HYUNDAI ROBOTICS

WARNING

INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED INSTALLATION PERSONNEL AND MUST CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi4a190401CMEN5

Hi4a Controller Maintenance Manual

- Hi4a-0000, Hi4a-0010,
- Hi4a-0008, Hi4a-P000,
- Hi4a-0002, Hi4a-0012

HYUNDAI ROBOTICS

Printed in Korea - Apr. 2019. 5th Edition

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1.1. Introduction

The main purpose of this chapter is to describe the safety precautions for users and operators who repair and manipulate the industrial robot.

This manual describes safety precautions for robot manipulator and controller, in comply with the requirement of ANSI/RIA R15.06-1999, Standard for Safety, Industrial Robots, and qualified with safety regulations. The technical description and installation method of robot system is presented in detail at the specifications regarding installation of robot manipulator and controller.

Every operator, who installs, replaces, adjusts, manipulates, maintains, and repairs, must read thoroughly and fully understand the manipulation and maintenance manual, in particular, the special attention must be paid to the WARNING symbol(⚠), the most important marking related to the safety.

Installation, replacement, adjustment, manipulation, maintenance, and repair of robot system must be performed by the personnel who was duly trained for these purposes, following the indicated operating procedure.

This company is planning and carrying out the relevant training such as maintenance, repair, and manipulation for the above operations, so robot users make sure that robot operators should get the relevant training. And make sure that the robot handling work should be carried out only by the operators who completed this training course.

The Users of industrial robots have a responsibility under the safety relevant regulations enable in the country where the robot is installed, and a responsibility to properly design, install, and operate the safety devices to protect workers.

The dangerous zone of robot system, that is the working range in which the robot, tool, and peripheral equipment are operated, must be safeguarded to prevent workers or objects from entering the zone. If a person or object should nevertheless enter the dangerous zone, make sure that the robot system is immediately shut down by emergency stop system. The operators of robot system have a responsibility to take all necessary steps to make correct installation, examination and operation of the relevant safety devices.

This manual is provided for the utilization of HR, HX, HS and HA Series Manipulator models and Hi4a controller.
Enable application and disable environment of HR, HX, HS and HA Series robots are as follows.

Application

It is applied to the 6-axis industrial robot used by installing on the surface of wall or plane (axes addable). It is also appropriate for controlling operation in the dotted section or consecutive section.

Major application is

- Spot welding
- Arc welding
- Cutting
- Handling
- Assembly
- Application such as Sealing
- MIG/MAG welding
- Palletizing
- Grinding

For the other use than the above emergency application, make a contact with our company to consult on the robot use and possible applications.

Disable environment

Our robot must not be used in a highly explosive environment and the areas contaminated by oil, flammable materials or chemical materials. (Prohibited to be installed and manipulated.)

1.2. Relevant Safety Regulations

The robot is designed as per ISO 10218. Jan. 1992 safety standards for industrial robots, and furthermore in comply with ANSI/RIA R15.06-1999 regulations.

1.3. Safety Training

All the personnel who intend to teach, operate or inspect the robot must be trained in an approved robotic operation and safety training course before start-up. The safety training course includes the following details:

- Purpose and functions of safety devices
- Safety procedure to handle the robot
- Performance of robot or the robot system and possible hazards
- Tasks associated with any specific robot applications
- Safety concepts, etc

1.4. Safety Related Nameplate

1.4.1. Safety Marking

For the purpose of effective safety instructions, the following safety symbols are used in this manual.

Table 1-1 Safety marking

Symbols		Descriptions
Warning		Indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel and damage to equipment. The special attention must be paid to the operation and handling.
Mandatory		Indicate the compulsory measures that should be performed.
Prohibited		Indicate the prohibited actions and/or operations that should not be performed.

1.4.2. Safety Nameplate

Identification plates, warning label and safety symbols are attached to the robot and to the inside and outside of control panel. The designation labels and cable Mark for wire harness between the robot and control panel, and the cables inside/outside of control panel are provided.

All of these plates, labels, symbols and marks constitute safety-relevant parts of the robot and the control panel. They must remain attached to the robot manipulator and control panel at their clearly visible positions all the time for the safety and their full performance.

The painted markings on the floor and signs indicating dangerous zones must be clearly distinguished in form, color, and style from other markings on the machine near the robot system or inside the plant facilities where the robot system is installed.

It is forbidden to remove, cover, or paint over by way of spoiling the clearly visible identification plates, warning labels, safety symbols, designation labels and cable marks.

1.5. Definition of Safety Functions

Emergency Stop Function - IEC 204-1,10,7
There is one emergency stop button on the controller and teaching pendant respectively. If necessary, additional emergency buttons should be able to connected to the robot's safety chain circuit. The emergency stop function, which overrides all other robot controls, stops all moving parts by disconnecting power supply, and removes drive power to prevent the use of other dangerous functions controlled by the robot.

Safety Stop Function - ISO 10218(EN 775),6.4.3
When a safety stop circuit is provided, each robot must be delivered with the necessary connections for the safeguards and interlocks associated with this circuit. The robot should have a number of electrical input signals which can be used to connect external safety devices, such as safety gates, safety pads, and safety lamps. These signals allow the robot's safety functions to be activated by all equipment, including peripheral equipment and the robot itself.

Speed Limitation Function - ISO 10218(EN 775),3.2.17
In a manual mode, the speed of robot is strictly limited to 250 mm per second as maximum.
The speed limitation applies not only to the TCT(Tool Coordinate Time), but to all parts of manual mode robot. The speed of equipment mounted on the robot should be possibly monitored.

Restricting working Envelope - ANSI/RIA R15.06-1999
The working envelope of robot axes should be restricted using software limits.
Axis 1,2, and 3 can also be restricted by means of mechanical stopper.

Operation Mode Selection - ANSI/RIA R15.06-1999
The robot must be operated either manually or automatically. In a manual mode, the robot must be operated only by using the teach pendant.

1.6. Installation

1.6.1. Safety Fence

Install safety fence against the possible collision between the robot and workers, so that no worker may approach the robot .When operators or other personnel enter the robot's working envelope by accident, it may cause an accident. Install the safety fence to stop the robot when one, who intends to replace for TIP DRESSING or TIP replacement, or to inspect welding equipment, opens the fence gate and approaches the equipment during operation.

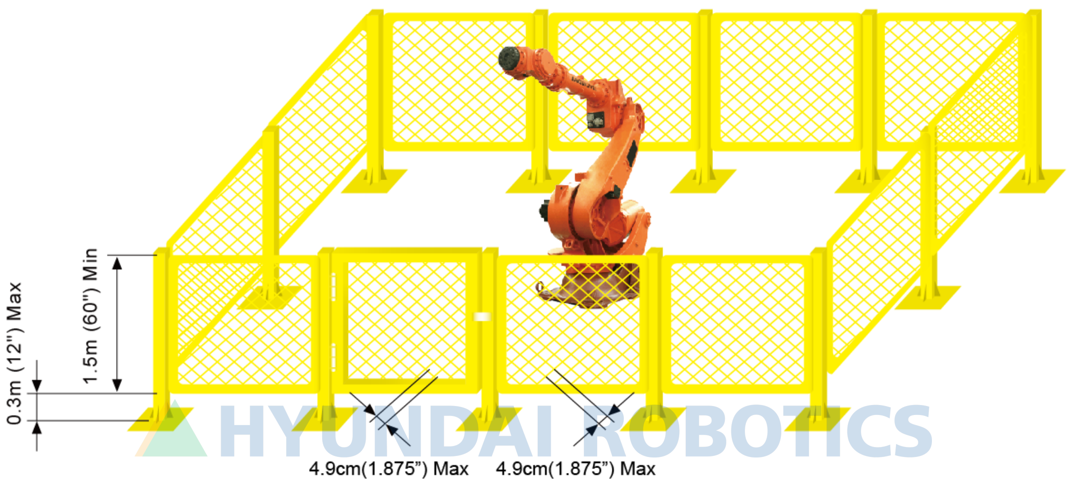


Fig. 1.1 Recommended Size for Fence and Gate Hole (Square Gate)

Fig. 1.2 Recommended Size for Fence and Gate Hole (Slot Gate)

(1) Install the safety fence to cover the robot's working envelope and to secure enough space for teaching and maintenance working. The safety fence should also be firmly installed so that it is hardly accessible and removable.

(2) The safety fence should be a fixed type in principle, using harmless materials that do not have any broken surface or projecting part.

(3) Install the safety fence with an entrance gate, and register the safety plug at the gate so that it does not open unless pulling the plug out. Interlock the robot to be MOTOR OFF when the safety plug is pulled out., or wire the robot to be MOTOR OFF when the safety fence is open. (Refer to "11. Connecting the Other Signals", Hi4a Controller Manual)

(4) When intending to operate the robot with the safety plug pulled out, wire the robot as a low-speed play mode. (Refer to "11. Connecting the Other Signals", Hi4a Controller Manual)

(5) For immediate emergency stop, install emergency stop button within operator's easily accessible distance.

(6) If the safety fence is not installed, install other devices substituting for the safety plug in the whole place within the robot's working envelope, such as photoelectric switch and mat switch. These devices may stop the robot automatically when a person enters the working envelope

(7) The robot's working envelope(dangerous zone) should be distinguished from other zones by painting its floor.

1.6.2. Placement of Robot & Peripheral Equipment

(1) Make sure that the power supply is off before operating, when connecting the primary power of controller or peripheral equipment. There is a possible danger of electric shock because the high voltage such as 220V and 440V is used as its primary power.

(2) Post a sign [No enter during operation] up the safety fence gate, and inform the operators of its purport.

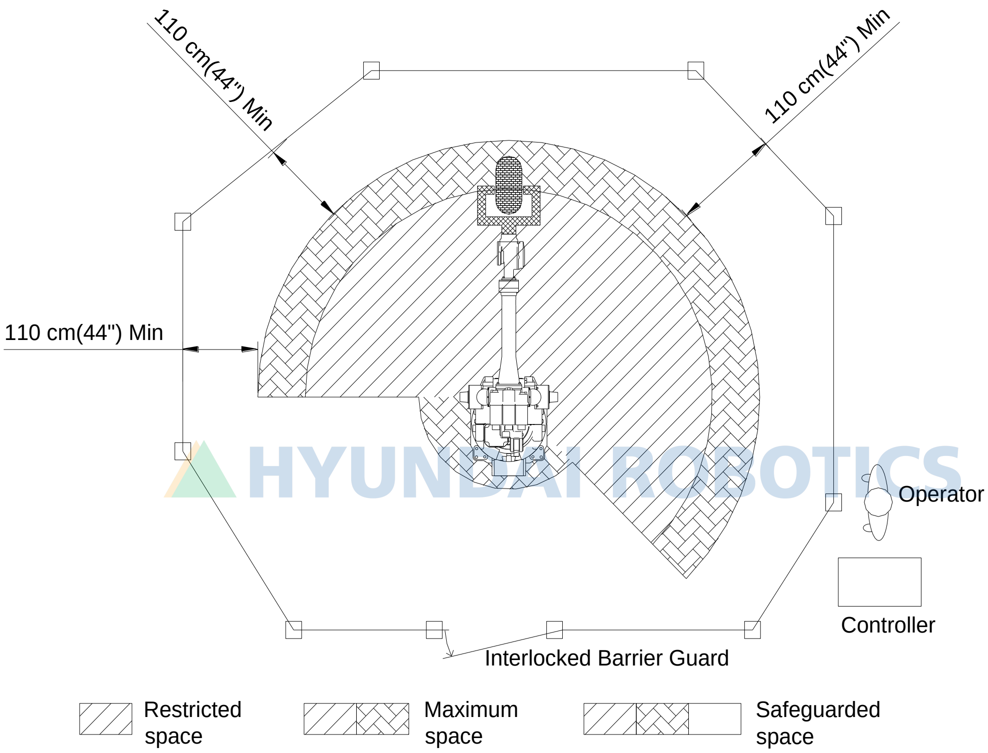


Fig. 1.3 Placement of Peripheral Equipment and Operator

(3) Arrange such devices as controller, interlock panel, and other manipulation panels to be handled outside of the safety fence.

(4) When installing operation stand, install the emergency stop button on the stand. Make sure that the stand stops in an emergency wherever the robot is handled.

(5) Make sure that the robot manipulator and the wiring and piping of controller, interlock panel, and timer should not be placed in the way of operator's working range so that they would not be directly stepped on by FORK and LIFT. There is a possible danger of accident if the workers are affected by electricity or the wiring is down.

(6) Place the controller, interlock panel, and handling stand within the sight of robotic performance. It may cause a serious accident to operate the robot while the operator is working, or the robot is malfunctioning in an invisible sight.

(7) Restrict the robot's working envelope by using soft limits and mechanical stopper if the necessary working envelope is narrower than the holding workable envelope. It is possible to stop the robot in advance when it moves beyond its normal working envelope due to an abnormal condition. (Refer to the 『Robot Manipulator Maintenance Manual』.)

(8) Welding spatters directly on the operator or around him may cause burning or fire. Install such devices as a glare shield or a cover in the full sight of robot's working envelope.

(9) Make sure that the device indicating the robot's running condition whether automatic or manual mode must be noticeable even in the far distance. In the case of automatic start-up, warning with a buzzer or warning lamp is also enable.

(10) Make sure that there is no projecting part in the robot's peripheral equipment. Cover it, if necessary. It usually may cause an accident if the operator comes in touch with it. And it may lead a serious accident if the operator is astonished at the sudden movement of robot, and conducts it.

(11) Don't make the system designed to allow the workers to carry the Work in and out using their hands through the safety fence. It could be a cause of accident associated with compressing or amputating.

1.6.3. Installing the Robot

Install the robot as per the planning and layout which has been previously reviewed and studied for its optimized performance and functionality. In case of poor conditions for robot installation, the serious problems can take place, including error of relative position between robot and workpiece during operation, bad performance quality of robot caused by vibration, shortening lifetime, and cause of serious accidents. Thus, pay attention to the following precautions when installing the robot.

General Safety Precautions

(1) Design and install the robot system properly in compliance with laws, regulations, and safety requirements enable in the country where the robot system is installed.

(2) All the workers for the robot system must have the complete knowledge on the information specified in the application and supplementary manual, and proficiently operate and handle the industrial robot.

(3) Installation workers of robot must follow the safety instructions and apply them to the installation when they face any safety problems.

(4) System provider must ensure that all the circuits utilizing safety functions perfectly perform in a safe way.

(5) Install main power supply to be disconnected from outside of the robot’s working envelope.

(6) System provider must ensure that all the circuits utilizing emergency stop function perfectly perform in a safe way.

(7) For the immediate emergency stop, install emergency stop button within the accessible distance for the operator.

Technical Safety Precautions

(1) Eliminate any interference with peripheral equipment considering the dimension and working envelope

(2) Avoid such places for installing which is directly exposed to the sun, extremely humid, contaminated by oil or chemicals, and containing a large amount of metal powder and explosive gas.

(3) Install at the ambient temperature ranged 0~45℃

(4) Secure sufficient space for the easier disassembly and maintenance.

(5) Install safety fence with a gate, and prohibit any person from entering the robot's working envelope.

(6) Remove any obstacles out of the robot’s working envelope.

(7) Take a special measure, considering thermodynamics of controller, if the robot is installed near the heating elements or places exposed directly to the sun.

(8) Take a special measure if the robot is installed in a place of abundant dust such as metal powder in the air.

(9) Install the robot not to transmit welding electric current. (In other word, insulate SPOT GUN with/from the robot’s wrist.)

(10) Grounding is very critical in preventing electric shock and malfunction caused by noise, and thus install as following instructions.

① Install an exclusive grounding terminal using class 3 or higher. (For the input voltage of 400V of higher, use special class 3 or higher.)

② Connect grounding line into the grounding bus-bar inside of the control panel

③ In case of direct grounding on the floor by anchoring, two-point grounding both by robot manipulator and by controller can produce a “ground loop” and contrariwise cause abnormal operation. In this case, connect the grounding line to the base of robot manipulator and disconnect the second grounding point to the controller. If the robot vibrates even after stopping, double-check the grounding status because the possible main causes could be an incomplete grounding or “ground loop”

④ In the use of internal transgun(GUN), there is a possible danger of dropping because the primary power cable is directly connected to the spot gun. In this case, directly connect the grounding line to the base of robot manipulator in order to prevent any electric shock and protect the control panel, but do not connect it to the controller.

1.6.4. Space for Robot Installation

Install robot after securing sufficient space for maintaining the robot manipulator, Hi4a controller, and other peripheral equipment. Install the robot manipulator and controller, securing space for installation as per the guideline as described in the figure below. Install Hi4a controller outside of the safety fence in order to monitor the robot manipulator and to operate in a safe way.

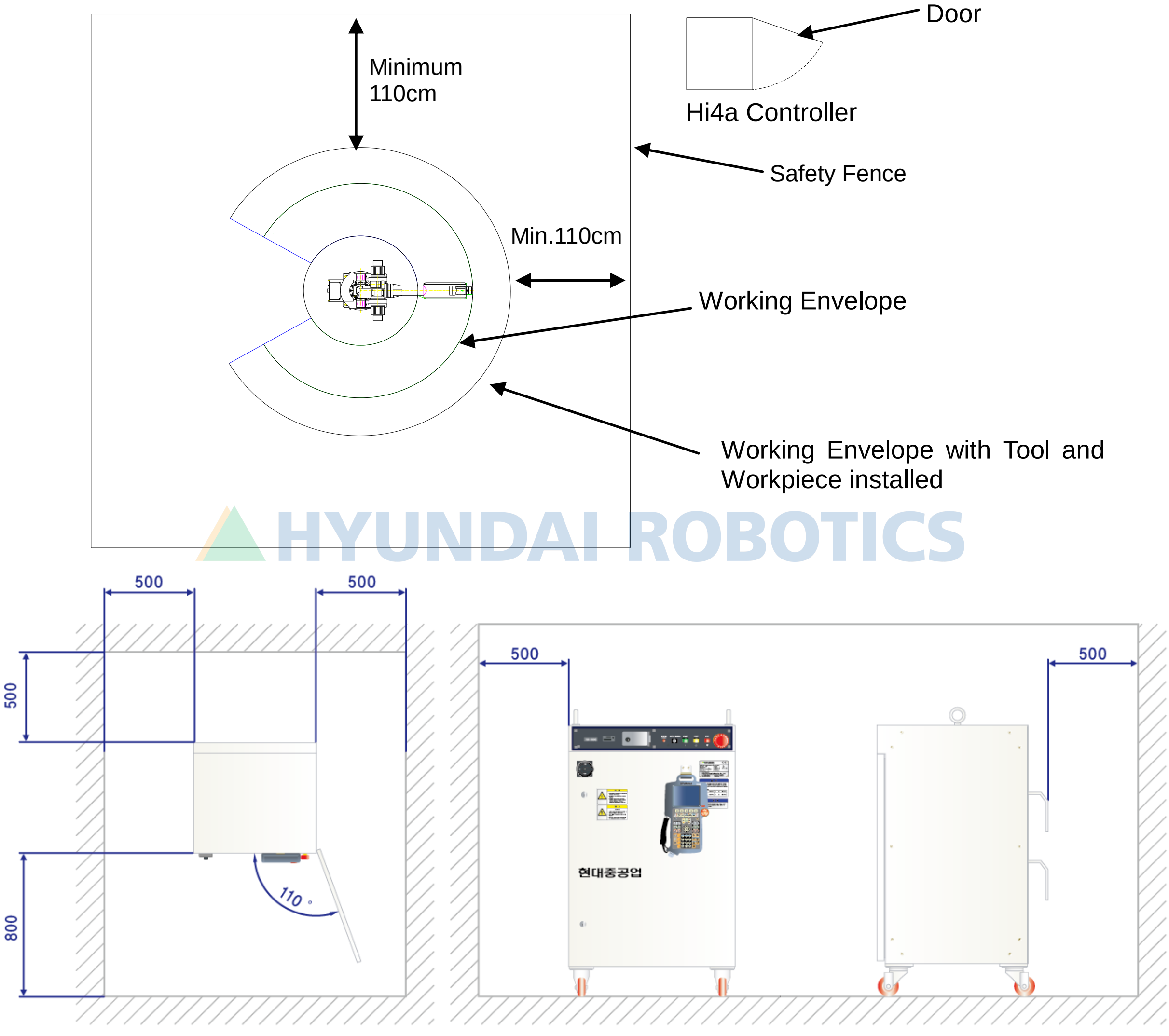


Fig. 1.4 Space for robot installation

When installing, be sure to make it easier to perform the maintenance when opening the Hi4a Controller door. Secure the available space. The controller power in the above Figure could change depending on the kind of controller.

1.7. Safety Operation for Robot Handling

Follow the safety instructions to prevent any accidents. Don't modify nor ignore safety devices or circuits at any time, and be careful of electric shock.
All the normal operations in an automatic mode must be performed outside of the safety fence. Check the robot's working envelope if anyone is inside before operating.

1.7.1. Safety Precautions for Robot Handling

(1) Do not handle the robot other than such personnel as operators handling the robot and other possible operators and supervisors who were designated as whom duly trained in an approved robotic training course and become familiar enough with the proper operation of the safety and robotic functions.

(2) Be sure to wear helmets, goggles, and safety shoes.

(3) Perform the work in pairs. One person must be ready to press the emergency stop button in an emergency while the other must perform his work quickly but carefully within the robot’s working envelope. Always check the escape route before working.

(4) Make sure that there is no one in the working envelope when the power source is on.

(5) Operations such as teaching must be performed outside of the robot's working envelope. However, if the operation is performed within the working envelope after stopping the robot, enter the envelope with safety plug or key switch for converting to automatic mode. Make sure that other operators do not change it into automatic mode by accident. Also, pay close attention to the specific direction of robotic movement in case of abnormal operation and malfunction.

(6) Supervisors should follow the instructions below.
① Be located at a place where you could take an entire view of robot, and commit yourself to monitoring.
② Press the emergency stop button immediately when abnormality is found.
③ Anyone is forbidden to be near the operating area other than those who are engaged in the operation.

(7) In a manual mode, the speed of teaching is limited to 250mm/sec.

(8) In teaching, post a sign [Under Teaching].

(9) Operators must pull the safety plug out, and enter the safety fence with the plug.

(10) Do not use any devices causing noise in and around the teaching area.

(11) Handle the teaching pendant button, while checking the teaching point with your naked eyes, and do not handle it just relying on your sense.

(12) Do not work with your back against the robot, and always pay attention to the robot's movement.

(13) In teaching, check and examine carefully under your feet. In particular, in high teaching for more than 2M, secure a safe zone on which you may step before teaching.

(14) Instructions for any abnormal operations.

① Press immediately the emergency stop button when any abnormal operations are found.
② Be sure to check if the relevant equipment is stopped when checking the abnormality in an emergency stop.
③ In case that the robot stops automatically due to power failure, investigate possible causes and take actions after confirming that the robot completely stops.
④ In case of malfunction of emergency stop devices, immediately disconnect the main power and investigate possible causes to take necessary actions.
⑤ Investigation of the failure must be conducted only by a designated person. For the re-operation after emergency stop, operators must clarify the cause of failure and take necessary actions, and then operate the robot again following the proper procedure.

(15) Write out the operating rules proper to working details and installing location regarding the operation and handling method for the robot, and the necessary actions for robot's any failure. In addition, it is recommended to operate the robot in accordance with the operating rules.

(16) Instructions when the robot stops
Make sure not to approach the robot even when it seems to be stopped. Most accidents occur from a sudden movement of robot which seemed to be stopped when one approaches it. The conditions that the robot stops is as follows.

Table 1-2 State of Robot Stop

No.	State of Robot	Drive Power	Access
1	Pause (Minor failure, Pause switch)	ON	X
2	Emergency stop (Major failure, Emergency stop switch, Safety gate)	OFF	O
3	Input signal standby of peripheral equipment (START INTERLOCK)	ON	X
4	Playback Completion	ON	X
5	Standby	ON	X

Even in the accessible state of robot, be watchful against any possible sudden movement of robot. Make sure to avoid approaching the robot without precautions for emergency under all circumstances.

■ **Though the access during a pause is shown in the table as『×』, allow the access to robot with the same precautions as teaching work if the entrance is open to take actions for minor failures(i.e. malfunction caused by failure in arc, nozzle contact and weldment detection).**

(17) Clean up any split oil, tools, and impurities in the safety fence after completing robotic operation. Accidents such as conduction may occur in the working envelope contaminated by oil, or scattered tools on its floor. Make a habit of organizing and cleaning things up.

1.7.2. Safety Precautions for Operating Test

In case of operating test, errors in design or teaching and inferiority in manufacturing are possibly seen in the entire system such as teaching program, jig, and sequence. Thus, be more careful and safe in case of operating test. Accidents may occur by these combined causes.

(1) Before handling, check the stop buttons and signal functions to stop the robot such as emergency stop button or stop button. And then, check the abnormality - detective movements. Above all, it is the most critical to check all the stop signals. It would be the most important to stop the robot when any possible accidents are predicted.

(2) In case of operating test, start the robot at low speed(approximately 20%~30%) in the variable speed function, and repeat it more than one cycle to check the movements. If any errors are found, immediately correct them. After then, increase in speed (50% → 75% → 100%) gradually, and repeat more than one cycle respectively to check the movements. Operating at high speed from the very beginning may cause a serious accident.

(3) In case of operating test, it is hard to predict what problems would happen. Do not enter the safety fence during operating test. Unexpected accidents are likely to occur because of its low reliability.

1.7.3. Safety Precautions for Automatic Operation

(1) While posting a sign [Do Not Enter During Operation] up the safety fence gate, ask the operators not to enter during operation. If the robot stops, you may enter the safety fence under your full understanding of the situation.

(2) Be sure to check if any operators are inside of the safety fence when starting the automatic operation. Operating without checking the presence of operators may cause a personal injury.

(3) Before starting the automatic operation, check and confirm that the program number, step number, mode, and starting selection are in the possible state for automatic operation. If starting with the other programs or steps selected, the robot could move in an unpredicted way, and lead to an accident.

(4) Before starting the automatic operation, check if the robot is properly located to get started. Check whether the program number or step number is identical with the location of robot. Even if it's all identical, accidents are still possible to occur due to an abnormal movement when the robot is differently located.

(5) Be prepared to immediately press the emergency stop button when starting the automatic operation. Immediately press the emergency stop button in case of robot's unexpected movements or emergency.

(6) Be sure to detect any abnormalities by checking the route, condition, or sound of robot movement. Sometimes the robot may be abnormally operated including a sudden break down. However, it will show(give) a certain indication before the break down. Understand the robot's normal condition well in order to catch the symptom in advance.

(7) When any abnormality is detected from the robot, immediately stop and take proper actions on it. Using the robot before any proper actions taken may cause an interruption of produce as well as serious failure leading to a very serious personal injury.

(8) When checking the robot’s movement after the proper actions taken for the abnormality, do not operate the robot with operators inside of the safety fence. Unexpected accidents are possibly to occur because its low reliability may cause another abnormality.

