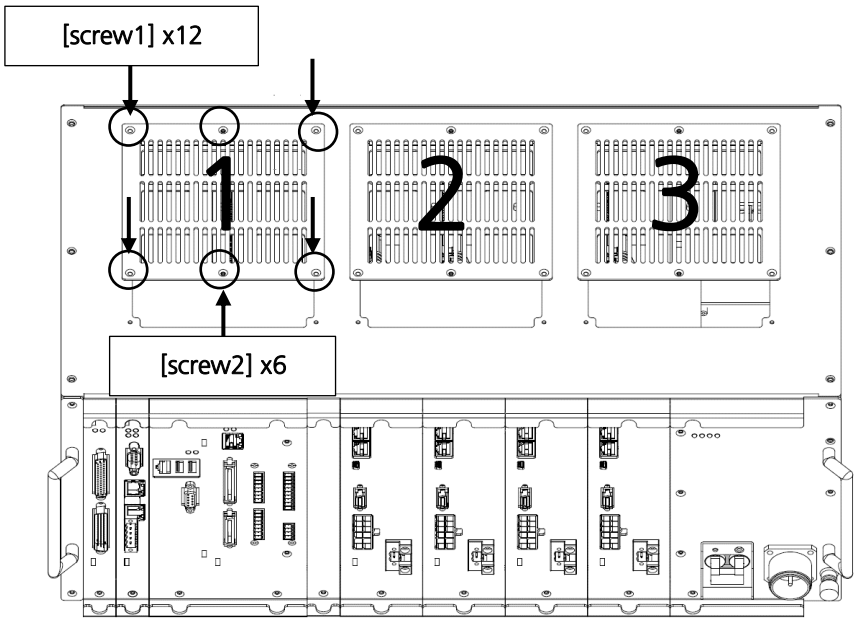


■ Inspection method
① Shut OFF power.
② Remove fixing screw1 (each 4 points, total 12 points) on the bottom fan.
③ Check for fastening status of the lead wire connected to the fan.
④ Check for foreign matter on the fan net and cooling fan and clean them.

■ Replacement method
① Shut OFF power.
② Remove screw1 (each 4 points, total 12 points) on the bottom fan.
③ Separate the lead wire connected to the fan.
④ Remove screw2 (4 points) on the fan and separate it from the fan net.
⑤ Install a new fan in reverse order of ④→②.

2.2 Inspection and replacement method for air filter

■ 3 intake filters are installed on top intake side of the controller.
■ If intake is not good enough due to foreign matter or others, it can cause deterioration due to generation of internal heat.



■ Inspection method

① Shut OFF power.
② Remove fixing screw1 (each 4 points, total 12 points) on the top air filter.
③ Remove screw2 (2 points) on the air filter bracket.
④ Check for foreign matter on the air filter and filter net and clean them.

■ Replacement method

① Shut OFF power.
② Remove fixing screw1 (each 4 points, total 12 points) on the top air filter.
③ Remove air filter fixing screw2 (2 points).
④ Install a new air filter in reverse order of ③→②.

2.3 Inspection and replacement method for RTC battery

- The N2S controller has no battery to backup memory. However, a battery to keep date and time is installed.
- In case of no power input on the board, lifetime of the battery, in theory, is about 3 years and lifetime may decrease depending on service environment. (In case of power input on the board, lifetime of the battery may increase.)
- If power is supplied to the controller when voltage of the battery is below 2V or discharged, the controller won't be normally booted.

- Inspection method
  ① Shut OFF power.
  ② Separate fixing screws (4 points) on the front main module.
  ③ Check location of mainboard battery of the main module.
  ④ Connect probes of a Multimeter onto ground of the board and positive terminal of the battery to measure DC voltage when a battery is installed on the board.

[Figure] Example of Measurement

■ Replacement method

① Shut OFF power.
② Remove fixing screws (4 points) on the front main module.
③ Check location of the mainboard battery on the left of the main module.
④ Open + (positive) terminal of the battery socket and remove the existing battery.
⑤ Check + (positive) terminal and - (negative) terminal of a new battery to correctly insert it into the socket.
⑥ Input power and reset System time (STIME).

STIME	PUB - ETC - TIME - STIME

■ Key specifications of the battery

Model No.	CR2032			
Manufacture	Panasonic			
Voltage	3V			
Capacity	225 mAh			
Operating Temp.	-30 to 60 ℃			
Recommend Storage Condition	Temperature : 5℃ to 35℃ Humidity : 45 ~ 85%RH			
Continuous Discharge Duration (Load:15kΩ, Cut off V:2.0V)		Temp.	Initial	After 1 year room temp
	Std.	20 ±2℃	1183h	1133h
	Min.		1041h	1019h
Height	3.2mm			
Diameter	20mm			
Pole	+ Pole		- Pole	
				

⚠ CAUTION

▶ Be cautious of shorting of battery terminals and inflow of ESD during battery replacement.
▶ Store the battery at temperature and humidity recommended by the maker. If not, lifetime it can lifetime decrease.

3. Works after replacing parts

Default settings of the robot and the controller of the N2S controller are set at the factory before deliver. In case of replacing or adding the parts listed below, set them observing the established procedures.

3.1 Origin position setup

■ Match position of the robot with position of the absolute value encoder.

■ In case of the followings, origin position must be set.

① If combination of the robot and the controller is changed
② If a motor or absolute value encoder battery is replaced
③ If reducer or belt inside the robot is adjusted
④ If origin is deviated due to collision of the robot

■ Procedure to set origin position

① Reset multi-turn data of the motor of each axis. (M-TURN).

M-TURN	PARA(1) - BODY -MOTOR(2) - M-TURN

② Move to origin position of the robot by manual operation of the robot.
③ Reset multi-turn data of the motor of each axis once more. (M-TURN).

M-TURN	PARA(1) - BODY -MOTOR(2) - M-TURN

④ After moving robot origin, perform Zero Calibration. (ZCAL)

ZCAL	PARA(1) - BODY - OFFS - ZCAL - MDI

⚠ CAUTION

- ▶ Since origin position and posture differ depending on robot capacity and model, refer to relevant robot instruction manual.
- ▶ For detailed operating method, refer to Operation Manual for N2S controller.

Chapter 7 Revision

Revision	Date	Revised Detail
1	2019.01.21	Initial Distribution
2	2019.07.10	Parts replacement

A. Literature Reference

All the literature, which are required for performing services, repair or installation of all robot system that uses this product, are specified in this chapter.
In the ID of all literature, the very first word indicates the controller name and the second word means the abbreviation of corresponding literature. The last indicates language and its version.

Language is marked according to the rules below.

- Korean: K
- English: E
- Chinese: C
- Vietnam: V

Document ID	Description
N2-IM-E□□	**Instruction and handling manual** This explains the controller structure and installation as well as the methods to interface with external devices.
N2-OM-E□□	**Operation manual** This explains the method to use the controller and teach pendant, parameter setting, JOB program editing and additional functions.
N2-PM-E□□	**Programming manual** This explains the method to create RRL (Robostar robot language) that is the Robostar robot program and describes the commands.
N2-HM-E□□	**Unihost manual** This explains about Unihost that is Robostar on-line PC program.
N2-AM-E□□	**Alarm and maintenance manual** This explains the information on problems occurred in the controller - based robot system as well as solutions and procedure for the problems.

N2S Series Controller

Instruction and Handling Manual
First edition, March 7, 2019

ROBOSTAR CO., LTD.
ROBOT R&D CENTER

Robostar