1.8. Safety Precautions for Access to Safety Fence

Robots are very powerful and heavy even at its low speed. When entering the safety fence, one must observe the relevant safety regulations of its pertinent country.
The operators always must be aware of the unexpected movements of robot. Robots are able to move fast shortly after being stopped. The operators should know that the robot is able to move in a different route, without any notice, by means of external signals. Thus, when trying to stop the robot during teaching or operating test, one should be able to stop the robot with a teaching pendant or control panel.
When entering the working envelope through the safety gate, take the teaching pendant with you so that other people may not operate the robot. Make sure to post up the control panel a sign indicating the state of robot handling.

Read carefully and be aware of the follows when entering the working envelope.

(1) Do not enter the working envelope other than teaching person.

(2) Operation set-up mode of controller must be a manual mode in the control panel.

(3) Always wear the approved working suite.(Do not wear a loose clothes as you please)

(4) Do not wear gloves when handling Hi4a controller.

(5) Do not leave innerwear such as underwear, shirts, or necktie out of the working suite.

(6) Do not wear personal accessories such as big earrings, rings, or necklaces.

(7) Make sure to wear safety shoes, helmet, and goggles and if necessary, wear other self-protective outfit such as safety gloves.

(8) Make sure that the emergency stop circuit is working correctly and in its proper function, turns MOTOR OFF when pressing the emergency stop button in the control panel and teaching pendant before handling the robot.

(9) Make your posture face-to-face with the robot manipulator when performing your work.

(10) Follow the predetermined working procedure.

(11) Be prepared for emergency exit or safe place considering that the robot may unexpectedly rush at you.

1.9. Safety Precautions for Maintenance and Repair

1.9.1. Safety Precautions for Hi4a Controller Maintenance and Repair

(1) Maintenance and repair of the robot must be performed by the personnel who was duly trained in the special maintenance training course and has a good knowledge of maintenance.

(2) Perform your work following the maintenance procedures for controller.

(3) Perform your maintenance and repair in a safe way by securing emergency exit or safe place.

(4) Before the daily maintenance, repair, or changing parts, be sure to power down. In addition, post a warning sign [Do Not Input Power] up the primary power so that other operators may not input power by accident.

(5) When changing parts, be sure to use the specified ones

(6) Be sure to power down when opening the Hi4a controller door.

(7) Before performing, wait for three minutes after power down.

(8) Do not touch the heat sink and regeneration resistor of servo amp because they generate an intense heat.

(9) After completing maintenance, Be sure to close the door completely after checking if tools or other things are still remained in the Hi4a controller.

1.9.2. Safety Precautions for Robot System & Manipulator Maintenance

(1) Refer to the safety precautions for Hi4a controller maintenance and repair.

(2) Perform your maintenance and repair for the robot system and manipulator, following the indicated procedures.

(3) Be sure to disconnect the primary power of controller. Post the warning sign [Do not input power] up the primary power to prevent other workers from connecting the power.

(4) Make sure that the Arm is fixed and immovable before maintenance and repair since dropping or moving of the robot's Arm may cause a danger during maintenance and repair. (Refer to the 『Robot manipulator maintenance manual』.)

1.9.3. Necessary Actions after Maintenance and Repair

(1) Check if the cables or parts of controller are properly connected.

(2) After maintenance is completed, carefully check that no tools are left around or inside of the controller and manipulator. Make sure that the door is firmly closed.

(3) Do not turn on the power if any problems or critical failures are detected.

(4) Be sure that there is no one within the working envelope, and that you are in a safe place before turning on the power

(5) Turn on the main circuit breaker on the control panel.

(6) Check the current position and status of robot.

(7) Operate the manipulator at low speed.

1.10. Safety Functions

1.10.1. Operating a Safety Circuit

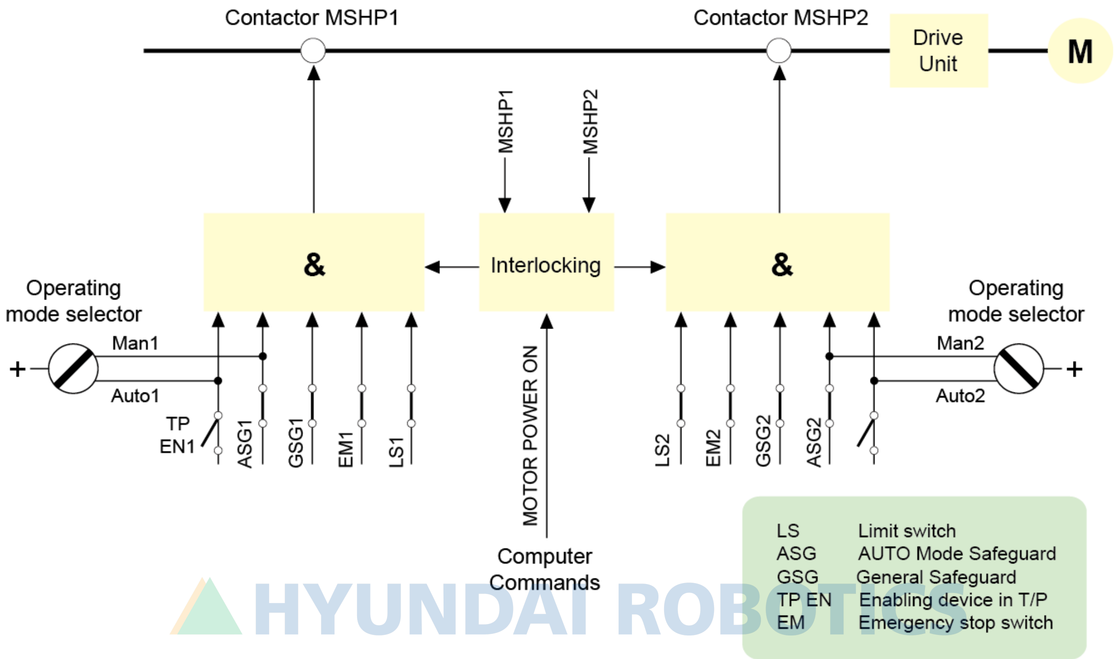


Fig. 1.5 Robot's Safety Circuit

The robot's safety system is based on a two-channel safety circuit that is continuously monitored. If an error is detected, the power supply to the motors is disconnected and the motor brake is applied. To return the robot to MOTOR ON mode, the switches of two-channel circuit must be connected. If one of the two-channel circuit switches shorts, the contactor of motor will be disconnected leading to the application of brake, and finally the robot will be stopped. Furthermore, when safety circuit is disconnected, the interrupting call will be sent automatically to the controller to find out the possible reason for the interruption.

The safety control circuit of operation is based on dual safety electric circuit in which the controller and MOTOR ON mode are operated interactively. In order to be in MOTOR ON mode, the safety circuit consisted of several switches must be all connected. MOTOR ON mode indicates that drive power is supplied to the motors. If one of the contactors is disconnected, the robot will always return to MOTOR OFF mode. MOTOR OFF mode indicates that drive power is removed from the robot's motors and the brakes are applied. The status of the switches is displayed on the teach pendant. (Refer to the I/O monitoring screen of "SERVICE" menu, 『Hi4a controller operation manual』.)

Safety circuit

The emergency stop buttons on the controller panel and on the teaching pendant and external emergency stop buttons are included in the safety circuit of operation. Users may install the safety devices (safety plug, safety stop device for safe place) which are operated in the AUTO mode. In a manual mode, the signals of these safety devices are ignored. You can connect the general safety stop devices that is active in all operating modes. No one can enter the working envelope in an automatic operation mode due to the unconditional operation of the safety devices (door, safety mat, safety plug etc.). These signals are also generated in a manual mode, but the controller will keep the robot operating while ignoring the robot's teaching. In this case, maximum speed of robot is restricted to 250mm/s. Thus, the purpose of this safety stop function is to secure the safe area around the manipulator while one approaches the robot for maintenance and teaching.
When the robot is stopped by a limit switch, it can be moved from the position by jogging it with the operation key on the teaching pendant. (Refer to “constant setting”, 『Hi4a controller operation manual』.)

The safety circuits must never be by-passed, modified or changed in any way.

1.10.2. Emergency stop

An emergency stop should be activated when people or equipment is located at the dangerous area. The emergency stop buttons are located both on the control panel and on the teaching pendant.
All safety control devices such as emergency stop buttons on the control panel must be located outside the working envelope and easily accessible at any time.

Status of Emergency stop

When the button is pressed, the robot will operate as follows.
Robot stops immediately in any cases.

- Disconnect the servo system power.
- Motor brake is activated
- Emergency stop message is displayed on screen.

For the emergency stop, the following two methods can operated simultaneously. (Emergency stop for control panel and teach pendant is basic)

(1) Emergency stop for control panel and teach pendant (Basic)

The emergency stop switch is on the control panel and teach pendant of the controller.

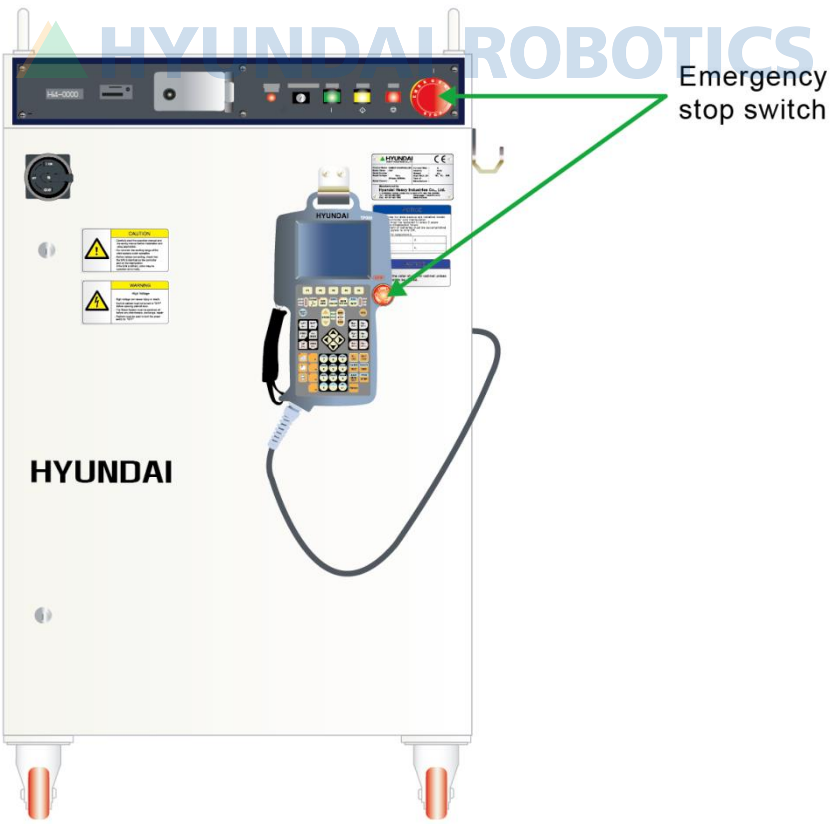


Fig. 1.6 Emergency Stop

(2) Emergency stop of external system

External emergency stop device (button etc.) can be connected to the safety electric circuit in accordance with applied standard for the emergency stop circuit.

▶ Emergency stop connection of the external system

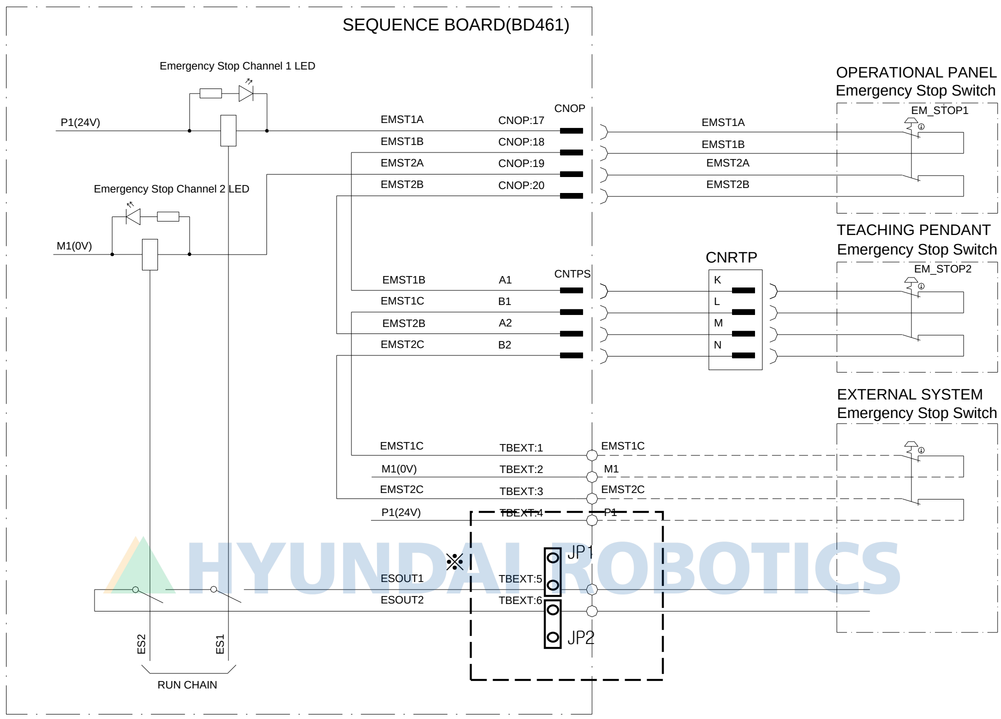


Fig. 1.7 Emergency Stop Connection of External System

※ When using the emergency stop of the external system, connect the Terminal No. 1 (ES1) & No. 2 (M1,0V Common) or No. 3 (ES2) & No. 4 (P1,24V Common) of the terminal block of BD461 to the external emergency stop line, and you must open JP1 or JP2.

At this time, the emergency stop must be connected to be Normal On and it must be check for proper operation during test run.

1.10.3. Operating Speed

To teach the robot, the operating mode switch must be in a MANUAL mode. Then the maximum speed of robot is limited to 250mm/s.

1.10.4. Connecting the Safety Devices

External safety devices such as light beams, light curtains, safety plug, and safety mats which can be adapted by the system builder execute interlocking the controller by way of connecting with safety circuit within the controller. These devices are used for safety device during execution of normal program in an automatic mode.

1.10.5. Restricting the working Envelope

When the robot is not necessary to reach certain area for specific applications, working envelope of the robot can be limited to secure the sufficient safety working area. This will reduce the damage or loss in case of robot's collision with external safety devices such as safety fence, etc. The movement of axes 1, 2, and 3 of HR, HX, HS and HA can be limited by means of mechanical stopper or electrical limit switches. In this case, the corresponding software limitation parameters must be also changed. The movement of the three wrist axes, if necessary, can be also limited by the Main CPU. Limitation of working envelope for all the axes could be carried out by the user. The robot is delivered to customer as the status of full working envelope setting.

Manual mode: Maximum speed is 250mm/s.
In a manual mode, by means of worker’s selection, workers may enter the safeguard area.

Auto mode: The robot can be operated via remote controller.
All safety devices such as safety door, safety mats, etc. are activated.
No one may enter the safety device area of robot.

1.10.6. Monitoring Function

(1) Motor monitoring function
Motors are protected against overload by means of onboard sensors.

(2) Voltage Monitoring Function
For the protection of, the servo amp module turns off the power switch when the voltage is too low or too high.

1.11. Safety Related to End Effectors

1.11.1. Gripper

(1) When a gripper is used to grip a workpiece, there should be safety precautions for unexpected dropping of the loaded workpiece.

(2) When any end effectors or devices are installed on the robot arm, use the required size and piece of bolt, and securely fasten as per the required torque using torque wrench. Do not use the bolt which has rust or dirt on its surface.

(3) End effector must be designed and manufactured not to exceed the maximum allowable load at the wrist of robot. Even though power or air supply stops, the gripped workpiece must not be dropped from the gripper. In order to remove any risks and problems which may cause personal injury and/or physical damage, the sharp edge and projecting part of end effector must be made dull and smooth.

1.11.2. Tool / Workpiece

(1) It must be possible to replace tools such as milling cutters in a safe manner. Make sure that safety devices are working correctly until the cutters stop rotating.

(2) Tool must be designed to keep in gripping workpiece securely even though a power failure or a control failure takes place. It must be possible to release workpiece from the gripper in a manual mode.

1.11.3. Pneumatic and Hydraulic Systems

(1) The special safety regulations will apply to pneumatic and hydraulic systems.

(2) Since residual energy of pneumatic and hydraulic systems can be still remaining even after the robot stops, particular care and attention must be paid by users. Internal pressure of equipment must be removed whenever starting the repair work for pneumatic and hydraulic systems.

1.12. Liabilities

The robot system has been built in accordance with the latest technical standards and approved safety rules. Nevertheless, the serious accidents such as death or personal injury still may take place due to the collision between the robot system and peripheral equipment.

The robot system must be used by operator who has a full technical knowledge on its designated use and also pay his close attention to the possible dangers and risks involved in its operation. The use of robot system is subject to compliance with these operating instructions and the operation and maintenance manual supplied together with the robot system. The safety related functions of robot system must not be used for any purposes other than safety.

When you use the robot system for any other or additional purposes than its designated usage, you must review whether it is enable in accordance with design criteria. The manufacturers cannot take any responsibility for any damage or loss which resulted from such misuse or improper use. The users shall have the full responsibility for the risks caused by such misuse or improper use. When you use and operate the robot system for its designated use, you must have a good command of all the information contained at these operating instructions as well as the maintenance manual.

The robot system may not be put into operation until it is ensured that the functional machine or plant) into which the robot system has been integrated conforms to the specifications of the EC directives 89/392 EWG dated 14 June 1989 and 91/368 EWG dated 20 June 1991.

The following harmonized standards in particular were taken into account with regard to the safety of the robot system.

- IEC 204-1,10.7
- ISO 11161,3.4
- ISO 10218(EN 775),6.4.3
- ISO 10218(EN 775),3.2.17
- ISO 10218(EN 775),3.2.8
- ISO 10218(EN 775),3.2.7

Users must take the full responsibility for any accident caused by their negligence or non-observance of these instructions. The manufacturer will not take any liabilities and responsibilities for any damages or losses caused by the misuse or malfunction of such equipment which is not included in the contract between manufacturer and user and provided by user, or such equipment which is installed around the robot system arbitrarily by the user. User must take the full liabilities and responsibilities for any risks and damages caused by such equipment.

HYUNDAI ROBOTICS

2
Specifications

2.1. Specifications

Table 2-1 Controller Specifications

Model / Specifications	Hi4a-0000 Hi4a-0008 Hi4a-0010	Hi4a-0002 Hi4a-0012	Hi4a-P000
CPU	32 Bit RISC		
Program Execution Mode	Teaching & Play Back		
Operation Mode	Menu-driven		
Interpolation Type	Linear, Circular		
Memory Backup Mode	Battery Backup IC Memory		
Encoder Type	Absolute Encoder		
Servo Drive Unit	6-Axis Monolithic type, Digital Servo		
Maximum Axes	12 Axes Max. Simultaneously		
Step	10,000 Points		
Program Selection	255(Binary)/8(Discrete)		
Teach Pendant Mark	LCD(40x15), Back Light		
Digital I/O	Input: 32 points (160 points Max.) Output: 32 points (160 Points Max.)		
Analog I/O	Input: 4 Points (Optional)/Output: 4 Points (Optional)		
Conveyor Pulse Counter	Line Driver/Voltage Output(Optional)		
Serial Port	RS232C : 2 Port		
Rated (supply) Voltage	3 -phase 220V (50/60Hz)±10%		
Maximum Voltage Consumption	7.5KVA	7.5KVA	7.5KVA
Dimension (WxHxD)	675x1158x615(mm) (except for CASTER)		730x1158x670(mm) (except for CASTER)

Specifications \ Model		Hi4a-0000 Hi4a-0008 Hi4a-0010	Hi4a-0002 Hi4a-0012	Hi4a-P000
Weight		205Kg(except for transformer)		254Kg (except for transformer)
		IP54		
Protection Grade		0~45℃		
Operating Temperature		Max. 70dB		
Noise Level		75%		
Board	**CPU**	BD412		
	DSP(Servo)	BD540(Hi4a-0000, Hi4a-0008, Hi4a-P000, Hi4a-0002) BD541 (Hi4a-0010, Hi4a-0012)		
	Mother Board	BD400		
	Sequence	BD461V31(Hi4a-0000, Hi4a-0008, Hi4a-P000, Hi4a-0002) BD541(Hi4a-0010, Hi4a-0012)		
	Input/Output	BD430V50		
	Communication Board	BD420		
		BD474		
	Arc I/F	BD481		
Servo Amp	**Basic Axis**	HSXY6	HDAD6	HSLXY6
	Additional Axis	HSXY2	HDAD2	HSXY2
Wire Harness		2 pieces (Hi4a-0002, Hi4a-0012) 3 pieces (Hi4a-0000,Hi4a-0010, Hi4a-P000) 4 pieces (Hi4a-0008)		
Teach Pendant		TP300		
Cooling Fan		4 fans		6 fans

HYUNDAI ROBOTICS

3

Installation of Hi4a Controller

Warning

All installing works must be done by qualified installing engineer, and in comply with relevant laws and regulations.

3.1. Components

3.1.1. Basic Components of Hi4a Controller and Robot Manipulator

Basic component of robot manipulator and controller is as follows.

- **Robot Manipulator**
- **Controller**
- **Teaching Pendant**
- **Wire Harness**

Fig. 3.1 Basic Components of Manipulator and Controller

3.1.2. Confirmation of Serial Number

Serial Number is located in the upper right of controller door.

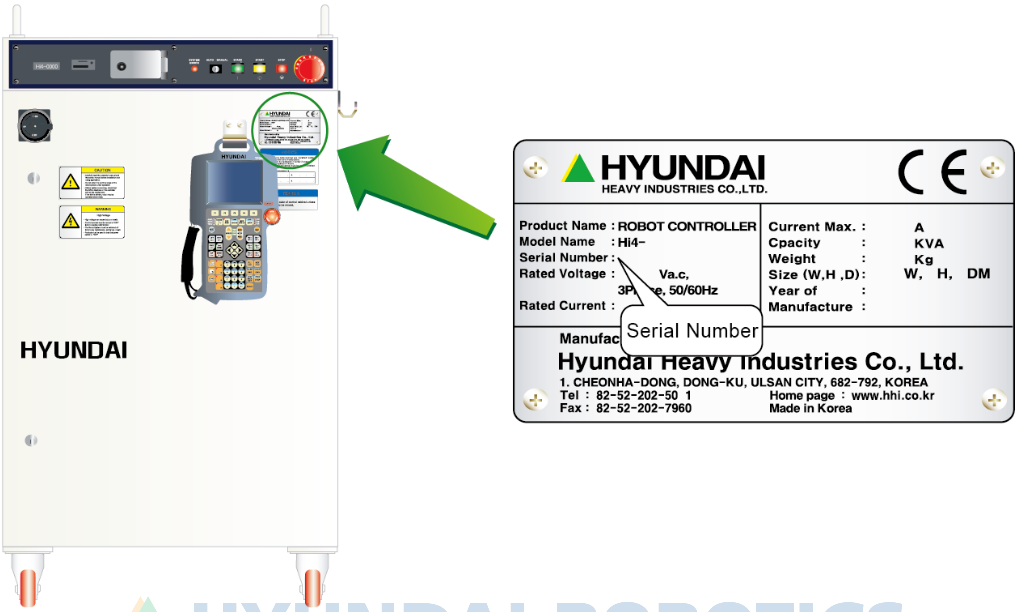


Fig. 3.2 Location of Serial Number

3.1.3. Confirmation of Nameplates

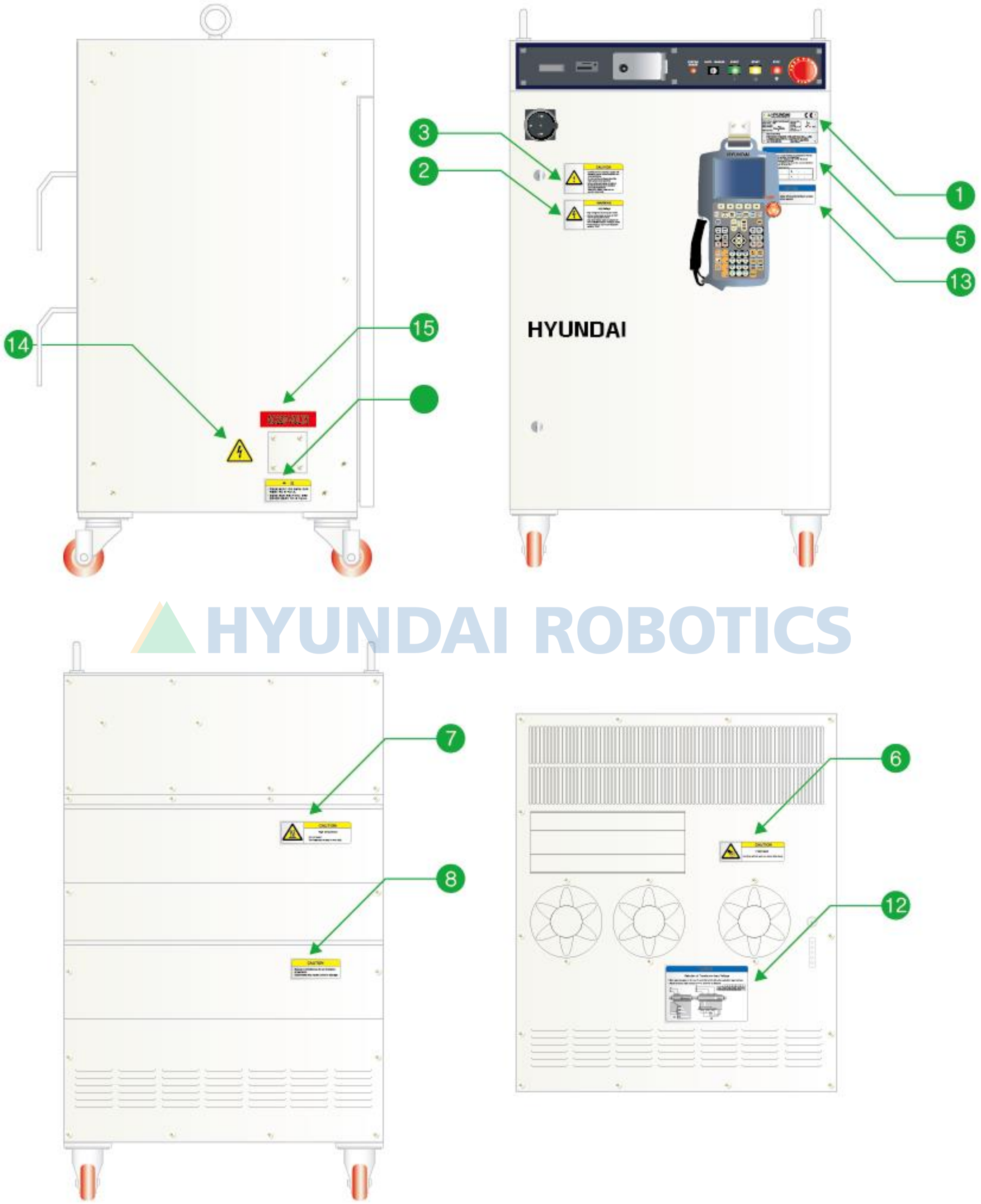


Fig. 3.3 Location of Controller Nameplate 1

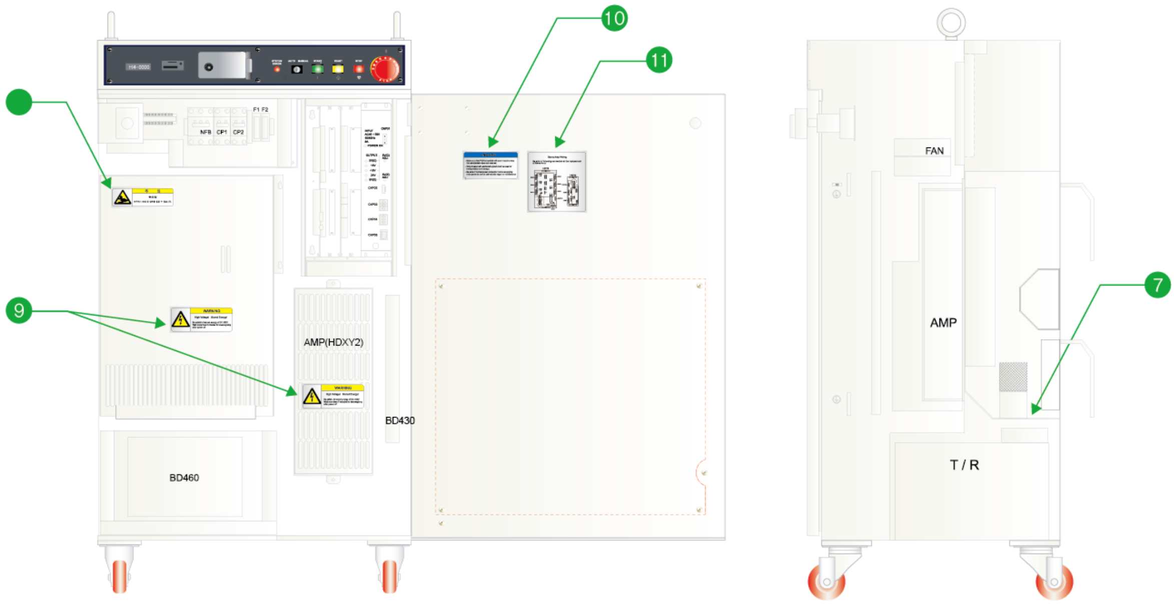
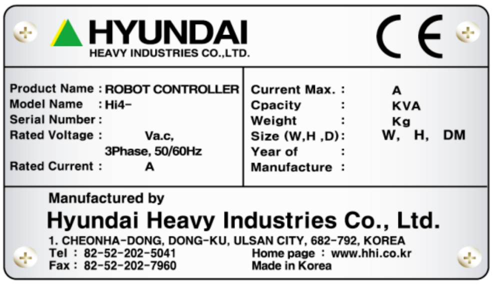
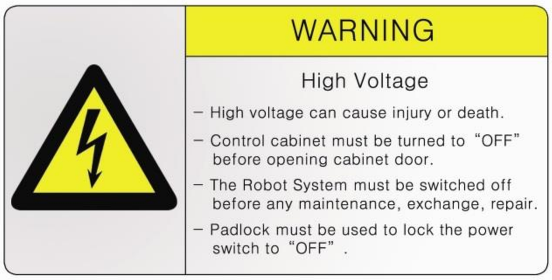


Fig. 3.4 Location of Controller Nameplate 2

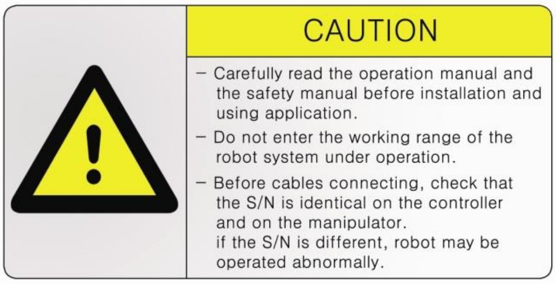
(1) Main Nameplate



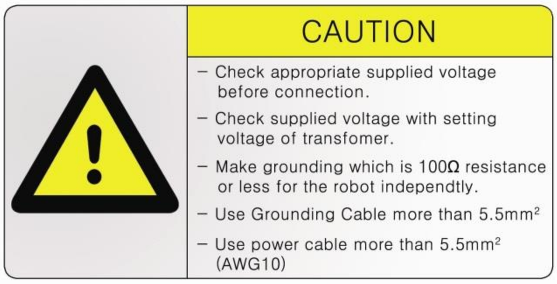
(2) High Voltage



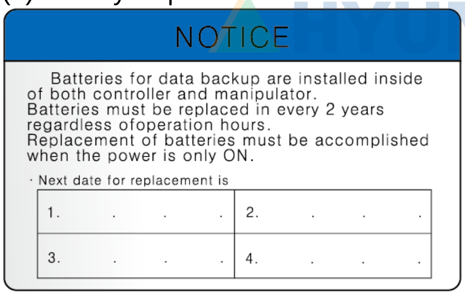
(3) Cautions for installation



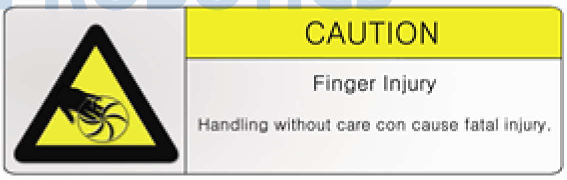
(4) Power supply



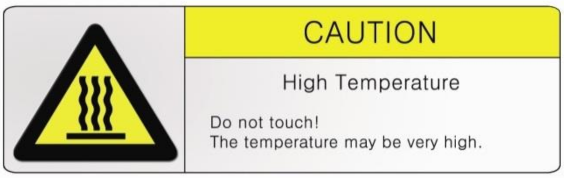
(5) Battery Replacement



(6) Caution for fan



(7) Caution for High Temperature



(8) Exhaust Pipe

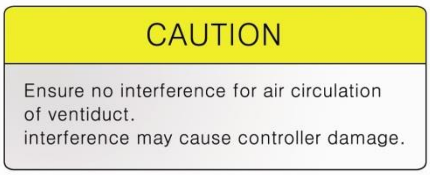
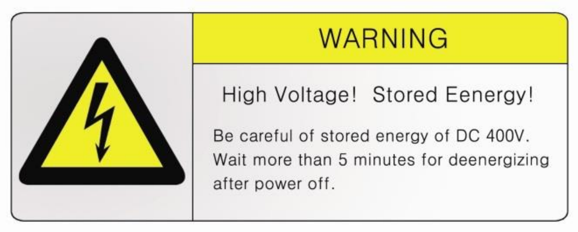
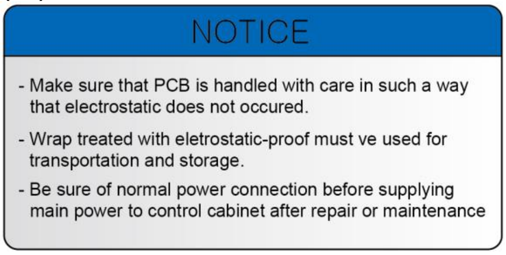


Fig. 3.5 Contents of Controller Nameplate 1

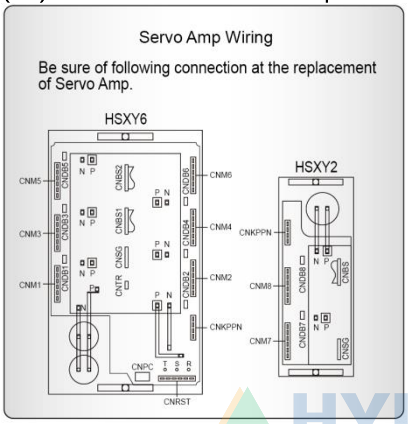
(9) Charged Energy



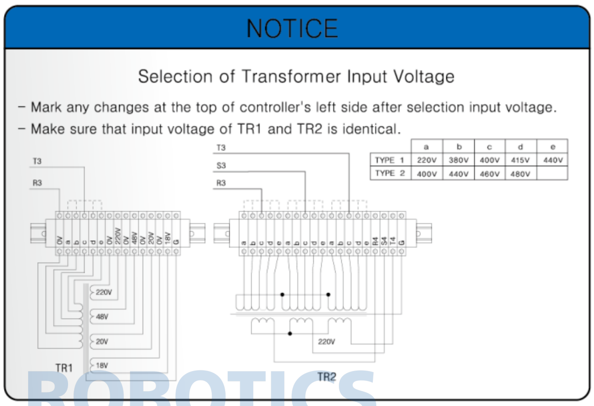
(10) Cautions for Board



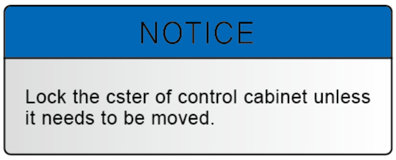
(11) Cautions for Servo Amp Wiring



(12) Transformer Wiring



(13) Cautions for Controller Wheel Fixation



(14) Caution for Electric Shock

(15) Power Supply

Fig. 3.6 Contents of Controller Nameplate 2

3.2. Packing

① Attach the nameplate of model to its box.

② Cover all the exposure connectors with dust cap or polyvinyl to protect.

③ For the packing of T/P in a box, use air cushioning materials to keep LCD intact from external impact during packing.

④ Attach the list of waterproof packing to the outer box.

3.3. Transportation of Hi4a Controller

Since Hi4a controller is a sophisticated device, transport it using crane or forklift truck in an uneven ground or for long distance.

Be sure to check the following instructions when transporting.

① Check if the front door of controller is completely closed.

② Remove, if any, everything unfixed on the controller

③ Check if the Eye Bolt on controller is securely fastened.

④ Since the controller is a sophisticated device, transport it very carefully without any impacts.

⑤ The weight of controller is 320Kgf. If using a crane, prevent wires from damaging objects on controller.

⑥ If using a forklift truck, secure the controller to prevent shaking.

⑦ If using a vehicle, secure the manipulator and controller with a squid and so on.

3.4. Unpacking

Caution

① Be fully aware of safety regulations and other instructions before unpacking and installing.

② Unpack the robot and controller, following the unpacking instructions.

③ Check if the place is safe enough to install the robot and controller

④ Check if a traveling path is secured to safely move the robot and controller.

⑤ Transporting robot must be performed by a qualified personnel.

⑥ Check out any damages from transportation or unpacking.

3.5. Hi4a Controller Handling

Transport the controller using crane or forklift truck.
Operating forklift truck must be performed by a qualified personnel.

3.5.1. Weight of Hi4a Controller

Table 3-1 Weight of Hi4a Controller

Model	TR2(optional)	Weight	
		Kg	lb
Hi4a-0000, Hi4a-0010, Hi4a-0008	X	184	406
	O	252	556
Hi4a-P000	X	235	519
	O	320	706
Hi4a-0002 Hi4a-0012	X	180	397
	O	226	499

TR2 : Primary Power Transformer

Table 3-2 Weight of Hi4a Controller by Models

Model	Weight	
	Kg	lb
Hi4a Controller except for TR2 (Hi4a-0000, Hi4a-0010, Hi4a-0008)	184	406
Hi4a Controller except for TR2 ((Hi4a-0002, Hi4a-0012)	180	397
Hi4a Controller except for TR2 (Hi4a-P000)	235	519
TR2 for Hi4a Controller (Hi4a-0000, Hi4a-0010, Hi4a-0008)	68	149
TR2 for Hi4a Controller (Hi4a-0002, Hi4a-0012)	46	102
TR2 for Hi4a Controller (Hi4a-P000)	80	177
Teach Pendant(TP300), Cable (10m)	4	8
Wire harness for Hi4a Controller (5m, Hi4a-0000, Hi4a-0010, Hi4a-0008)	15	32
Wire harness for Hi4a Controller (5m, Hi4a-0002, Hi4a-0012)	9	20

3.5.2. Transportation of Controller Using Crane

Check the following instructions when transporting the controller using a crane.

① In general, for the transportation of Hi4a controller, crane wire with Eye Bolt should be used.
② Check if the wire is strong enough to hold Hi4a Controller.
③ Check if the eye bolt is securely fastened.

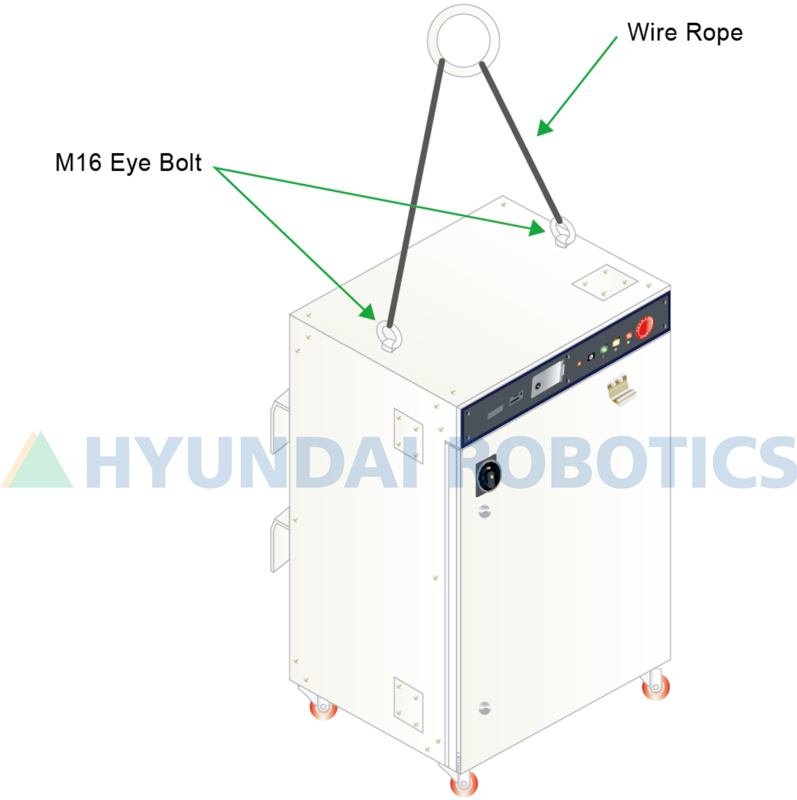


Fig. 3.7 Transportation of Controller Using Crane

3.5.3. Transportation of Controller Using Forklift Truck

Check the following instructions when transporting the controller using a forklift truck.

① If transporting with wire rope, be sure to use a strong wire to hold Hi4a controller.
② Check if the eye bolt is securely fastened.
③ Transport the controller as low as possible.

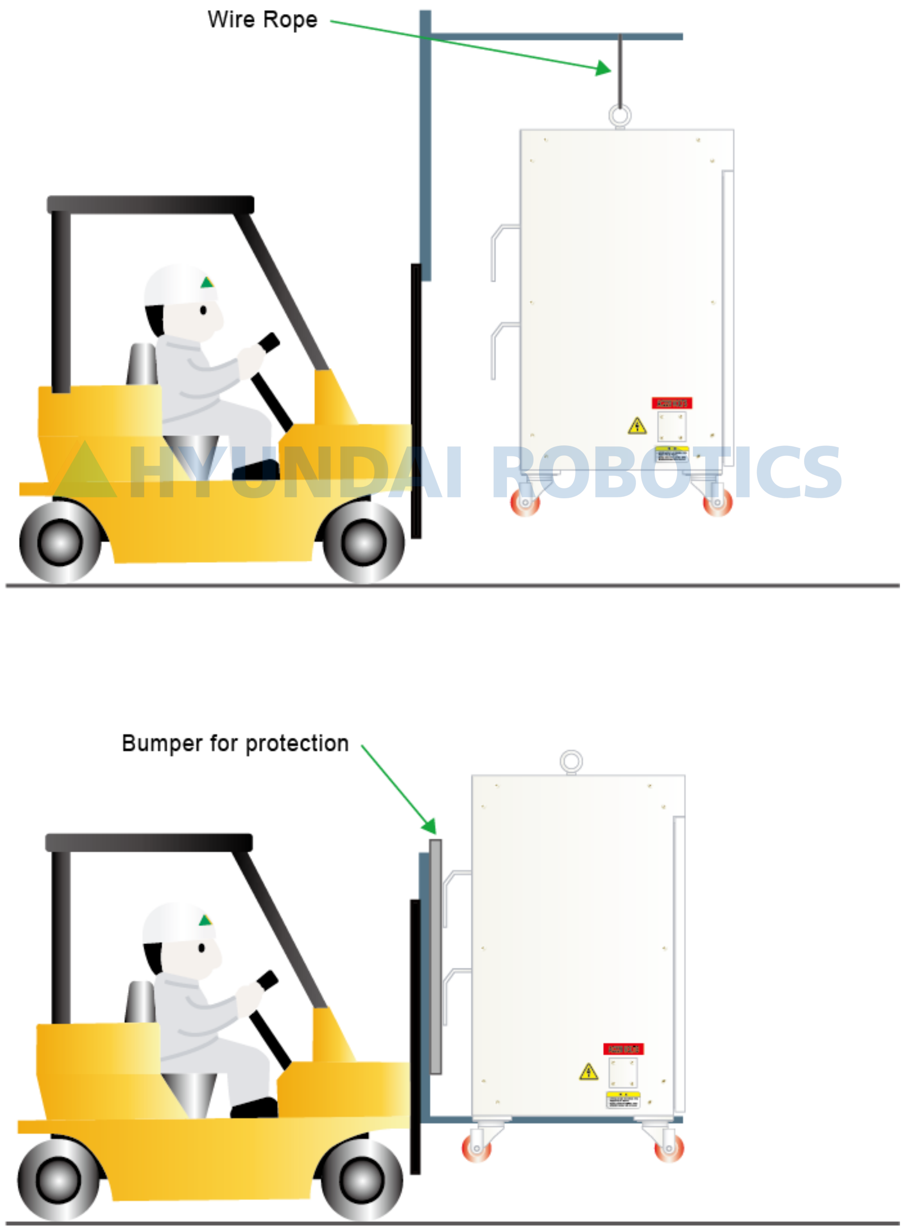


Fig. 3.8 Transportation of Controller Using Forklift Truck

3.6. Space for Installation

Check the following instructions before installation.

① Secure the robot working envelope.
② Secure the space for maintenance of robot manipulator and controller.
③ Check if the installing place has such environment as follows.

- Ambient Temperature ; $0^{o}C \sim 45^{o}C$
- No dust, oil, or moisture.
- No flammable, corrosive liquid or gas.
- No impact and shaking.
- Far from electrical noise generator.
- No exposed direct to the sun

3.6.1. Installation of Hi4a Controller

① Install the controller in a safe place outside of robot working envelope.
② If safety fence is located outside of robot working envelope, install the controller in a place where the robot's movement can be monitored from the outside of safety fence.
③ Open the front door and secure enough space for maintenance work.
④ Install the controller in a place where welding spatter and coolant are not reached.

3.6.2. Space for Installation

Secure enough space for robot manipulator and controller before installing. To install the manipulator and controller, secure the installing space as shown in the below figure. Install the controller outside of the safety fence to see the manipulator easily and to work safely.

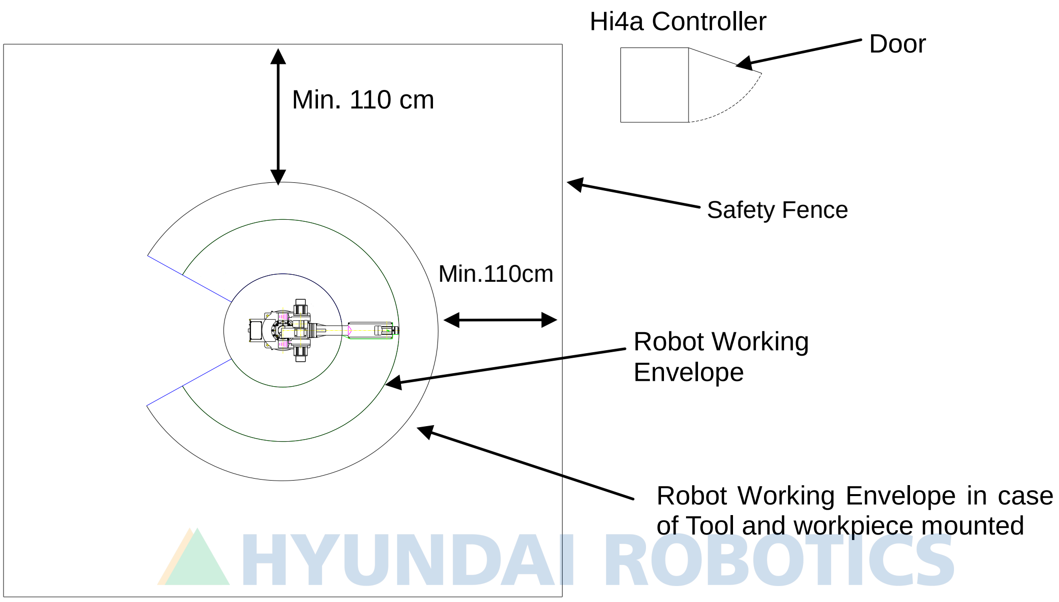


Fig. 3.9 Installing Location of Robot and Controller

Install the controller at intervals of a minimum 500mm from the surrounding walls.

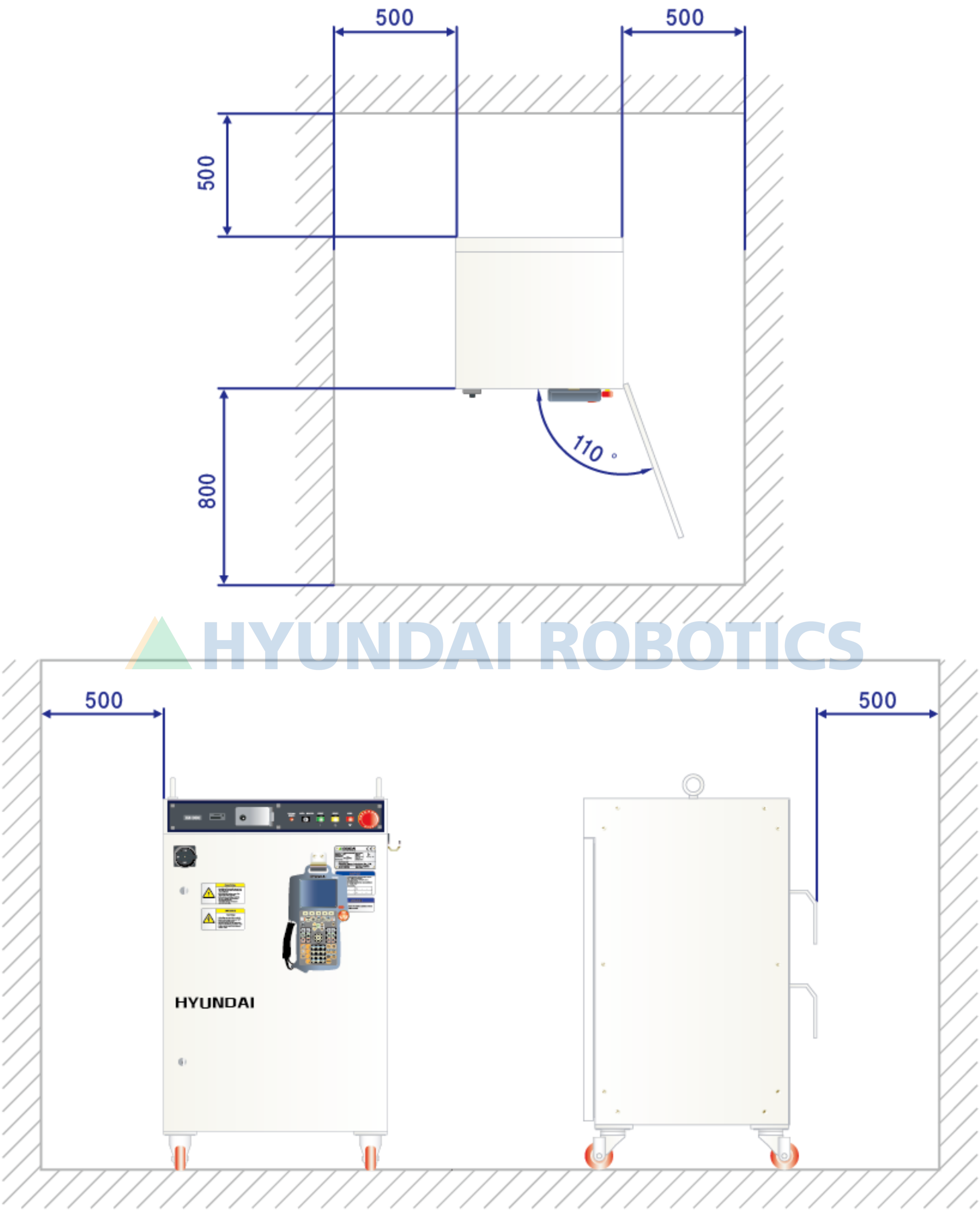


Fig. 3.10 Distance from Near Walls

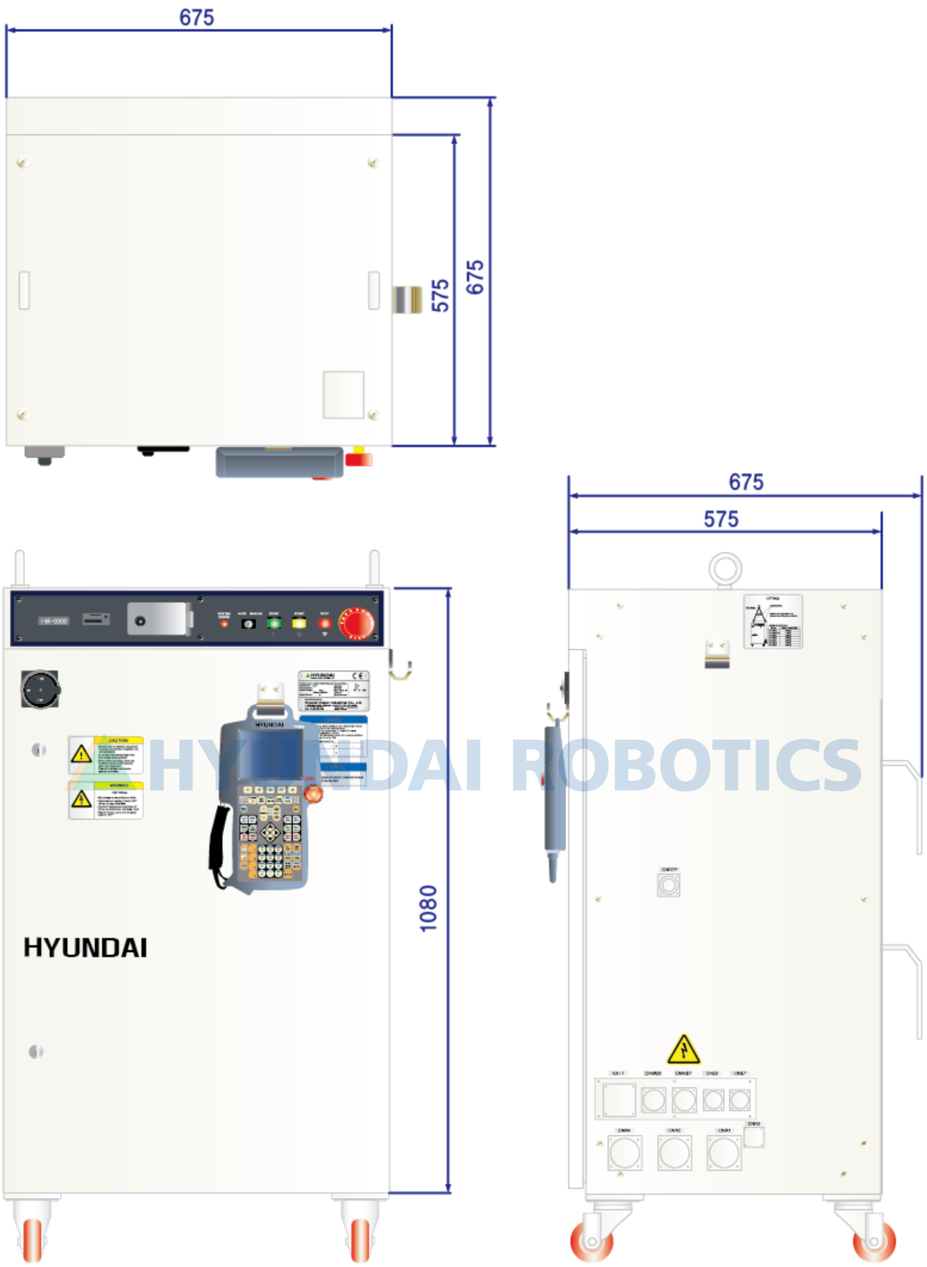


Fig. 3.11 Dimension of Hi4a Controller(Unit:mm) Hi4a-0000, Hi4a-0002, Hi4a-0008, Hi4a-0010, Hi4a-0012

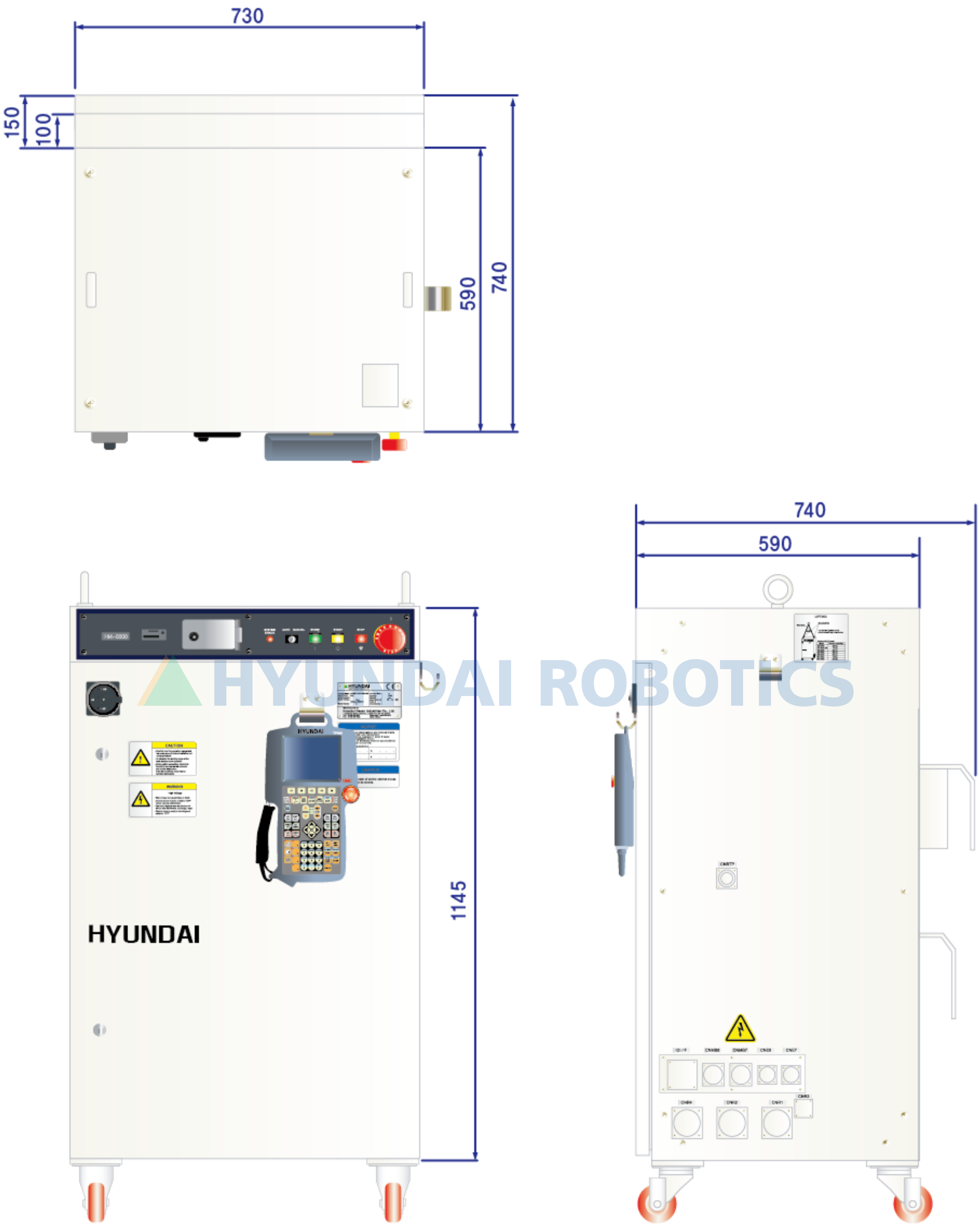


Fig. 3.12 Dimension of Hi4a(Unit:mm) Hi4a-P000

3.7. Connection

Caution

① Turn the main power switch of controller “OFF” before connecting cables, and use a lock to lock the main power switch.
② There is charged energy of DC 400V in the controller. Be careful. Turn the power switch “OFF” to discharge the energy, and wait for 5 minutes at least
③ When handling PCB, be careful of any damages from static electricity.
④ Wiring and interconnecting should be preformed by a qualified personnel.

3.7.1. Connection of Teach Pendant

Connect the cable connector of Teach Pendant to CNRTP receptacle in the side of controller.

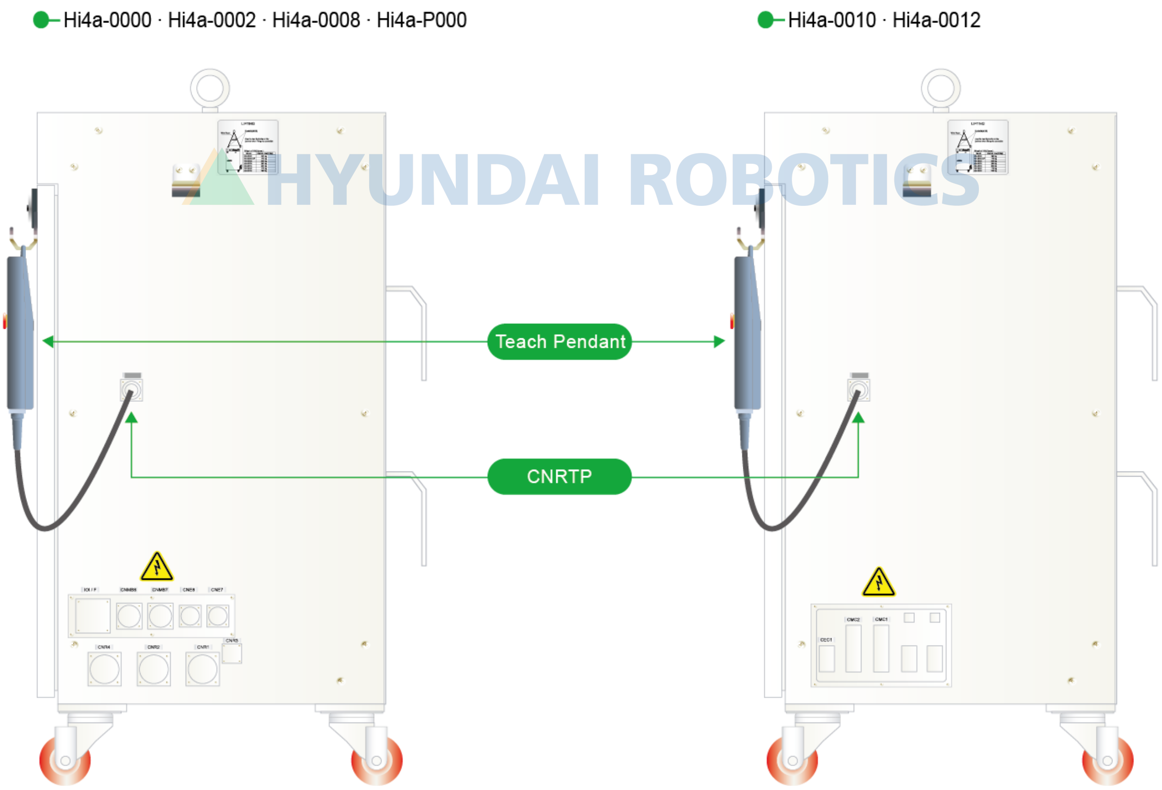


Fig. 3.13 Connection of Teach Pendant

3.7.2. Connection of Manipulator and Controller

Connect the robot manipulator to the controller by using wire harness. Check the respective name of receptacles before connecting.

Controller

Robot

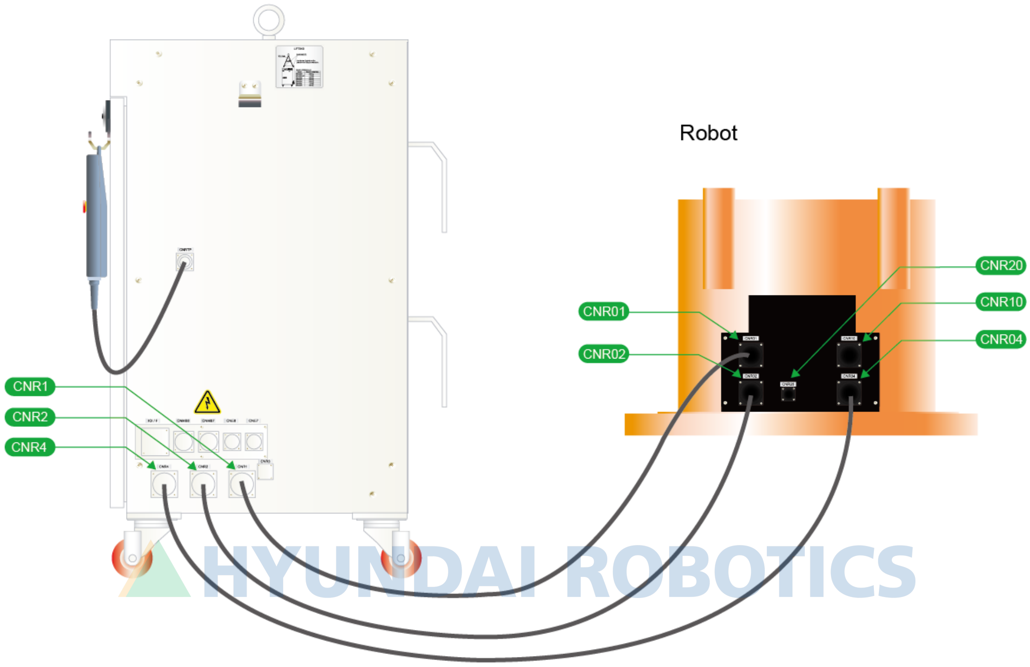


Fig. 3.14 Connection of Robot Manipulator and Controller(Hi4a-0000, Hi4a-P000)

Controller

Robot

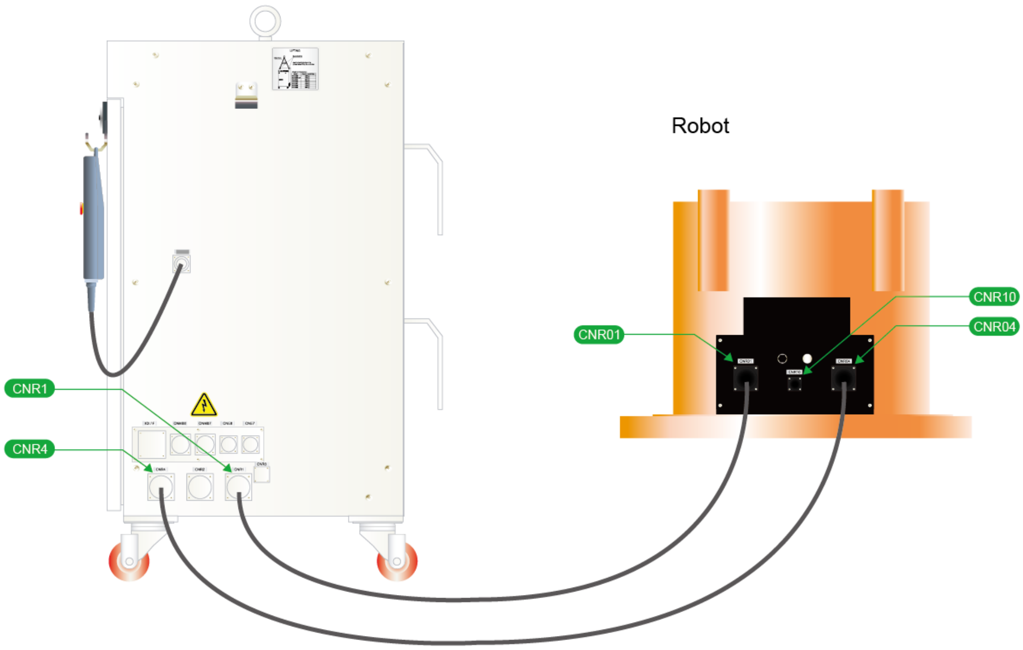


Fig. 3.15 Connection of Robot Manipulator and Controller (Hi4a-0002)

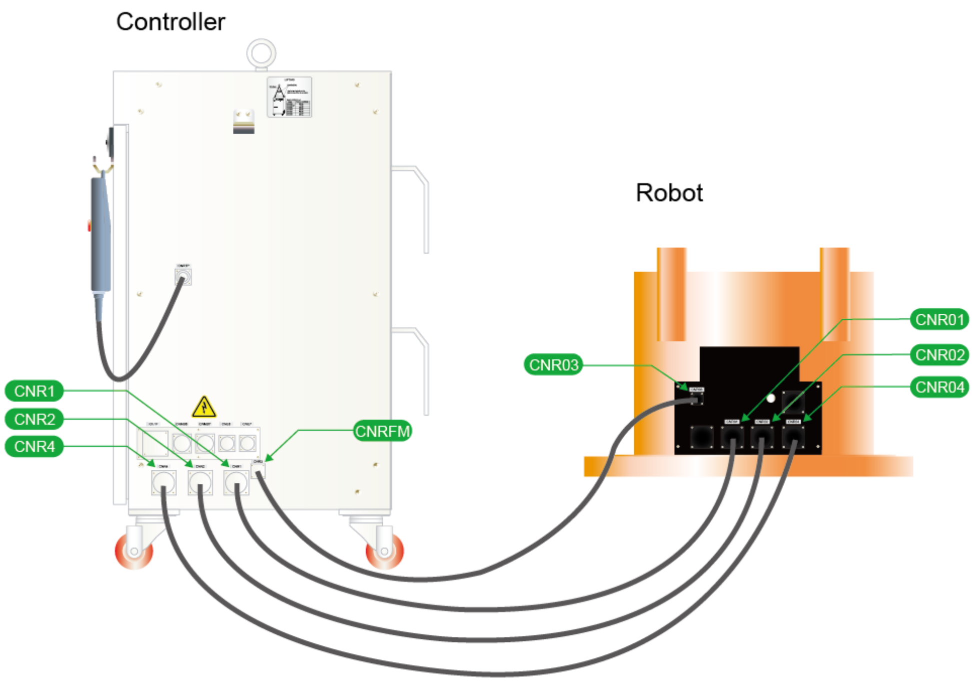


Fig. 3.16 Connection of Robot Manipulator and Controller (Hi4a-0008)

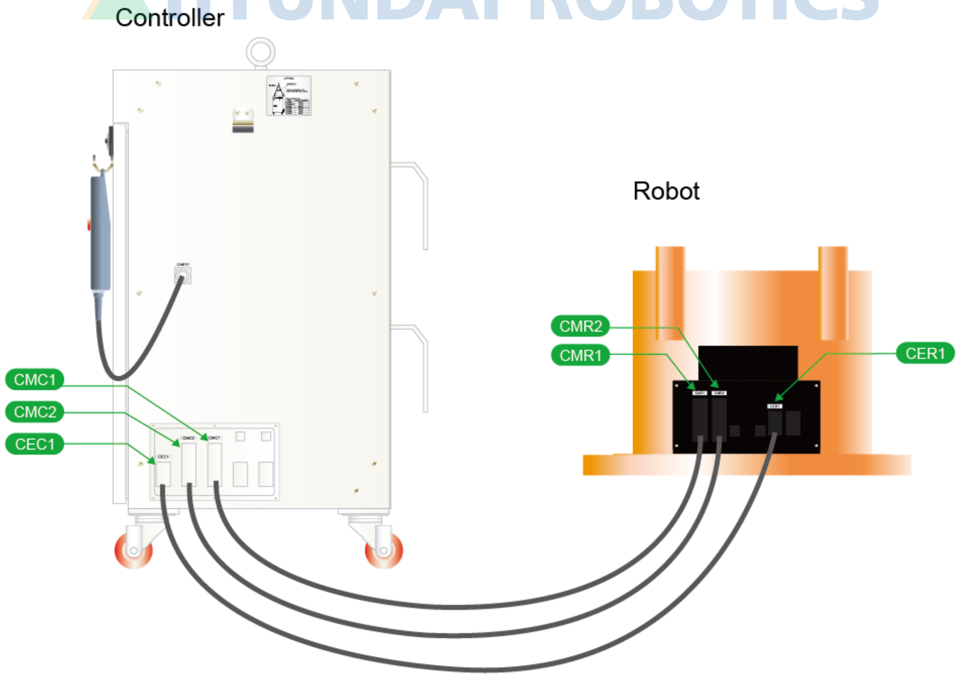


Fig. 3.17 Connection of Robot Manipulator and Controller (Hi4a-0010)

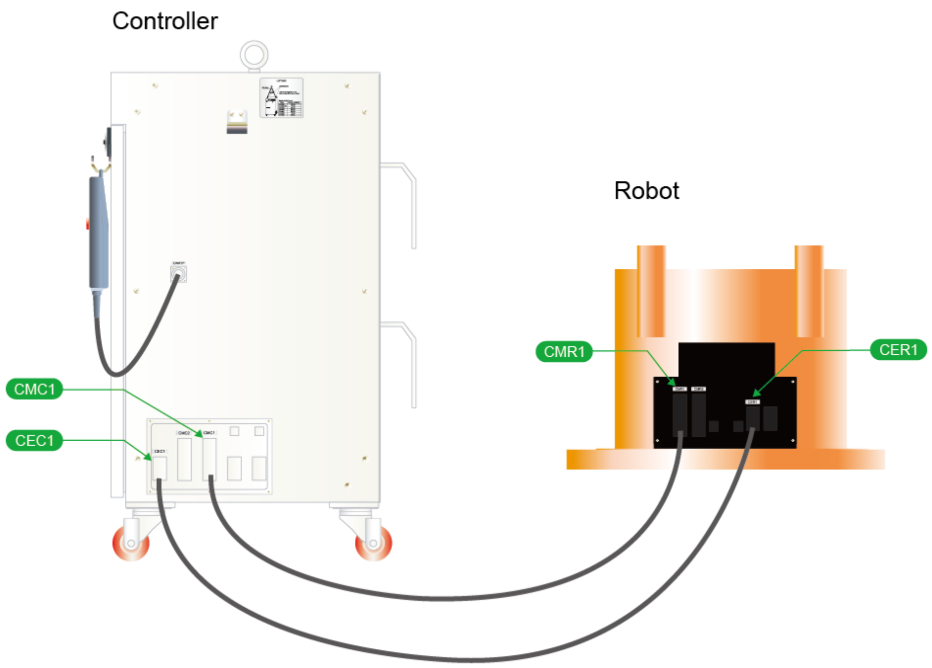


Fig. 3.18 Connection of Robot Manipulator and Controller (Hi4a-0012)

3.7.3. Connection of Controller and Primary Power

Check if the power is removed from the primary power and braker(CB1).
Insert the primary power cable into the power inlet to connect the terminal block(TBPW).
Here, use a proper size of terminal for the tip of primary power cable.

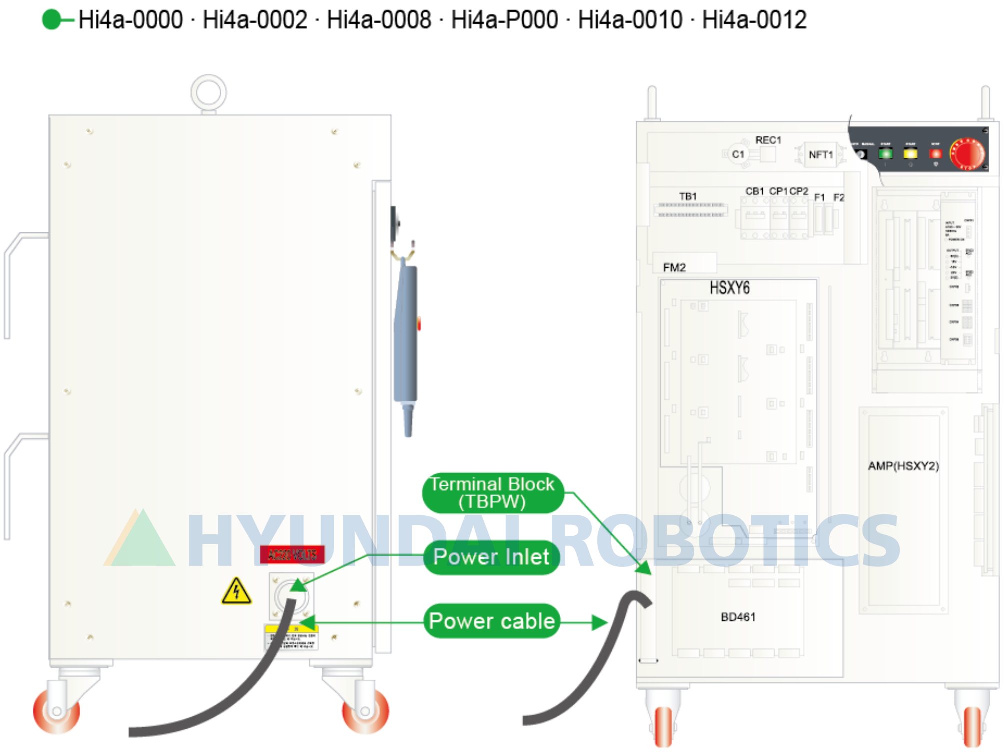


Fig. 3.19 Connection of Primary Power to Controller

3.7.3.1. Power Conditions

Table 3-3 Power Conditions

No.	Controller	Capacity (KVA)	Input Voltage (V) *1)	Frequency (Hz)	Max. Current (A) *2)
1	Hi4a-0000 Hi4a-0010 Hi4a-0008	7.5	220/380/400/415/440	50/60	23
2	Hi4a-P000	8.5	220/380/400/415/440	50/60	26
3	Hi4a-0002 Hi4a-0012	4.5	220/380/400/415/440	50/60	18

Note 1) Voltage Range : ±10% (Hi4a Controller Power Terminal)
Note 2) Max. Current : Current Interruption of Circuit Protector

3.7.3.2. Thickness of Power Cables

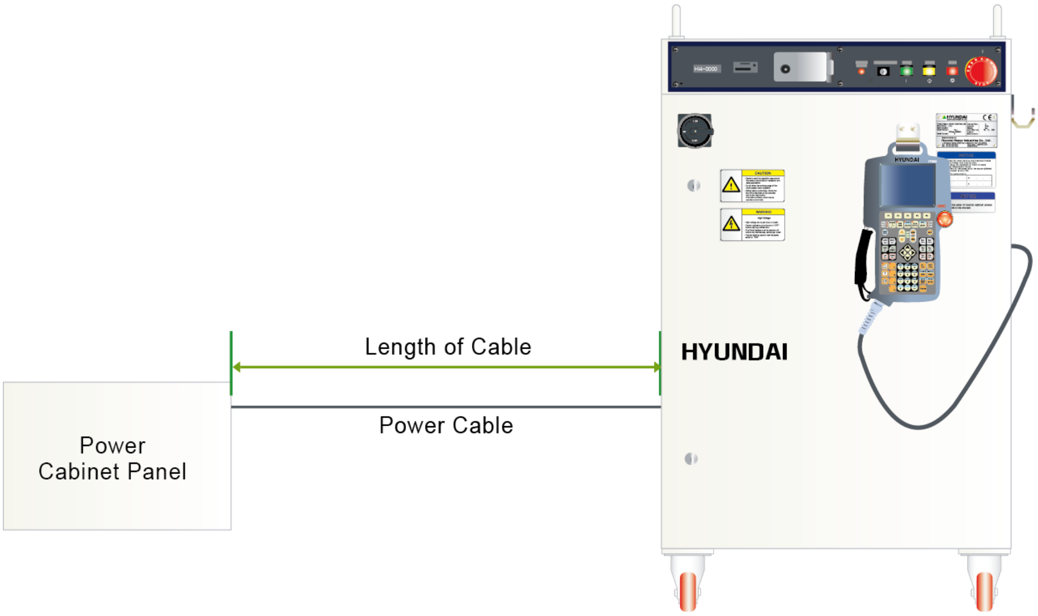


Table 3-4 Recommended Cable of Least Thickness

No.	Length of Cable m(feet)	Thickness of Cable (Hi4a-0000, Hi4a-0010, Hi4a-0008, Hi4a-P000)		Thickness of Cable (Hi4a-0002, Hi4a-0012)	
		mm^2	AWG		
1	0 ~ 50(0 ~ 160)	3.5	12	3.5	12
2	50 ~ 100(160 ~ 320)	5.5	10	3.5	12
3	100 ~ 180(320 ~ 590)	8	8	3.5	12
4	180 ~ 300(520 ~ 980)	14	6	5.5	10

3.7.4. Controller and Grounding

Connect the grounding conductor to the controller for safety.
Use the grounding conductor more than 5.5mm$^{2.}$ (class 3 grounding)

3.7.5. Other Cautions

① **For the wiring of controller and robot manipulator, separate the signal line and power line.** And use a separated DUCT between high power line and signal line for wiring.

② Shield the wires with protection cover against damages, and be careful of damage from traffic.

③ Be sure to double-check **the connecting relations, power specifications of controller, and specifications of power supply before primary power input**.

3.7.6. RS232C Connection of Small Door Part

Small Door part is located on the OP Panel in the front of controller, and has RS232C port for external connection. Interconnecting to PC and Pin Description is as follows.

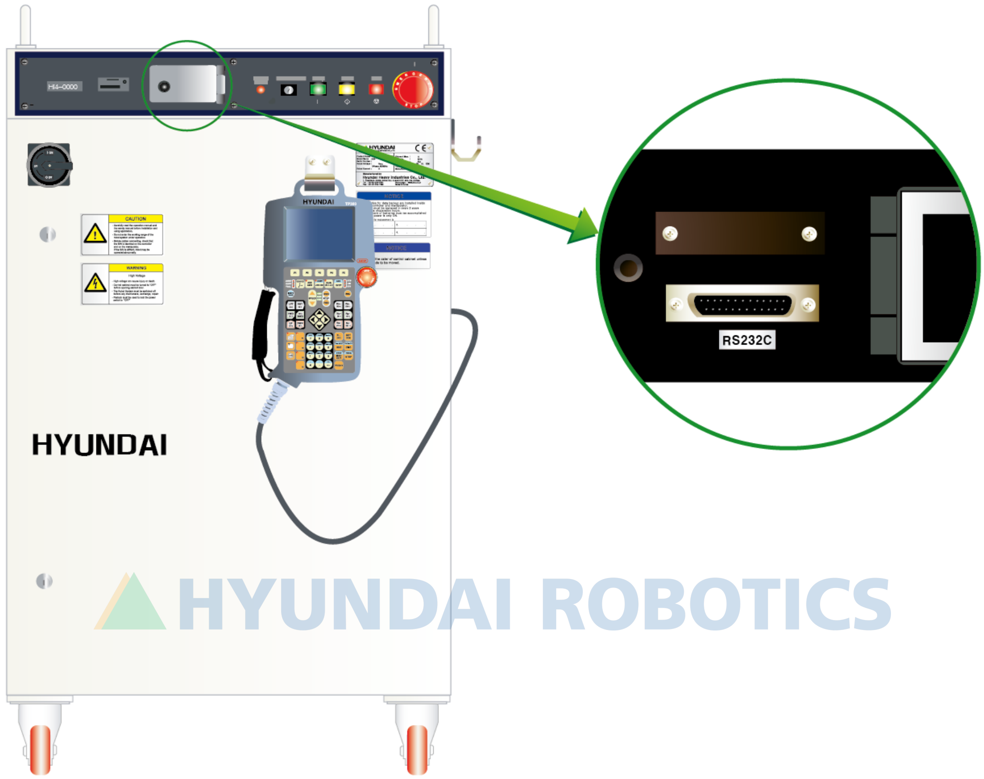


Fig. 3.20 RS232C Port Connection of Small Door Part

Table 3-5 Pin Descriptions (connector specifications; HIROSE HDBB-25S)

HDBB-25S Pin No.	Name	Abbreviation	Direction
2	Transmit Data	TX	Out
3	Receive Data	RX	In
4	Request to Send	RTS	Out
5	Clear to Send	CTS	In
7	Siganl Ground	SG	
6 ↔20 Short			

・ Interconnecting to PC is as follows.

- Connector　Maker ; HIROSE
- Product Name ; HDBB-25P, HDEB-9S

Connection (Back Side Soldering)

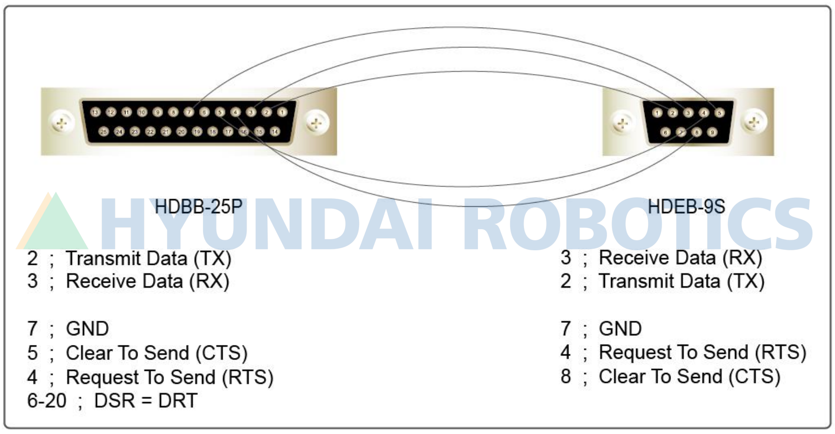


Fig. 3.21 Port Connection of PC and RS232C

4

Components of Hi4a Controller

Controller is composed of controller itself and Teach Pendant.
Personnel in charge of maintenance should begin his work with full knowledge of all the devices, parts configuration, and functions of Hi4a controller.

4.1. Parts Configuration of Hi4a Controller

Parts configuration of Hi4a controller is shown in the below figure 4.1~4.4, and the respective name of parts are shown in the below table 4-1.

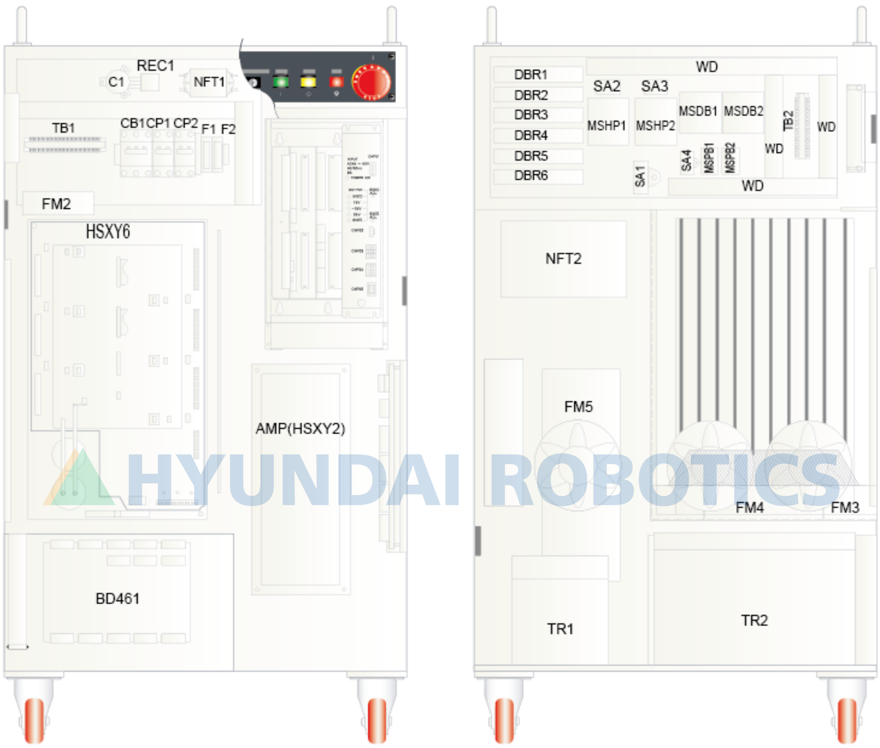


Fig. 4.1 Parts Configuration of Hi4a-0000, Hi4a-0010, Hi4a-0008, Hi4a-P000 Controller

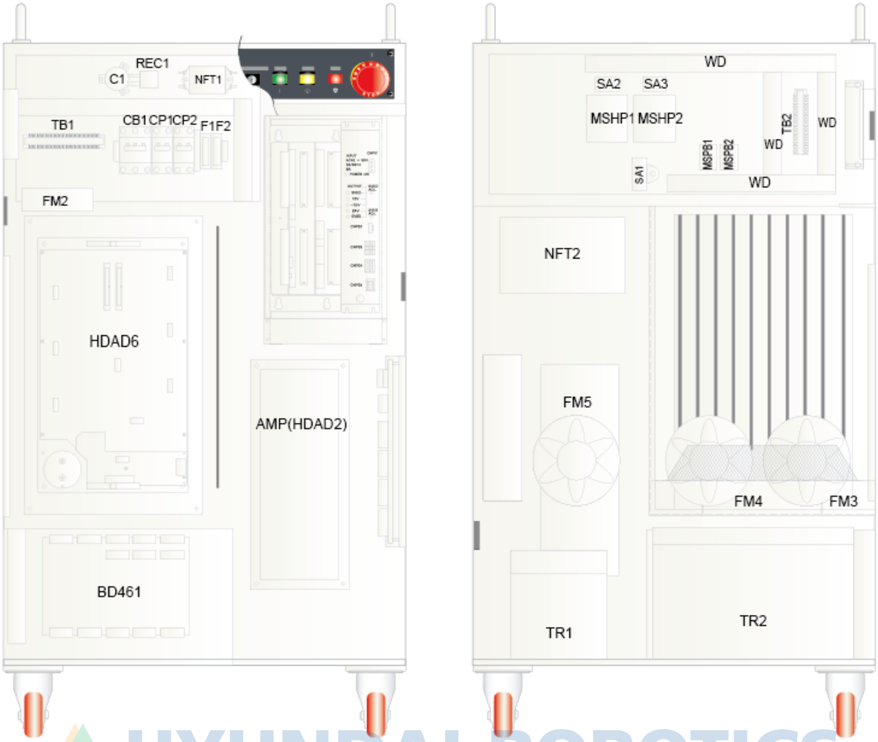


Fig. 4.2 Parts Configuration of Hi4a-0002, Hi4a-0012 Controller

Table 4-1 Hi4a Parts Name of Hi4a Controller

No.	Type	Product Name
1	BD412	Main CPU Board
2	BD430	I/O Board
3	BD540, BD541	Servo Board BD540(Compact ABS Encoder Application) BD541(Serial ABS Encoder Application)
4	BD461	Sequence / Brake Board
5	C1	Condenser (Capacitor)
6	CB1	Circuit Breaker for Wiring (Circuit Breaker)
7	CP1,2,3	Circuit Breaker for Wiring (Circuit Protector)
8	DBR1~6	Dynamic Brake Resistor
9	DS1	Disconnector
10	F1,2	Fuse
11	FM1~7	Fan
12	SR1	DC Power Supply System (SMPS)
13	HSXY2	Drive Unit for Medium-sized 2-Axis (optional)
14	HSXY6	Drive Unit for Medium-sized 6-Axis (standard)
15	HDAD2	Drive Unit for Small-sized 2-Axis (optional)
16	HDAD6	Drive Unit for Small-sized 6-Axis (standard)
17	HM	Hour Meter
18	MSDB1,2	Magnetic Contactor
19	MSHP1,2	Magnetic Contactor
20	MSPB1,2	Relay
21	NFT1,2	Noise Filter
22	RACK	Rack
23	RDR1	Regenerative Discharge Resistor
24	REC	Rectifier
25	SA1~4	Surge Absorber
26	TR1,2	Transformer
27	TB1,2	Terminal Block
28	WD	Wire Duct

4.2. Functions of Part

Table 4-2 Summary Table of Functions

No.	Classifications			Functions
	Type	Name	Specifications	
1	BOARD	Mother Board	BD400	Bus for signal connection between Boards (4 slots)
		Main Board	BD412	Recording a recorded point and calculating a motion path
				Programming and preserving robot constant
				Communicating with Teach Pendant
				Connecting PC, PC Card and Serial Communication
		I/O Board	BD430	Input/Output within controller (I/O for system)
				External Input/Output (I/O for users)
		Servo Board	BD540/BD541	CPU for Servo Control
				Encoder Connection
		Sequence Board	BD461 (BD461V31, BD461V41, BD461V50, BD461V60)	Sequence control and safety Circuit within controller
				Processing Input Signals from manipulator
				Output Servo and Brake Disconnection
			BD463	Brake Disconnection Switch (Manipulator)
		Multi-communi cation Board	BD420 (Option)	Supporting the field bus - DevieNet, Profibus-DP, InterBus
		CAN Communicatio n	BD474 (Option)	CAN Communication
				Baby Board of Main Board (BD412)
		ARC Board	BD481 (Option)	ARC welder connection, conveyor synchronization, analog I/O
2	Drive Unit	Servo Amp	Middle-sized 6-Axis :	Generating power for motor drive unit

No.	Classifications			Functions
	Type	Name	Specifications	
			HSXY6(BD457, BD457A, BD457B) Small-sized 6-Axis : HDAD6(BD453)	Regenerative Discharge
				Servo Motor Power Amplifier Circuit
				Output of Errors
3	DC Power Supply System	SMPS	SR1 - Input Power ; AC45~50V - Input Freqeuncy ; 50/60Hz	Board Power (DC+5V/8.29A) Supply
				T/P, I/O Power (DC+24V/1.87A) Supply
				Drive Unit (DC+15V/3.5A, DC-15V/0.8A)
				Encoder Power (DC+5V/4A) Supply
4	T/P	Teach Pendant	TP300	Display of information(LCD)
				Input of Button Switch (Function/Jog S/W , etc.)
				Input of Emergency Stop and Enabling Device
5	Cooling Device	Fan		Air Circulation within controller
				Cooling the Drive Unit

4.2.1. Board

4.2.1.1. RACK, MOTHER Board (BD400)

RACK plays a role in securing all kinds of PCB boards tightly.
Mother board connects PCBs mounted on the back side of PCB RACK each other.

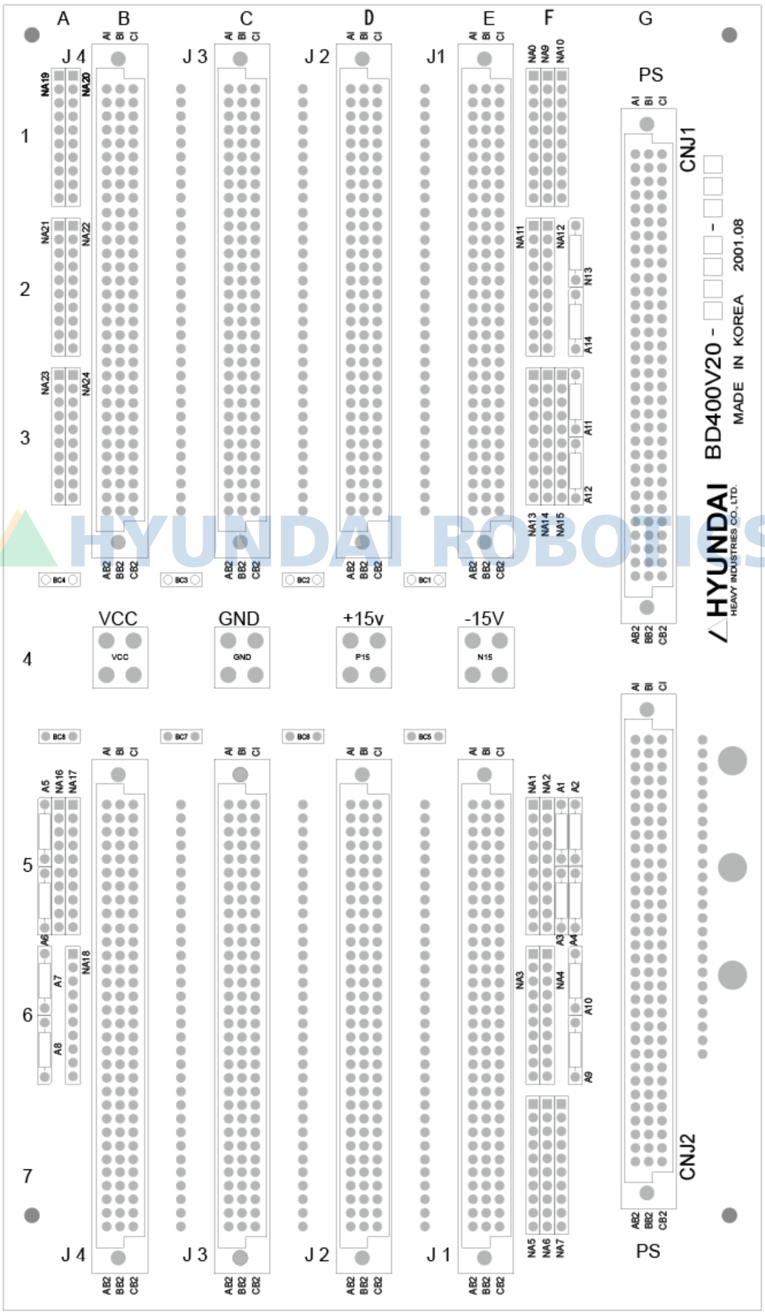


Fig. 4.3 Mother Board(BD400)

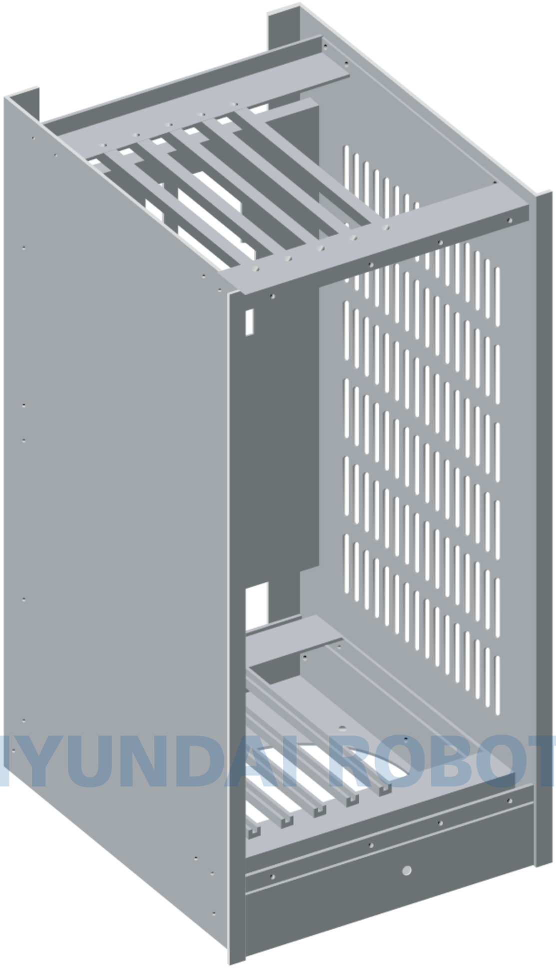


Fig. 4.4 RACK Exterior View

4.2.1.2. Main Board (BD412)

It processes all kinds of Data controlling the robot's movements, builds Man-Machine connecting environment, and processes data link information by communicating with peripheral equipment.
It can read and write files related to constant of controller, records of error, operating particulars, or Teaching program by using PC or PCMCIA SRAM Card.

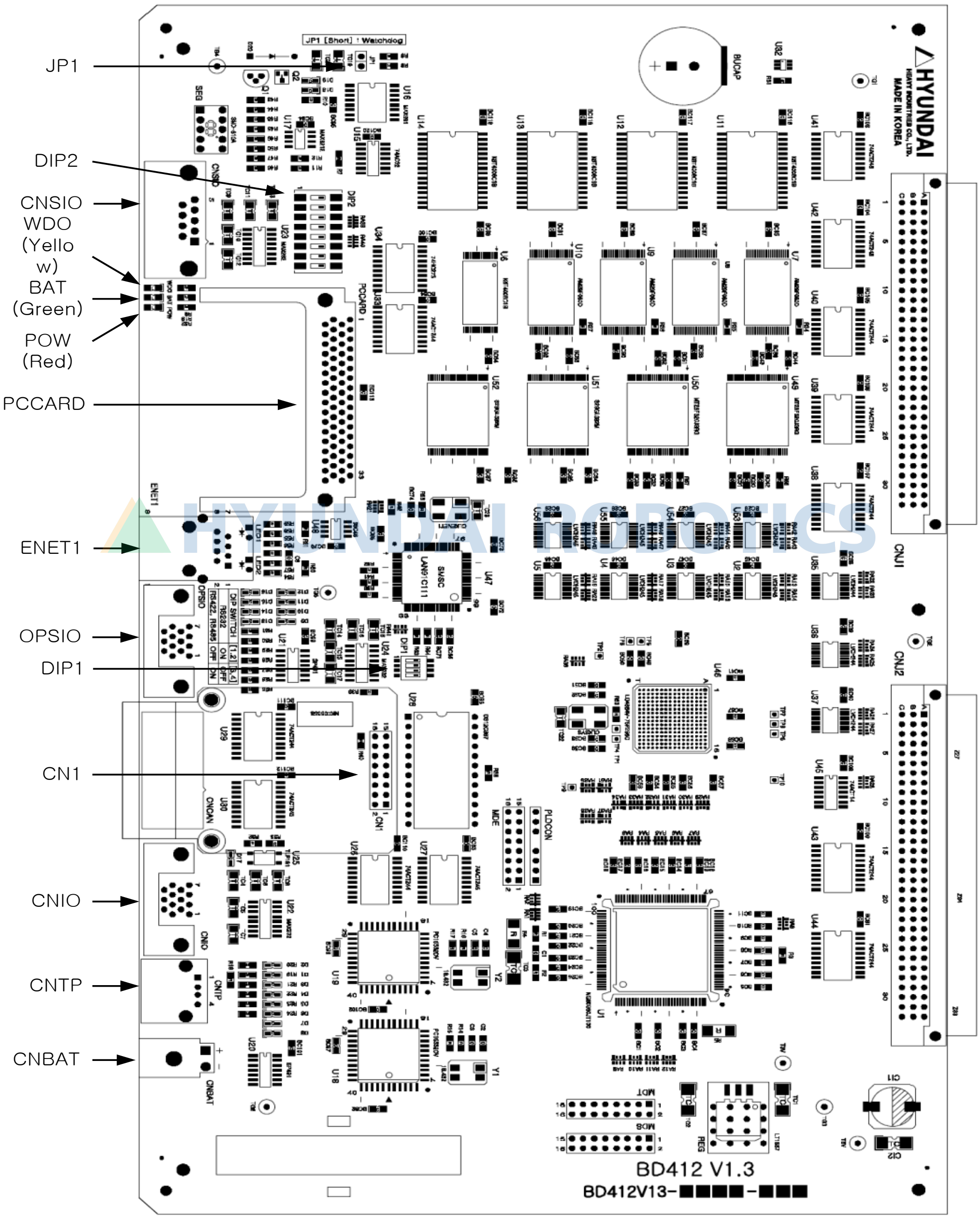


Fig. 4.5 Main Board (BD412) Exterior View

Table 4-3 Descriptions of Main Board(BD412) LED

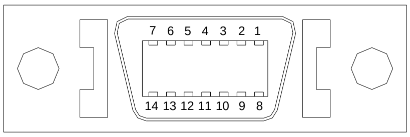
Status / Name	Color	Normal	Abnormal	Necessary Actions for Abnormality
BAT	Green	Light on	Light out	Battery replacement (every 2 years in full) - DC 3.6V
WDO	Yellow	Light out	Flickering	Main Board replacement - A/S request
POW	Red	Light on	Light out	Check the inserting condition in BD412 board Rack Check the voltage between SMPS(SR1) P5⇔& G1(DC 5V)

Table 4-4 Main Board(BD412) Connector Descriptions

Name	Uses	Connection with external devices
CNTP	Teach Pendant connection(RS422)	The Side CNRTP of controller
PCCARD	PC Card connection	PC Card
CNSIO	Serial Port connection (RS232C)	RS232 Serial Interface such as PC
CNIO	Main-I/O communication between boards(RS232C)	I/O board CNIO
OPSIO	Serial Port connection for Users	RS232C/RS422/RS485 Serial Interface ; determined by DIP1 & JP2 setting
ENET1	Ethernet Port connection	Ethernet 10/100Mbps
CN1	Connection with CAN Board	CAN board CN1(Option)
CNBAT	DC power supply for Backup	Connection to battery for Backup

Specifications of Connectors for Users

OPSIO



Main Board (BD412) : 3M MDR 10214-52A2JL

Plug (prepared by users): 3M MDR 10114-3000VE (HOOD;10314-52F0-008)

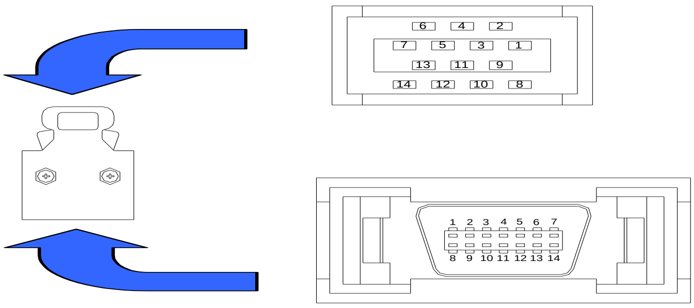


Table 4-5 Definition of Pins for OPSIO Connectors

No.	Name	Details	
1	RXD	RS232C	Serial Data Input
2	GND		Signal Ground
3	CTS#		Clear To Send
4	GND		Signal Ground
5	TXD		Serial Data Output
6	G		Signal Ground
7	RTS#		Request To Send
8	-	No Connection	
9	-	No Connection	
10	GND	RS422/RS485	Signal Ground
11	RX-		Inverting Receiver Input
12	RX+		Non-inverting Receiver Input
13	TX-		Inverting Driver Output
14	TX+		Non-inverting Driver Output

· Standard Setting of Jumper & DIP Switch

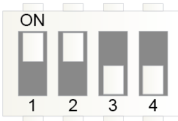
Main Board(BD412) has 2 switches for DIP(DIP1, DIP2) and 1 Jumper(JP1).

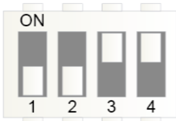
DIP1 switch is used to classify the serial port[OPSIO] for users into RS232C / RS422(or RS485), so users can use either of them as occasion demands.
In case that users intend to use it as RS422 or RS485, it would be available by setting in Teach Pendant.

Users cannot manipulate DIP2 switch because it has been already set when delivered from warehouse.

Users cannot manipulate JP1 because if has been already set when delivered from warehouse.

Table 4-6 Descriptions of Main Board(BD412) DIP1 Switch

<table>
<tr><td>Shape</td><td colspan="5">

OR

</td></tr>
<tr><td rowspan="2">No.</td><td colspan="4">Pin No. of DIP1 Switch</td><td rowspan="2">Details</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td rowspan="2">OPSIO (Serial Port for Users)</td><td colspan="2">ON</td><td colspan="2">OFF</td><td>RS232C</td></tr>
<tr><td colspan="2">OFF</td><td colspan="2">ON</td><td>RS422 or RS485</td></tr>
<tr><td>Delivery Setting</td><td colspan="2">OFF</td><td colspan="2">OFF</td><td></td></tr>
</table>

☞ Note

- DIP1 Switch must be set as No. [1, 2] and No. [3, 4] in pairs respectively, and do not set them to be crossed each other nor combined altogether.
- Be sure to set up the serial port [OPSIO] for users first before using because all the DIP1 switches are OFF when delivered from warehouse.

Table 4-7 Descriptions of Main Board(BD412) DIP2 Switch

<table>
<tr><td>Shape</td><td colspan="9">
</td></tr>
<tr><td>No.</td><td>1</td><td>2</td><td></td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td rowspan="4">Setting Details</td><td>OFF</td><td>OFF</td><td>TP Screen in Korean</td><td colspan="2" rowspan="4">Unchangeable</td><td rowspan="2">OFF Embedded PLC Disable</td><td colspan="2" rowspan="4">Unchangeable</td><td rowspan="2">OFF FLASH ROM BOOTING</td></tr>
<tr><td>OFF</td><td>ON</td><td>TP Screen in Slovak</td></tr>
<tr><td>ON</td><td>OFF</td><td>TP Screen in English</td><td rowspan="2">ON Embedded PLC Enable</td><td rowspan="2">ON PC CARD BOOTING</td></tr>
<tr><td>ON</td><td>ON</td><td>-</td></tr>
<tr><td>Delivery Setting</td><td>OFF</td><td>OFF</td><td></td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table>

4.2.1.3. I/O Board(BD430V50)

It is composed of input/output for system for sequence control of controller & I/O and input/output for users which is connected to interlock panel.

- Common (+) or (-) Digital Input 64 points (8 port)
- Common (+) or (-) Digital Input 64 points (8 port)
- Possible to install several other option boards
  BD481 Board, UCS Module, CC-Link Module
- AC Voltage detection
- RS-232C Communication (BD412(Main Board) : 57600bps)

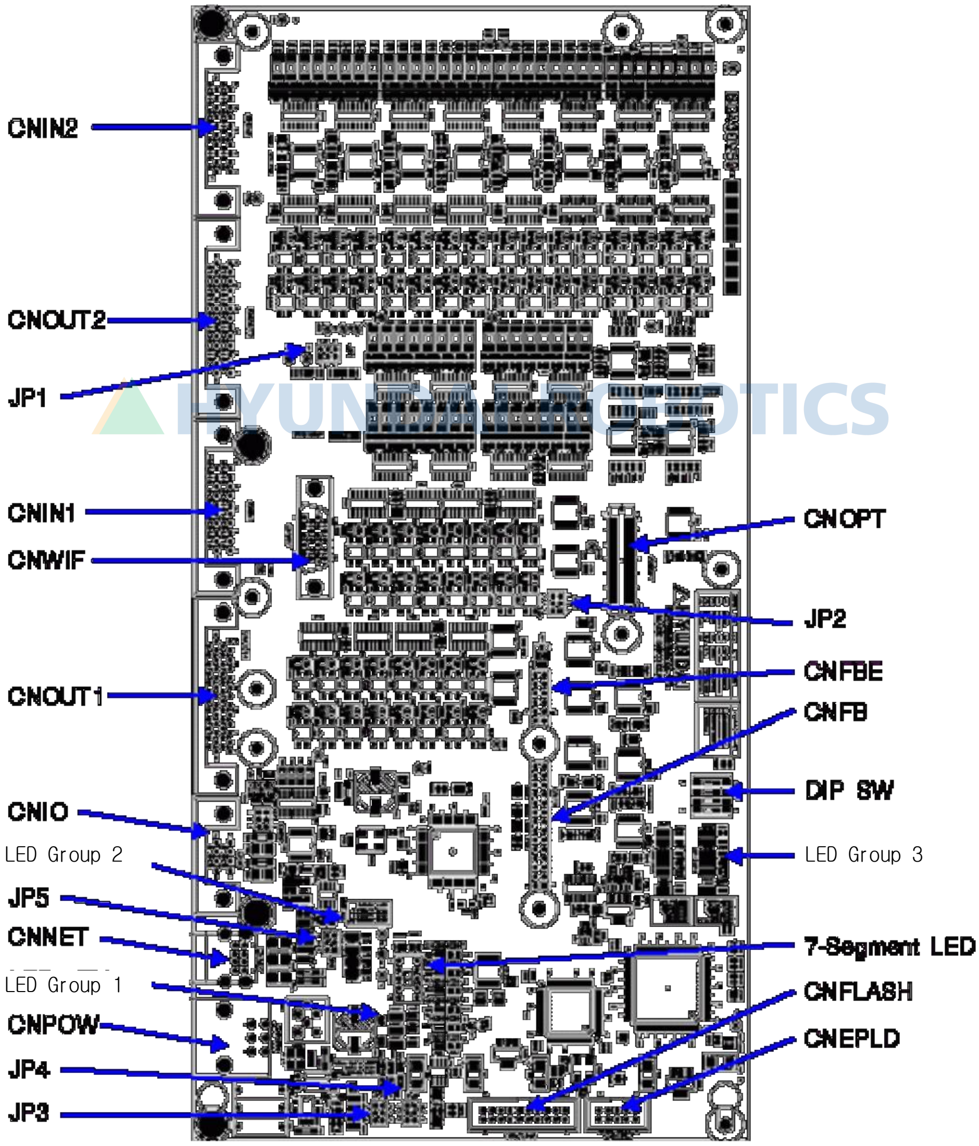


Fig. 4.6 BD430V50 Board Layout

4.2.1.3.1. Digital Input

Table 4-8 Pin Descriptions (CNIN1)

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
1	SDI01	General input 1 / MOTOR ON SW input
2	SDI02	General input 2 / reserved system input
3	SDI03	General input 3 / START SW input
4	SDI04	General input 4 / STOP SW input
5	SDI05	General input 5 / reserved system input
6	SDI06	General input 6 / reserved system input
7	SDI07	General input 7 / reserved system input
8	SDI08	General input 8 / reserved system input
9	COMIN1	External Power Input (Power for Users):
10	COMIN1	+24 V (for NPN type) / 0V (for PNP type) (for SDI01~SDI08)
11	SDI09	General input 9 / AUTO/MAN SW input
12	SDI10	General input 10 / OL input
13	SDI11	General input 11 / MSHPON input
14	SDI12	General input 12 / DMAN input
15	SDI13	General input 13 / EM STOP input
16	SDI14	General input 14 / TSP input
17	SDI15	General input 15 / OVT input
18	SDI16	General input 16 / ARM input
19	COMIN2	External Power Input (Power for Users):
20	COMIN2	+24 V (for NPN type) / 0V (for PNP type) (for SDI09~SDI16)
21	SDI17	General input 17 / EX MON input
22	SDI18	General input 18 / PB DET input
23	SDI19	General input 19 / OH input
24	SDI20	General input 20 / OV input
25	SDI21	General input 21 / MSPRIN input
26	SDI22	General input 22 / AMP TYP input
27	SDI23	General input 23 / SG input
28	SDI24	General input 24 / reserved system input
29	COMIN3	External Power Input (Power for Users):
30	COMIN3	+24 V (for NPN type) / 0V (for PNP type) (for SDI17~SDI24)
31	SDI25	General input 25 / WCR input
32	SDI26	General input 26 / COLLISION SEN input
33	SDI27	General input 27 / WIRE STICK input
34	SDI28	General input 28 / WELDER ERR input
35	SDI29	General input 29 / WIRE STATE input
36	SDI30	General input 30 / GAS STATE input
37	SDI31	General input 31 / reserved system input
38	SDI32	General input 32 / reserved system input
39	COMIN4	External Power Input (Power for Users):
40	COMIN4	+24 V (for NPN type) / 0V (for PNP type) (for SDI25~SDI32)

Table 4-9 Pin Descriptions (CNIN2)

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
1	DI01	General input 1
2	DI02	General input 2
3	DI03	General input 3
4	DI04	General input 4
5	DI05	General input 5
6	DI06	General input 6
7	DI07	General input 7
8	DI08	General input 8
9	COMIN5	External Power Input (Power for Users): +24 V (for NPN type) / 0V (for PNP type) (for DI01~DI08)
10	COMIN5	
11	DI09	General input 9
12	DI10	General input 10
13	DI11	General input 11
14	DI12	General input 12
15	DI13	General input 13
16	DI14	General input 14
17	DI15	General input 15
18	DI16	General input 16
19	COMIN6	External Power Input (Power for Users): +24 V (for NPN type) / 0V (for PNP type) (for DI09~DI16)
20	COMIN6	
21	DI17	General input 17
22	DI18	General input 18
23	DI19	General input 19
24	DI20	General input 20
25	DI21	General input 21
26	DI22/WI	General input 22(signal for welding completion)
27	DI23/EX_START	General input 23(signal for external drive/power)
28	DI24/EX_STOP	General input 24(signal for external stop)
29	COMIN7	External Power Input (Power for Users): +24 V (for NPN type) / 0V (for PNP type) (for DI17~DI24)
30	COMIN7	
31	DI25/PI1	General input 25(signal for external program selection 1)
32	DI26/PI2	General input 26(signal for external program selection 2)
33	DI27/PI3	General input 27(signal for external program selection 3)
34	DI28/PI4	General input 28(signal for external program selection 4)
35	DI29/PI5	General input 29(signal for external program selection 5)
36	DI30/PI6	General input 30(signal for external program selection 6)
37	DI31/PI7	General input 31(signal for external program selection 7)
38	DI32/PI8	General input 32(signal for external program selection 8)
39	COMIN8	External Power Input (Power for Users): +24 V (for NPN type) / 0V (for PNP type) (for DI25~DI32)
40	COMIN8	

- Connector Specifications

Board(BD430) side : 3M MDR 10240-52A2JL

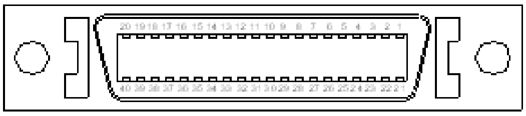


Fig. 4.7 Connector Specifications on Board side

Plug(prepared by users) side : 3M MDR 10140-3000VE (HOOD;10340-55F0-008)

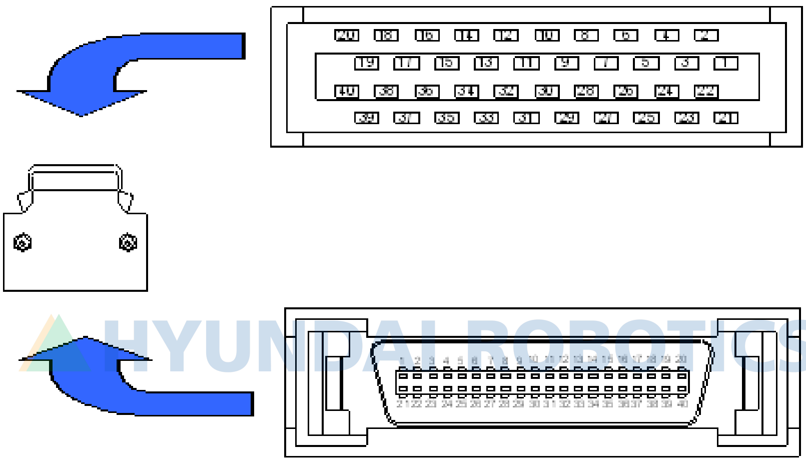


Fig. 4.8 Connector Specifications on Plug side

- Input Specifications

Input Port Device : AC Input Type Porter Coupler
Input Impedance = 3 ㏀
Common(+) Input Voltage = 24VDC
Common (-) Input Voltage = 0VDC

- Schematic Diagram

  ① If User System is NPN voltage output type :
  User power +24V is used as common signal..

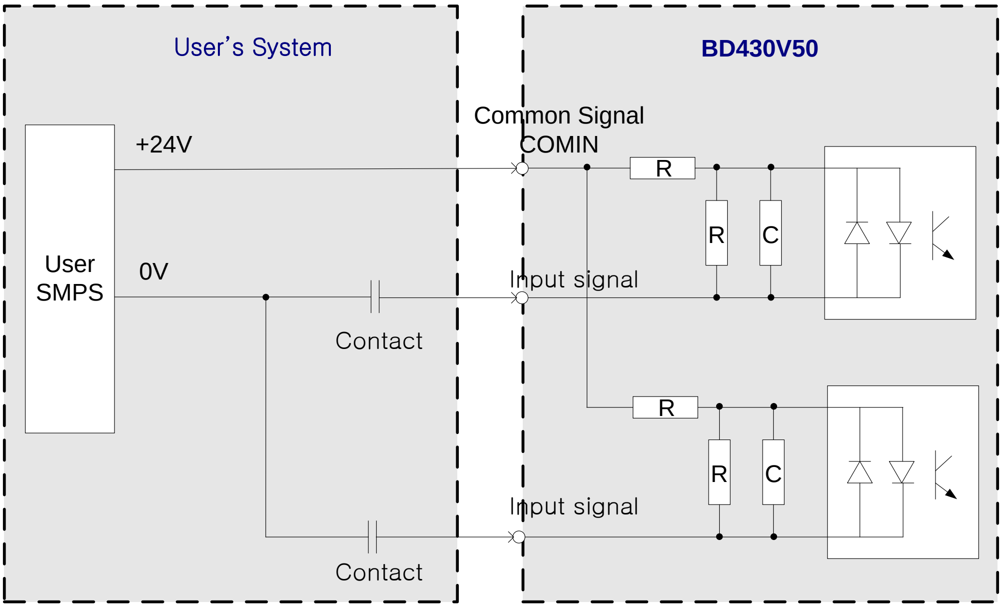


Fig. 4.9 Schematic Diagram(NPN voltage output type)

  ② If User System is PNP voltage output type :
  User power 0V is used as common signal.

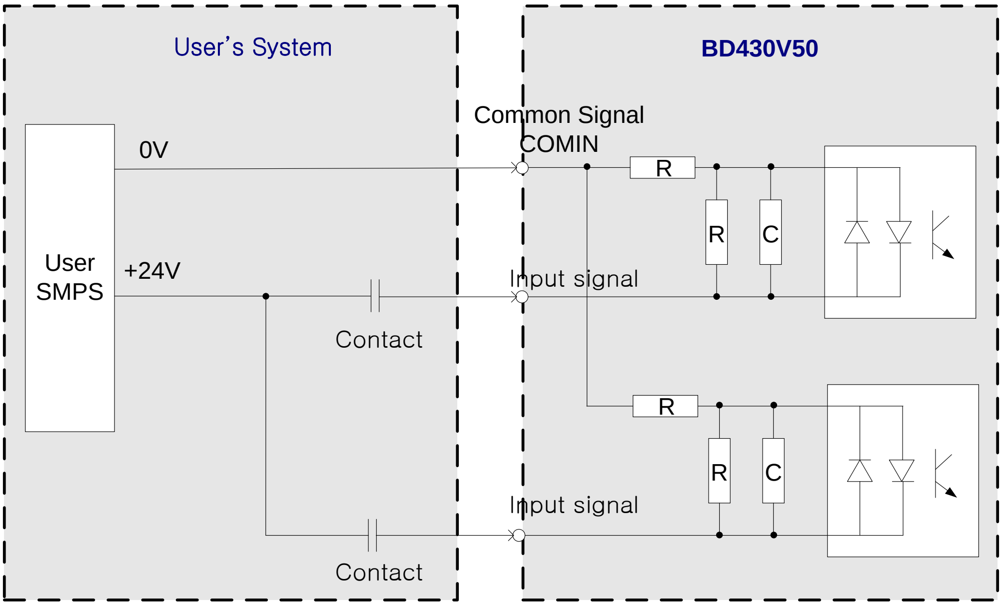


Fig. 4.10 Schematic Diagram(PNP voltage output type)

4.2.1.3.2. Digital Output

Table 4-10 Pin Descriptions (CNOUT1)

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
1	SDO01	General output 1 / MOTOR ON LED output
2	SDO02	General output 2 / reserved system output
3	SDO03	General output 3 / START LED output
4	SDO04	General output 4 / STOP LED output
5	SDO05	General output 5 / reserved system output
6	SDO06	General output 6 / reserved system output
7	SDO07	General output 7 / reserved system output
8	SDO08	General output 8 / reserved system output
9	COMOUT1	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for SDO01~SDO08)
10	COMOUT1	
11	SDO09	General output 9 / SYS ERR LED output
12	SDO10	General output 10 / reserved system output
13	SDO11	General output 11 / TORCH SW output
14	SDO12	General output 12 / INCHING output
15	SDO13	General output 13 / RETRACT output
16	SDO14	General output 14 / STICK CHK output
17	SDO15	General output 15 / GAS VALVE output
18	SDO16	General output 16 / WELDOUT RSV output
19	COMOUT2	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for SDO09~SDO16)
20	COMOUT2	
21	N.C	Out of Use
22	N.C	Out of Use
23	N.C	Out of Use
24	N.C	Out of Use
25	N.C	Out of Use
26	N.C	Out of Use
27	N.C	Out of Use
28	N.C	Out of Use Out of Use
29	N.C	
30	N.C	Out of Use
31	SDO17	General output 17 / MOTOR POWER ON output
32	SDO18	General output 18 / BRAKE RELEASE ON1 output
33	SDO19	General output 19 / BRAKE RELEASE ON2 output

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
34	SDO20	General output 20 / BRAKE RELEASE ON3 output
35	SDO21	General output 21 / BRAKE RELEASE ON4 output
36	SDO22	General output 22 / BRAKE RELEASE ON5 output
37	SDO23	General output 23 / reserved system output
38	SDO24	General output 24 / PLAYBACK output
39	COMOUT3	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for SDO17~SDO24)
40	COMOUT3	
41	SDO25	General output 25 / RELEASE output
42	SDO26	General output 26 / MSPRON output
43	SDO27	General output 27 / reserved system output
44	SDO28	General output 28 / reserved system output
45	SDO29	General output 29 / reserved system output
46	SDO30	General output 30 / reserved system output
47	SDO31	General output 31 / reserved system output
48	SDO32	General output 32 / reserved system output
49	COMOUT4	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for SDO25~SDO32)
50	COMOUT4	

Table 4-11 Pin Descriptions (CNOUT2)

Pin No.	Signals	Descriptions(Expanded Board / Basic Board)
1	DO01	General output 1
2	DO02	General output 2
3	DO03	General output 3
4	DO04	General output 4
5	DO05	General output 5
6	DO06	General output 6
7	DO07	General output 7
8	DO08	General output 8
9	COMOUT5	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for DO01~DO08)
10	COMOUT5	
11	DO09	General output 9
12	DO10	General output 10
13	DO11	General output 11
14	DO12	General output 12
15	DO13	General output 13
16	DO14	General output 14
17	DO15	General output 15
18	DO16	General output 16
19	COMOUT6	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNP type) (for DO09~DO16)
20	COMOUT6	
21	N.C	Out of Use
22	N.C	Out of Use
23	N.C	Out of Use
24	N.C	Out of Use
25	N.C	Out of Use
26	N.C	Out of Use
27	N.C	Out of Use
28	N.C	Out of Use
29	N.C	Out of Use
30	N.C	Out of Use
31	DO17	General output 17
32	DO18	General output 18
33	DO19	General output 19
34	DO20	General output 20

Pin No.	Signals	Descriptions(Expanded Board / Basic Board)
35	DO21	General output 21
36	DO22	General output 22
37	DO23/GUN1	General output 23 / GUN signal 1
38	DO24/GUN2	General output 24 / GUN signal 2
39	COMOUT7	External Power Input (User's power): 0V or +24V (for DO09~DO16)
40	COMOUT7	
41	DO25/MX	General output 25 / MX signal
42	DO26/Program END	General output 26 / Output when the program END
43	DO27/Synthetic error	General output 27 / Output when there is a system error
44	DO28/Interlock-abnormal warning	General output 28 / Output when interlock time is over
45	DO29/In operation	General output 29 / Output for in-operation
46	DO30/Auto mode	General output 30 / Output for Auto mode
47	DO31/Robot ready OK	General output 31 / Output when Robot ready OK
48	DO32/Home position	General output 32 / Output for home position status
49	COMOUT8	External Power Input (User's power): 0V or +24V (for DO09~DO16)
50	COMOUT8	

- Connector Specifications

  Board(BD430) side : 3M MDR 10250-52A2JL

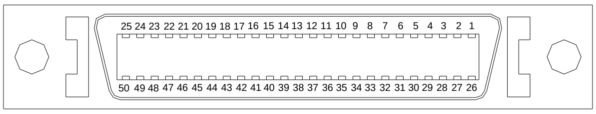


Fig. 4.11 Connector Specifications on Board side

  Plug(prepared by users) side : 3M MDR 10150-3000VE (HOOD;10350-52F0-008)

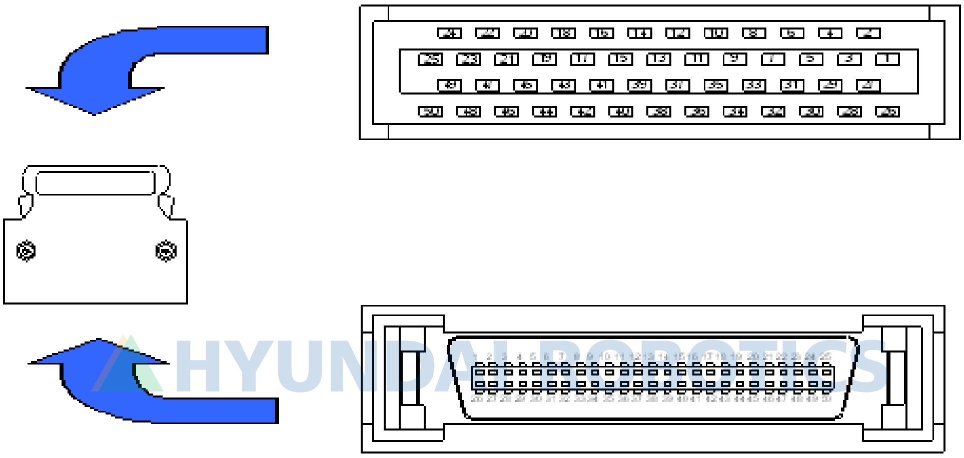


Fig. 4.12 Connector Specifications on Plug side

- Output Specifications
  * BD430V50
  Output Port Device : NPN Transistor open collector + Bridge diode
  Rate Output = 125mA(Continuous load current), 24V DC
  Duplex Common is available by port units(8bits)

- Schematic Diagram
  ① If User System is NPN voltage output type :
  User power 0V is used as common signal.

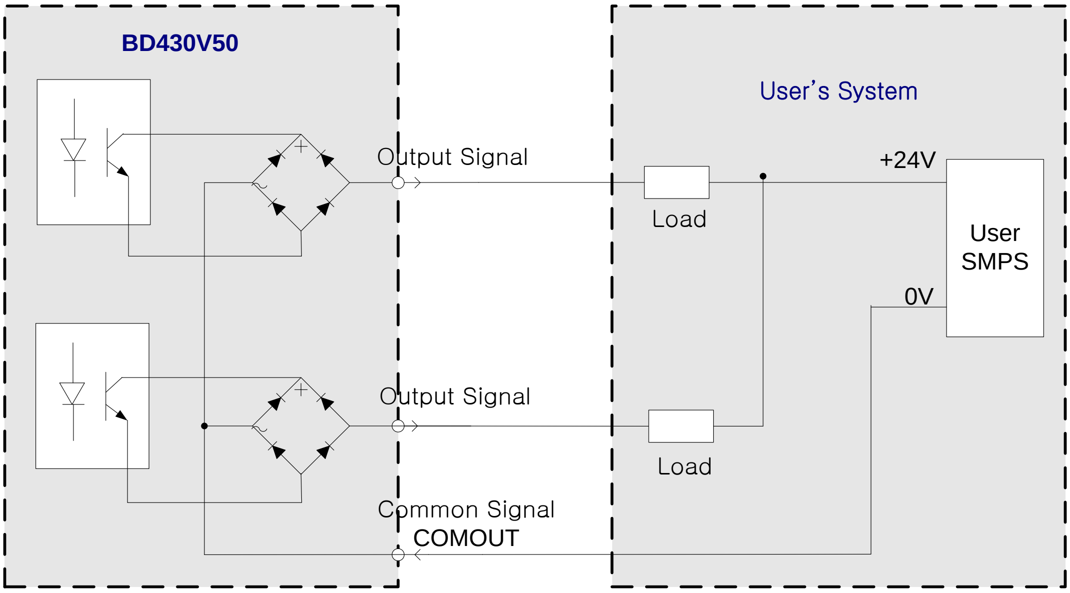


Fig. 4.13 BD430V50 Board Schematic Diagram(NPN voltage output type)

② If User System is PNP voltage output type:
User power 24V is used as common signal.

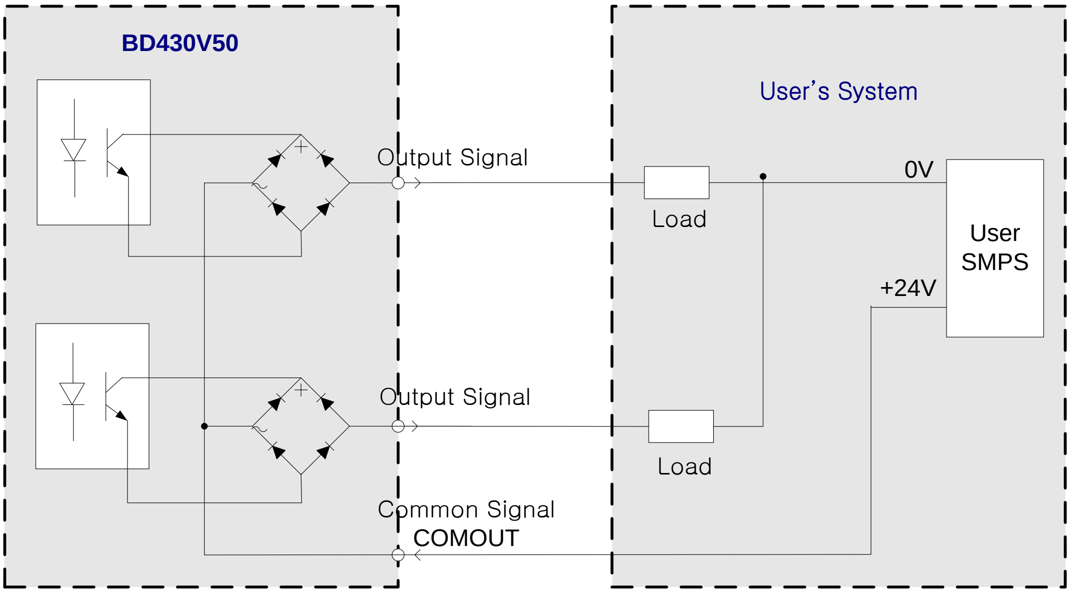


Fig. 4.14 BD430V50 Board Schematic Diagram(PNP voltage output type)

4.2.1.3.3. Connector of BD430

Table 4-12 I/O Description of I/O board (BD430V50) connector

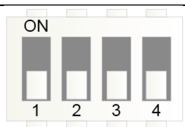
Name	Usage	Interface with external unit
CNIO	Data communication port with main board	BD412 board CNIO
CNIN1	Input port for system	BD461 board CNIN1
CNOUT1	Output port for system	BD461 board CNOUT1
CNIN2	Input port for users	User unit such as interlock panel
CNOUT2	Output port for users	User unit such as interlock panel
CNNET	Data communication port for extension of I/O board	Extension I/O board CNNET
CNPOW	DC power supply (+5V,G1)	SMPS +5V,G1
CNAC	AC power supply (AC 18V) for detection of power failure	Transformer T1
CNWIF	Connection port of arc welder	Transformer T1
CNSP	PC connection port	PC

4.2.1.3.4. Description of DIP switch, jumper setting/LED

- **Setting of DIP switch**

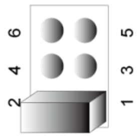
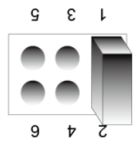
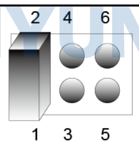
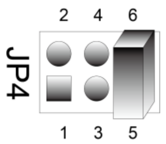
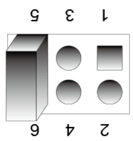
☞ **Caution**
Followings cannot be changed by users at random and for extending I/O board, contact our corporation.

Table 4-13 Description of I/O board (BD430V50) DIP switch

<table>
<tr><td colspan="2">Shape</td><td colspan="4">
</td></tr>
<tr><td colspan="2">Switch number</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td rowspan="2">Settings</td><td>OFF</td><td colspan="2" rowspan="2">Number : 1 2
Basic board : OFF, OFF
Expansion 1 : ON , OFF
Expansion 2 : OFF, ON
Expansion 3 : ON , ON</td><td>Preliminary</td><td>Normal mode</td></tr>
<tr><td>ON</td><td>Preliminary</td><td>Test mode</td></tr>
<tr><td colspan="2">Delivery Setting</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table>

- **Jumper setting**

Table 4-14 Description of I/O board (BD430V50) jumper

No.	Item	Jumper layout / Initialization	Setting value	Name	Description
JP1	Common setting of arc signal input	JP1  Initial value : 1-2	1 - 2	COMIN4	Select common of digital input for signal for arc welding as COMIN4 of common power of existing system.
			3 - 4	N.A.	-
			5 - 6	ARC_CIN	Select common of digital input for signal for arc welding as separate external power.
JP2	Common setting of arc signal output	JP2  Initial value : 1-2	1 - 2	COMOUT2	Select common of digital output for signal for arc welding as COMOUT2 of common power of existing system.
			3 - 4	N.A.	-
			5 - 6	ARC_COUT	Select common of digital output for signal for arc welding as separate external power.
JP3	Setting of AC input voltage for power failure detection	JP3  Initial value : 1-2	1 - 2	18VAC	Select AC input voltage for detection of power failure as AC18V.
			3 - 4	N.A.	-
			5 - 6	48VAC	Select AC input voltage for detection of power failure as AC48V.
JP4	Setting of standard voltage of AC freezing	JP4  Initial value : 5-6	1 - 2	90%	Set standard freezing voltage of AC power waveform for detection of power failure to 90% of maximum value.
			3 - 4	80%	Set standard freezing voltage of AC power waveform for detection of power failure to 80% of maximum value.
			5 - 6	70%	Set standard freezing voltage of AC power waveform for detection of power failure to 70% of maximum value.
JP5	Setting of termination for extension board communication	 JP5 Initial value : 5-6	1 - 2	300ohm	Select termination resistance in communication line between extension boards to 300 ohm.
			3 - 4	500ohm	Select termination resistance in communication line between extension boards to 500 ohm.
			5 - 6	1.8kohm	Select termination resistance in communication line between extension boards to 1.8kohm.

- **LED Descriptions**

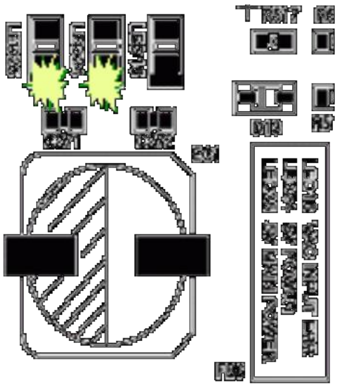


Fig. 4.15 LED Group 1

Table 4-15 Description of I/O board (BD430V50) LED group 1

Item	Parts number	Illumination color	Description	Initial status	For error/ operation
VAC setting error	LED16	Red	Turns on in order to inform error status where AC supply voltage for detection of power failure is different from setting values of JP3.	Off	
Board power supply (DC5V)	LED24	Green	Turns on when DC5V as board power is supplied.	On	
Supply of main power to board (DC5V)	LED25	Green	Turns on when main power is created from board power (DC5V) and normally supplied.	On	

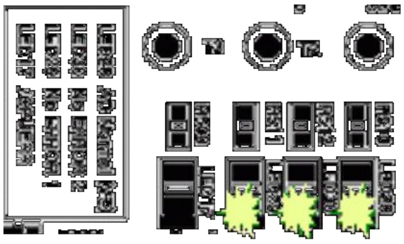


Fig. 4.16 LED group 2

Table 4-16 Description of I/O board (BD430V50) LED group 2

Item	Parts number	Illumination color	Description	Initial status	For error/ operation
CPUERR	LED17	Red	Turns on where main causes CPUERR and induces same behavior as emergency stop or short-circuited cables.	Off	
VAC Power supply	LED28	Green	Turns on when AC voltage for detection of power failure is supplied.	On	
NO ERR1	LED29	Green	Turns on when there is no error from mains or it is not short-circuited cables. Currently preliminary.	On	
NO ERR2	LED30	Green	Turns on when there is no error from mains or it is not short-circuited cables. Currently preliminary.	On	

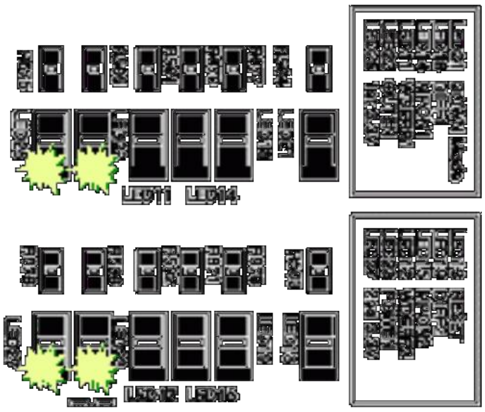


Fig. 4.17 LED group 3

Table 4-17 Description of I/O board (BD430V50) LED group 3

Item	Parts number	Illumination color	Description	Initial status	For error/ operation
DOWN MODE	LED21	Green	Turns on when down loading program to flash memory of MCU.	Off	
DIFF1	LED18	Red	Turns on when EPLD1 detects that output of signal related with the motor differs between the front end and rear end of buffer.	Off	
MPON1	LED14	Green	Turns on when motor power-on wiring in the safety chain 1 is opened..	Off	
WDERR1	LED11	Red	Turns on when EPLD1 detects that Watchdog occurs in the MCU.	Off	
OUTEN	LED22	Green	Turns on when output port related with the motor is opened in normal status.	On	
1st 3.3V	LED26	Green	Turns on when DC3.3V is supplied to EPLD1.	On	
RESET	LED13	Red	Turns on when reset occurs.	Off	
DIFF2	LED19	Red	Turns on when EPLD2 detects that output of signal related with the motor differs between the front end and rear end of buffer.	Off	
MPON2	LED15	Green	Turns on when motor power input wiring in the safety chain to is opened.	Off	
WDERR2	LED12	Red	Turns on when EPLD1 detects that Watchdog occurs in the EPLD2.	Off	
POWEN	LED23	Green	Turns on when operation power of the output port related with the motor is normally supplied.	On	
2st 3.3V	LED27	Green	Turns on when DC3.3V is supplied to EPLD2.	On	

4.2.1.3.5. Method to install BD430V50 board

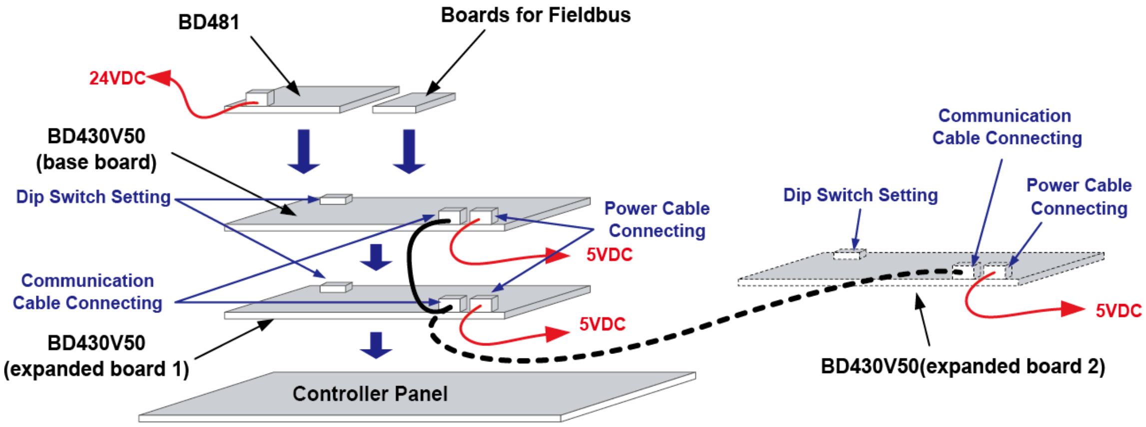


Fig. 4.18 Installation of BD430V50

(1) Set dip switch number 1,2 of the expansion board to number of the extension board.

(2) Mount on the extension board to the order of base board, option board as above figure. (Except for installing extension board on separate position)

(3) Connect power cables and communication cables (RS485) as above figure.

(4) Turn on power.

4.2.1.4. Servo Board (BD540, BD541)

It performs an operating control to 6-axis motor(8-axis max.) by the locating instruction from Main Board. It also processes encoder signal, checks errors, and makes PXM signal of Drive Unit.

- BD540 : Compact ABS Encoder applied (Hi4a-0000, Hi4a-0002, Hi4a-0008, Hi4a-P000)
- BD541 : Serial ABS Encoder applied (Hi4a-0010, Hi4a-0012)

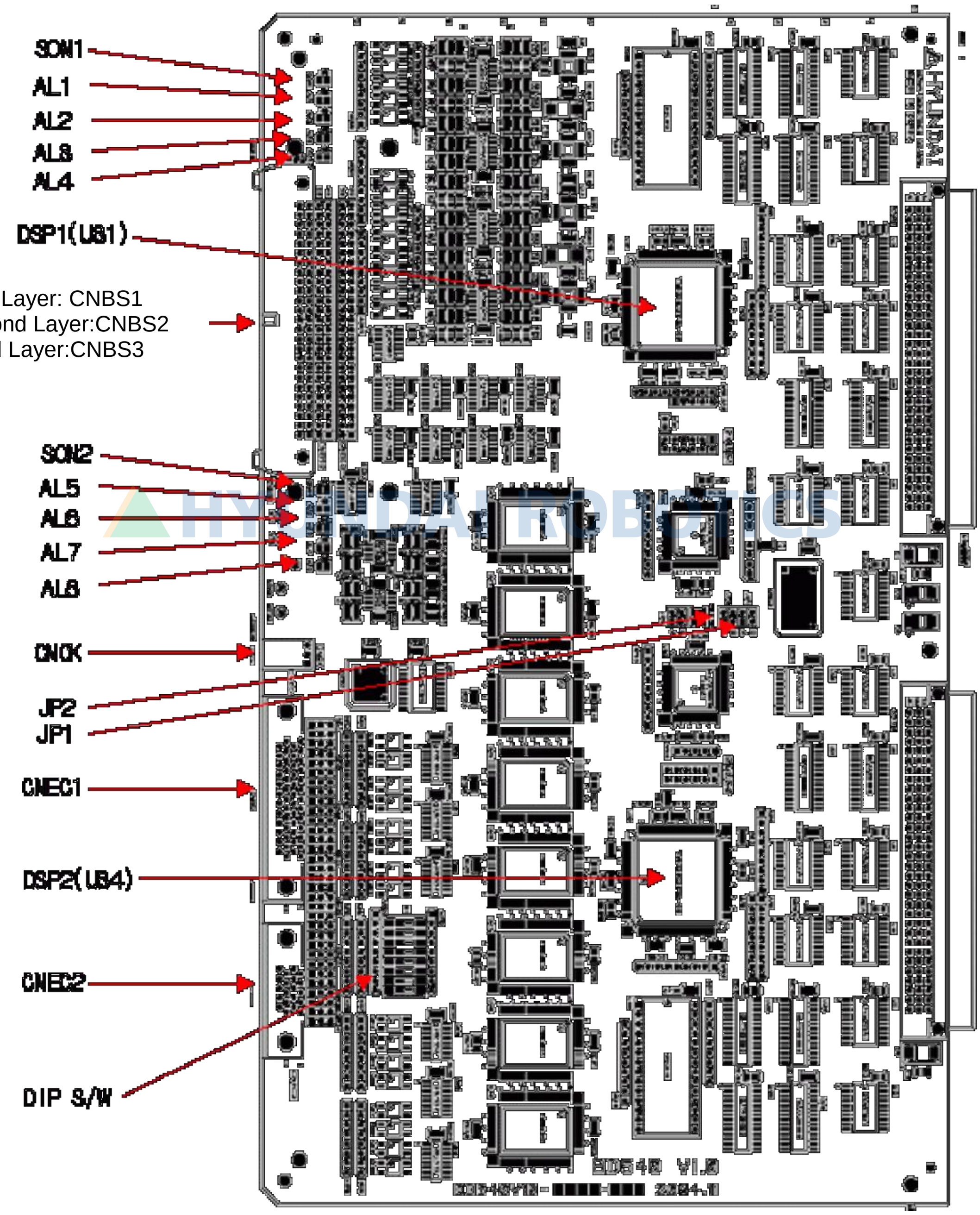


Fig. 4.19 Exterior View of BD540 Board

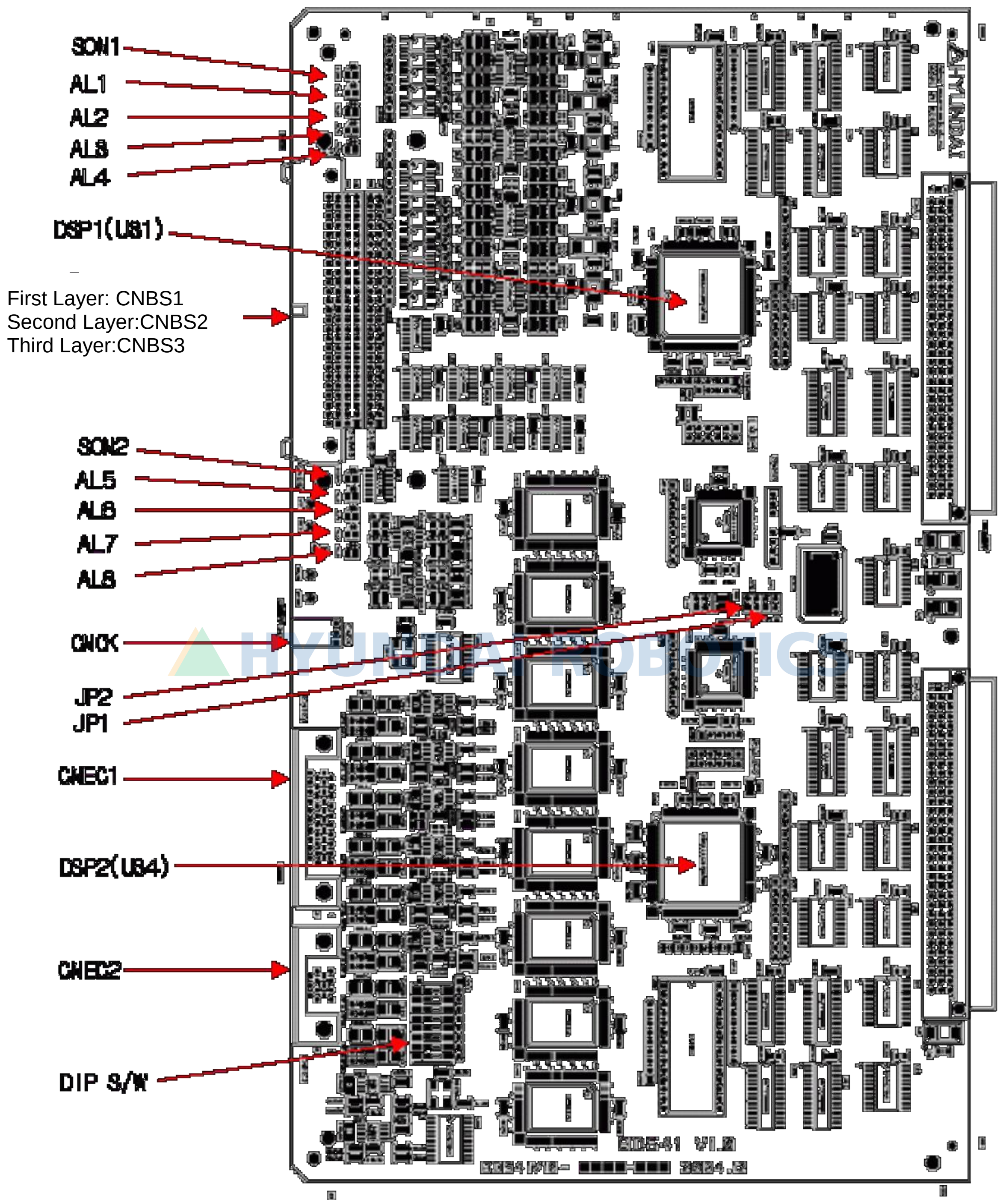


Fig. 4.20 Exterior View of BD541 Board

Table 4-18 Descriptions of Servo Board(BD540,BD541) Connector

Name	Uses	Connection with External Devices
CNEC1	Connection with Encoder signal	CNR4
CNEC2	Connection with Encoder signal of additional axis	CNR7,CNR8
CNBS1,2,3	Connection with Drive Unit signal	CNBS1,2,3 of Drive Unit
CNCK	PWM clock synchronization between servo boards when controlling more than 9 axes	Additional Servo Board (BD540, BD541) CNCK
CNISO	Downloading Port for the ispLSI program	Download tool for ispLSi program

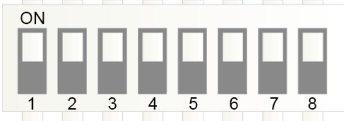
Table 4-19 Servo Board(BD540,BD541) LED

Status / Name	Color	Normal	Abnormal	Remarks
AL1~8	Red	Light Out	Light Up	ALX : Asix X (X=1~8)
SON1~2	Green	Light Up when motor is ON	Light Out when motor is OFF	SON1; 1st DSP, SON2; 2nd DSP

■ Standard Setting for Jumper & DIP Switch

☞ Caution
Users cannot change the DIP Switch arbitrarily because it has been set to ON when delivered from warehouse.

Table 4-20 Descriptions of Servo Board(BD540,BD541) DIP Switch

Shape								
No.	1	2	3	4	5	6	7	8
Delivery Setting	ON	ON	ON	ON	ON	ON	ON	ON

☞ Caution
The followings may not be changed arbitrarily by users. If you intend to expand DSP board, make contact with our company.

Table 4-21 Descriptions of Servo Board(BD540,BD541) Jumper

Name / **Setting Details**		**JP1**		**JP2**	
		1-2	**3-4**	**1-2**	**3-4**
DSP1(U31) Setting	**Setting as 1st 1DSP**	SHORT	SHORT	Unchangeable	
	Setting as 3rd DSP	SHORT	OPEN		
DSP2(U34) Setting	**Setting as 2nd DSP**	Unchangeable		OPEN	SHORT
	Setting as 4th DSP			OPEN	OPEN
Delivery Setting		SHORT	SHORT	OPEN	SHORT

☞ Caution
User cannot change JP3 arbitrarily because it has been set to OPEN when delivered from warehouse.

Table 4-22 Descriptions of Servo Board (BD540,BD541) Jumper3

Name / **Setting Details**	**JP1**	
	1-2	**3-4**
Delivery Setting	OPEN	OPEN

4.2.1.5. Sequence Board

Table 4-23 Type of sequence board

Name	Safety IO correspondence (TBPLC terminal)	Brake cancel switch	Remarks
BD461V31	No	Yes	Main model: HX165 etc.
BD461V41	No	No (Require BD463 on main unit)	Main model: HA006,HA020,HS165D
BD461V50	Yes	Yes	Main model: HX165 etc.
BD461V60	Yes	No (Require BD463 on main unit)	Main model: HA006,HA020,HS165D

4.2.1.5.1. Sequence Board (BD461V31/BD461V41)

It monitors all kinds of signals from robot manipulator and controller, and supports safety circuit. It also provides sequence to operate the robot as a hardware by the instruction of MAIN, such as magnetic contactor MSHP(providing motor power to drive unit), relay MSPR operation(provision of prior charged power), and brake operation.

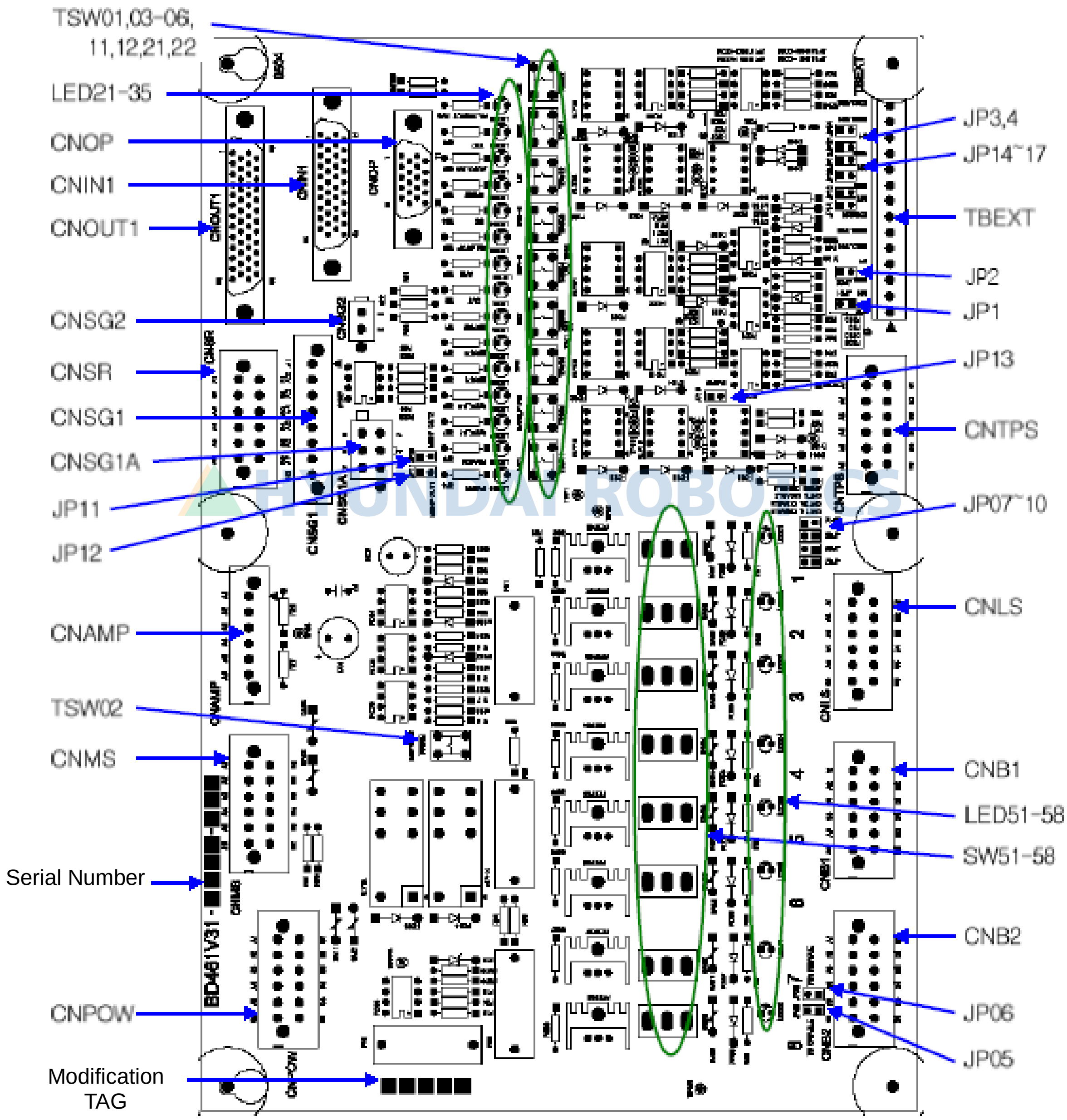


Fig. 4.21 Exterior View of Sequence Board(BD461)

Table 4-24 Descriptions of Sequence(BD461V31) Connector

Name	Uses	Connection with External Devices
CNIN1	Input port for sequence & OP Panel	BD430 Board CNIN1
CNOUT1	Output port for sequence & OP Panel	BD430 Board CNOUT1
CNOP	I/O Port for OP Panel	OP Panel components
CNPOW	DC Power Supply(+24V,G2,PB,MB,PREPB), MSPB Output	SMPS +24V, G1, MSPB1, 2
CNMS	MSHP ON/OFF input/output, error signal(OL) input	MSHP1, 2
CNLS	Input limit switch, and Over-travel	CNR4
CNTPS	Input the status of T/P Emergency Stop & Enabling Device	CNRTP
CNAMP	MSPR ON/OFF input/output, AMP_TYPE input	Drive Unit CNPC
CNSG1	/PWMON signal output, error signal(OV,OH) input, servo error	Drive Unit CNSG
CNSG1A	/PWMON signal output, error signal(OV,OH) input, servo error	CNSG of previous version Drive Unit
CNSG2	For additional axis /PWMON signal output	Additional axis Drive Unit CNSG
CNB1	Brake Release/Hold output, error(TS)input	CNR1, 2
CNB2	Additional Axis Brake Release/Hold output, error(TS) input	Additional Axis
CNSR	Input/output signals for preliminary system	Preliminary

Table 4-25 Descriptions of Sequence(BD461V31) Terminal Block TBEXT

Terminal No.	Name	Uses	Setting
1	ES1	Emergency Stop Channel 1 input	If there is no external system emergency stop chain 1, short between terminal no.1 and no.2 or JP01. (in case of use, make sure JP01 to open)
2	M1	Emergency Stop Chain 1 input Common(M1)	
3	ES2	Emergency Stop Channel 2 input	If there is no external system emergency stop channel 2, short between terminal no.3 and no.4 or JP02. (in case of use, make sure JP02 to open)
4	P1	Emergency Stop Chain 2 input Common(P1)	
5	ESOUT11	Contact point of Emergency Stop output(chain1)	For the use if it is necessary for external system
6	ESOUT12		
7	EXMON	External Motor ON input	When using motor ON in external system, input ON/OFF using M1 (terminal no.8) as Common
8	M1	External Motor ON input Common	
9	SG1	Safeguard Chain1 input	If there is no external system emergency stop chain 1, short between terminal no.9 and no.10 or JP03. (in case of use, make sure JP03 to open)
10	M1	Safeguard Chain1 input Common(M1)	
11	SG2	Safeguard Chain2 input	If there is no external system emergency stop chain 1, short between terminal no.11 and no.12 or JP04. (in case of use, make sure JP04 to open)
12	P1	Safeguard Chain1 input Common(P1)	
13	ESOUT21	Contact point of Emergency Stop output (chain2)	For the use if it is necessary for external system
14	ESOUT22		

Table 4-26 Descriptions of Sequence (BD461V31) Jumper

Jumper No.	Terminal Name	SHORT	OPEN	Delivery Setting
JP01	ES1	Emergency Stop Channel 1 input disable	Emergency Stop Channel 1 input enable	Short (disable)
JP02	ES2	Emergency Stop Chain 2 input disable	Emergency Stop Chain 2 input enable	Short (disable)
JP03	SG1	Safeguard Chain 1 disable	Safeguard Chain 1 enable	Short (disable)
JP04	SG2	Safeguard Chain 2 disable	Safeguard Chain 2 enable	Short (disable)
JP05	TS Disable	Motor heat sensor input disable	Motor heat sensor input enable	Open (enable)
JP06	TSA Disable	Additional axis motor heat sensor input disable(short when additional axis is not used)	Additional axis motor heat sensor input enable	Short (disable)
JP07	OVT1A Disable	Limit switch(for detection of aberrance from restricted area mounted on additional axis) chain 1 input disable(short when additional axis is not used)	Limit switch(for detection of aberrance from restricted area mounted on additional axis) chain 1 input enable	Short (disable)
JP08	OVT2A Disable	Limit switch(for detection of aberrance from restricted area mounted on additional axis) chain 2 input disable(short when additional axis is not used)	Limit switch(for detection of aberrance from restricted area mounted on additional axis) chain 2 input enable	Short (disable)
JP09	OVT2 Disable	Over-travel chain 2 input disable	Over-travel chain 2 input enable	Short (disable)
JP10	EXEM2 Disable	External Emergency Stop chain 2 input disable	External Emergency Stop chain 2 input enable	Short (disable)
JP11	MSHP OUT1	MSHP output chain 2 disable (JP12 should be opened)	MSHP output chain 2 enable (JP12 should be opened)	Short (disable)
JP12	MSHP OUT2	MSHP output chain 2 enable (JP11 should be opened)	MSHP output chain 2 disable (JP11 should be opened)	Open (enable)
JP13	SVERR	Servo error input disable	Servo error input enable (apply to previous version controller)	Short (disable)
JP14	SG1 -COM	Safety chain1(-)common		Short
JP15	SG2 +COM	Safety chain2(+)common		Short
JP16	SG1 +COM	Safety chain1(-)common		개방
JP17	SG2 -COM	Safety chain2(+)common		개방

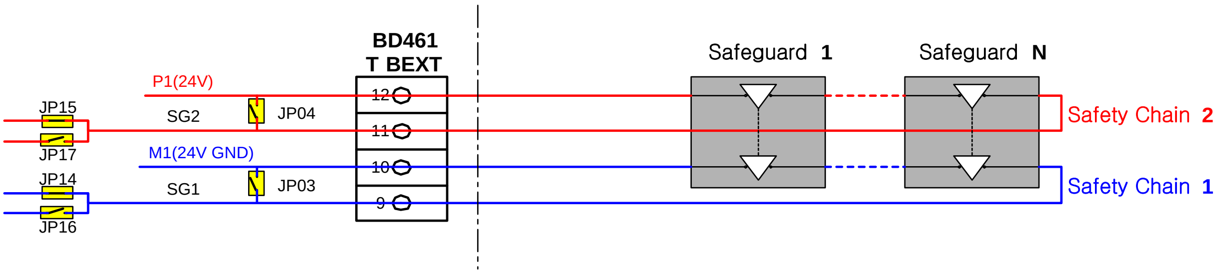
☞ **Caution**

: These jumpers may not changed arbitrarily by users.
In case of additional axis installation, adjustment of JP06~08 is needed. Make contact with our company.

☞ **Caution**

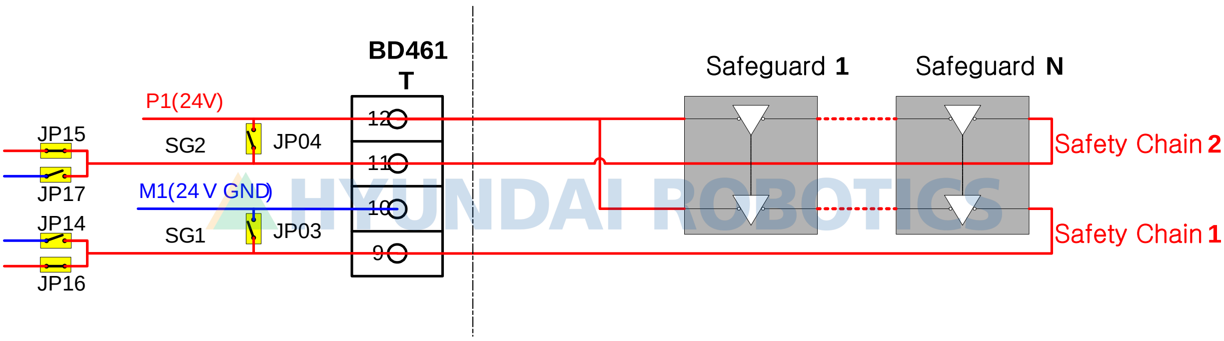
: The servo error processing function (Open JP13) is available only for the versions compatible with the servo board and drive (amp). Make contact with our company.

▶ Connection of Safeguard



- Chain1 : When (-) common input or NPN type input is used
- Chain2 : When (+) common input or PNP type input is used
- Jumper setting : JP14(short), JP15(short) / JP16(open), JP17(open)

Fig 4.22 Connection of Standard Safeguard



- Chain1,2 : When (+) common input or PNP type input is used
- Jumper setting : JP14(open), JP15(short) / JP16(short), JP17(open)

Fig. 4.23 Connection of Special Safeguard

▶ Connection of Emergency Stop in External System

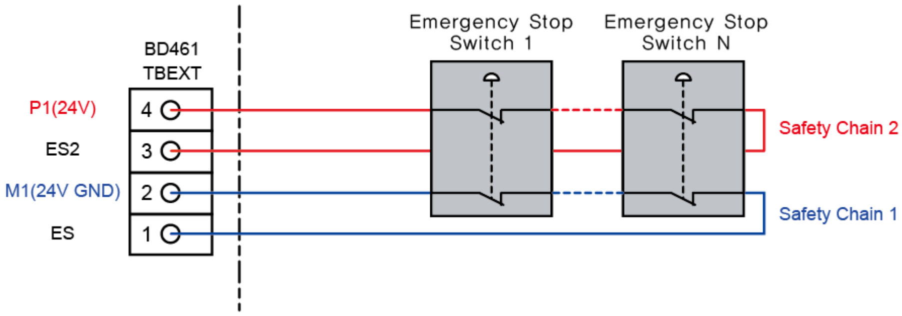


Fig. 4.24 (a) Connection of Emergency Stop Switch in External System

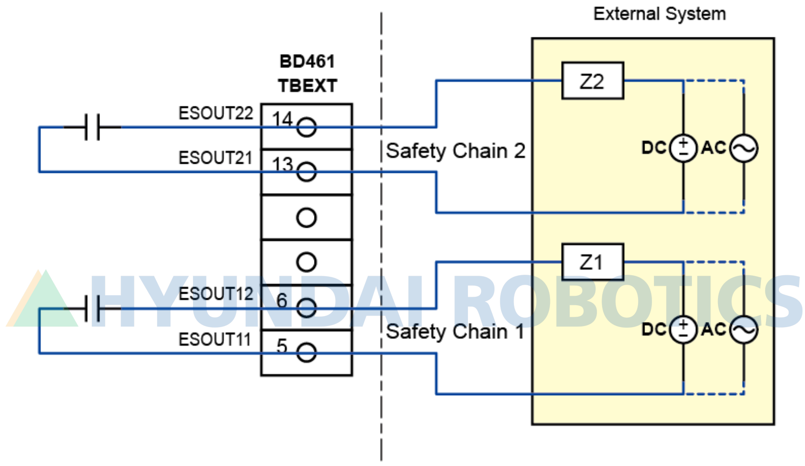


Fig. 4.25 (b) Connection of Emergency Stop Output to External System

▶ Connection of EXMON(External Motor ON) Input

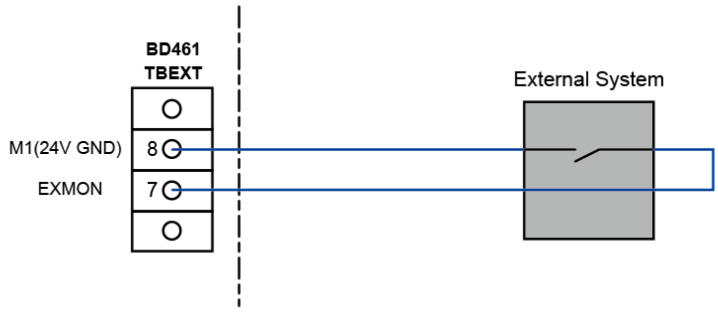


Fig. 4.26 Connection of External Motor ON Input

Fig 4-27 Descriptions of LED in Sequence Board BD461V31

No.	LED Name	Light Up	Light Out
LED21	OVT	Within restricted area	Aberrant from restricted area
LED22	EXEM	normal stats	External Emergency Stop status
LED23	EM_STOP	Emergency stop switch is released	Emergency stop switch is pressed
LED24	SG	Safeguard channel 2 input disable	Safeguard channel 2 input enable
LED25	ENSW	Enabling switch is pressed	Enabling switch is released
LED26	AUTO_SW	Mode switch in an automatic mode	Mode switch in an automatic mode
LED27	SAFE_IL1	Chain 1 is safe	Chain 2 in an emergency stop status
LED28	SAFE_IL2	Chain 2 is safe	Chain 2 in an emergency stop status
LED29	MSHP1	Magnetic contactor of Chain 1 for motor power supply is in operation	Magnetic contactor of Chain 1 for motor power supply is interrupted
LED30	MSHP2	Magnetic contactor of Chain 2 for motor power supply is in operation	Magnetic contactor of Chain 2 for motor power supply is interrupted
LED31	MSPRIN	Relay for motor power prior charge is in operation	Relay for motor power prior charge is interrupted
LED32	TSP	Normal heating of Motor	Overheating of motor above the limit
LED33	PB_DETECT	Brake power is normally supplied	Brake power is interrupted
LED34	SVERR	No occurrence of servo error	Servo error occurred
LED35	PWMON	Sequence supplied motor power to drive unit, so servo ON is possible.	Sequence cut motor power, so servo ON is impossible.
LED51 ~58	BA1~BA8	Brake Release power is supplied, so motor drive is possible	Brake release power for corresponding axis is interrupted, so motor drive is impossible

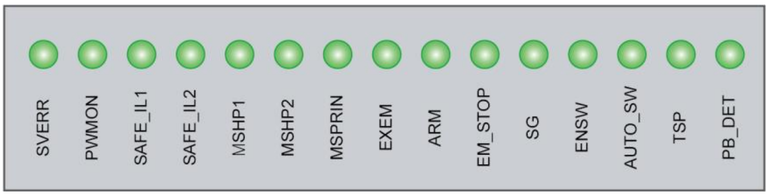


Fig. 4.27 LED Configuration in Sequence Board BD461V31

Fig 4-28 Descriptions of Test Switch TSWxx in Sequence Board BD461V31

No.	Details
TSW01	SAFE_PB1, SAFE_P1 forced supply.
TSW02	MSPROUT forced output
TSW03	Forced output of brake release power in Main Axis(1,2,3 axis)
TSW04	Forced output of brake release power in Wrist axis(4,5,6 axis)
TSW05	Forced output of brake release power in additional axis 7
TSW06	Forced output of brake release power in additional axis 8
TSW11	MSHP1, MSPB1 forced output
TSW21	MSHP2, MSPB2 forced output
TSW12	Forced release of OVT, ARM limit switch chain 1
TSW22	Forced release of OVT, ARM limit switch chain 2

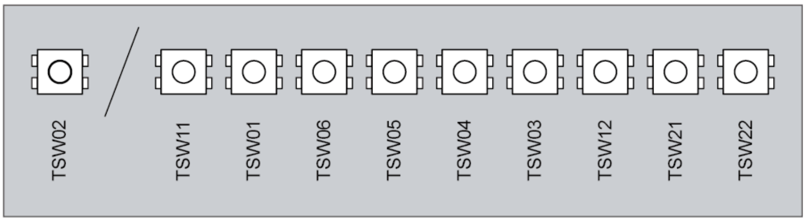


Fig. 4.28 Test Switch TSWxx Configuration in Sequence Board BD461V31

☞ **Caution :**
Do not manipulate the test switch randomly because it may affect the safety chain by some combination. Use this switch only for inspection.

4.2.1.5.2. Sequence board (BD461V50/BD461V60)

The sequence board receives various types of safety signals from the inside and outside of the robot controller and controls the power necessary to operate the robot through dual safety chain.

- Various safety signal input: Emergency stop, limit switch, safety guard etc.
- Dual safety chain with interlock
- Servo drive unit signal interface: PWMON, UV, OV, OC etc.
- Brake activate/deactivate control: Can be expanded to basic 8 axes (Main 3 axes, manual 3 axes, additional individual 2 axes), 8 axes
- Other I/O interface

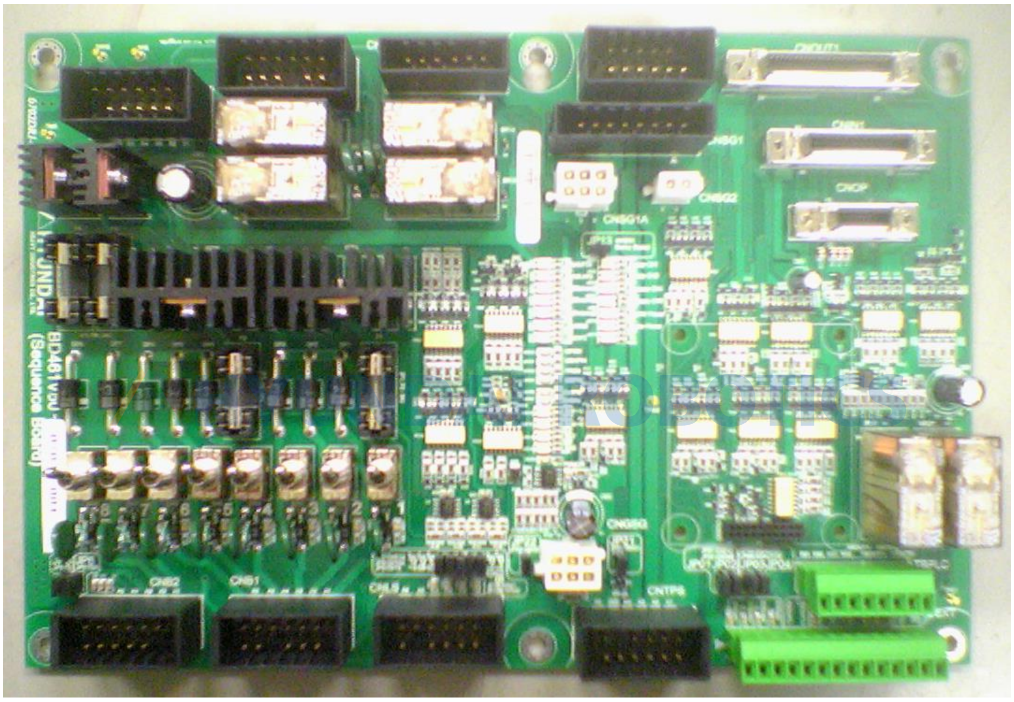


Fig. 4.29 Sequence board (BD461V50) exterior

The following figure simply shows the location and usage of various connectors on the sequence board.

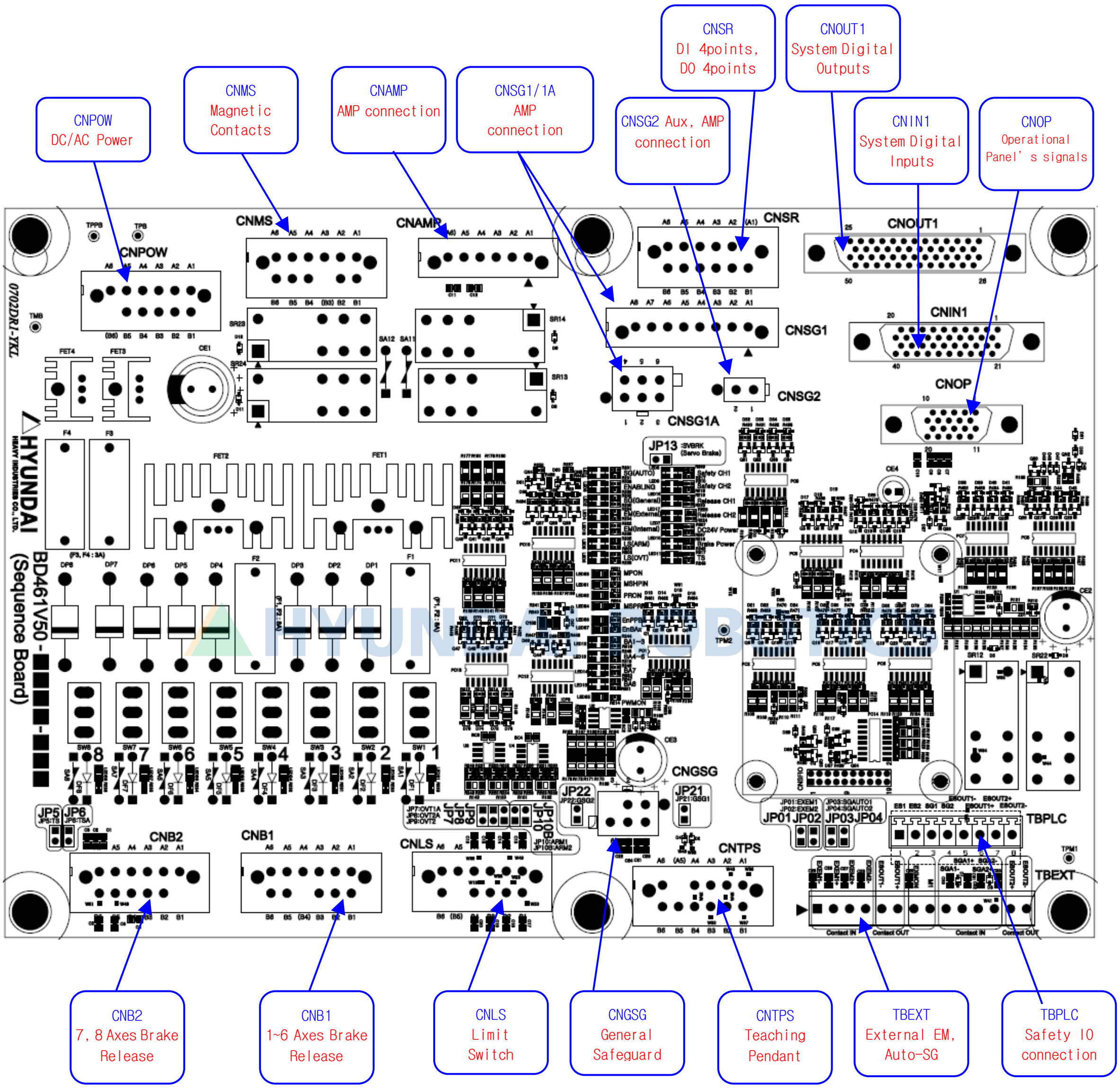


Fig. 4.30 Connector arrangement of sequence board (BD461V50/60)

Table 4-29 Sequence board (BD461V50/60) connector description

Name	Usage	External unit connection
CNIO1	Sequence and OP panel input port	BD430 board CNIN1
CNOUT1	Sequence and OP panel output port	BD430 board CNOUT1
CNOP	Various switch and LED I/O of operating panel	OP panel
CNPOW	DC power supply (+24V,G2,PB,MB,PREPB), MSPB output	SMPS +24V,G1, MSPB1,2
CNMS	MSHP ON/OFF I/O, OL input	MSHP1,2
CNLS	Arm interference, limit switch input for over-travel detection	W/H CNR4
CNTPS	Emergency stop of T/P, enabling device condition input	W/H CNRTP
CNAMP	MSPR ON/OFF I/O, AMP_TYPE input	Drive unit CNPC
CNSG1	/PWMON signal output, Error signal (OV,OH) input, servo error	Drive unit CNSG
CNSG1A	/PWMON signal output, Error signal (OV,OH) input, servo error	CNSG of old version drive unit
CNSG2	/PWMON signal output for additional axis	CNSG of additional axis drive unit
CNGSG	GENERAL safety guard input	External safety guard unit of controller
CNB1	Brake deactivate output, error (TS) input	W/H CNR1,2
CNB7	Additional axis brake deactivate output, error (TS) input	Additional axis (7,8 axis) W/H
CNSR	DIO I/O for preliminary system DIO	Internal preliminary IO unit of controller
CNLSA1	Limit switch input for over-travel detection for additional axis	Additional axis (7 axis) W/H
CNLSA2	Limit switch input for over-travel detection	Additional axis (8 axis) W/H
CNSGC	/PWMON signal output, various error signals (OV,OC) input	PWM Converter CNSGC
CNSGA	/PWMON signal output	AMP CNSGA
CNPLC	Safety signal connection for safety PLC	Safety PLC

Name	Usage	External unit connection
CNMC	Magnetic connector (MC1,2) related I/O signal connection	Electronic module electronic board CNMC
CNPC	Various circuit protectors, fuse connections	Electronic module electronic board CNPC
CNPB	Brake power supply (PB,MB,PREPB)	SMPS for electronic module brake SMPS
TBEXT	Emergency stop, AUTO safety guard input	External emergency stop switch and safety guard unit of controller
TBPLC	Safety IO connection	Safety IO (p-common type)

(1) Terminal block for external safety signal; TBEXT

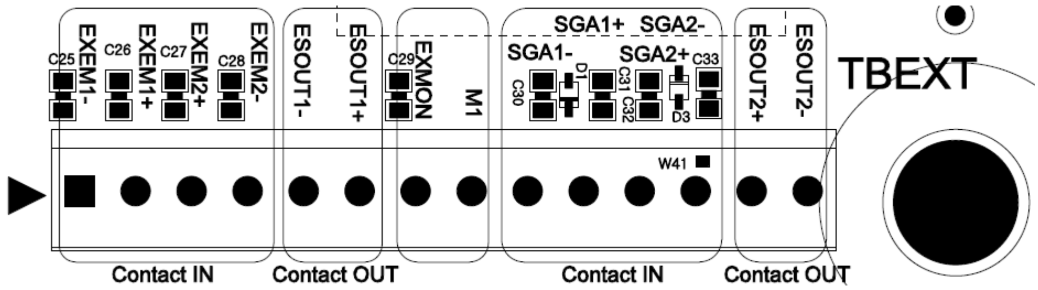


Fig. 4.31 Pin diagram of terminal block TBEXT

Table 4-30 Sequence board (BD461V50/60) terminal block TBEXT description

Terminal No.	Terminal name	Usage	Others
1	EXEM1-	External emergency stop chain 1 input	When the emergency stop chain 1 of the external device is not used, short circuit the device. (or short circuit JP01)
2	EXEM1+		
3	EXEM2+	External emergency stop chain 2 input	When the emergency stop chain 2 of the external device is not used, short circuit the device. (or short circuit JP02)
4	EXEM2-		
5	ESOUT1-	Internal emergency stop output chain 1	Relay contact point output
6	ESOUT1+		
7	EXMON	External motor ON input	When the robot motor is ON in the external system, input ON/OFF while using M1 as common
8	M1	Common external motor ON input	
9	SGA1-	AUTO safety guard chain 1 input	When the AUTO safety guard chain 1 is not used, short circuit the device. (or short circuit JP03)
10	SGA1+		
11	SGA2+	AUTO safety guard Chain 2 input	When the AUTO safety guard chain 2 is not used, short circuit the device. (or short circuit JP04)
12	SGA2-		
13	ESOUT2+	Internal emergency stop output chain 2	Relay contact point output
14	ESOUT2-		

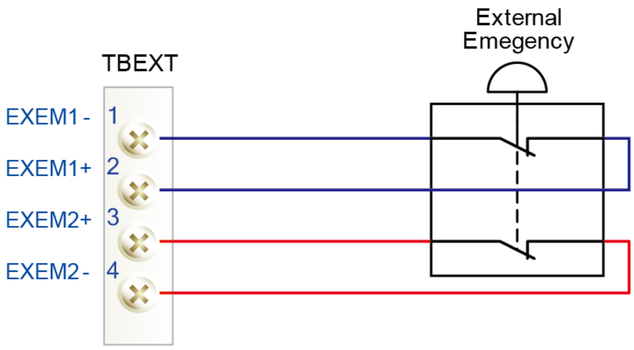


Fig. 4.32 Connection of external emergency stop switch of terminal block TBEXTF

Fig. 4.33 Connection of AUTO safety guard switch of terminal block TBEXT

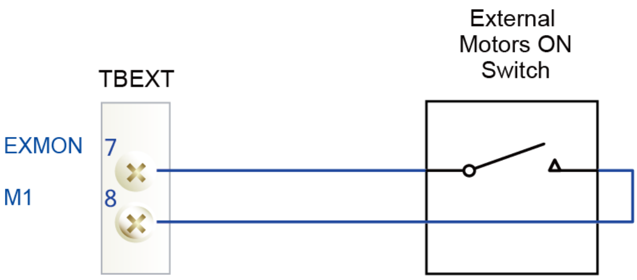


Fig. 4.34 Connection of external motor power ON signal input of terminal block TBEXT

(2) Terminal block for safety IO (P common type); TBPLC

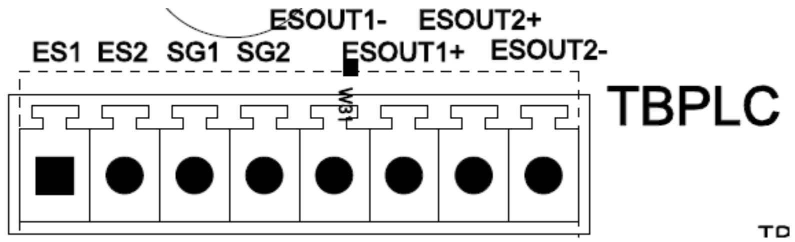


Fig. 4.35 Pin diagram of terminal block TBPLC

Table 4-31 Sequence board (BD461V50/60) terminal block TBPLC description

Terminal No.	Terminal name	Usage	
1	ES1	External emergency stop chain 1 input; P Common (DC24V)	
2	ES2	External emergency stop chain 2 input; P Common (DC24V)	
3	SG1	Safety guard chain 1 input; P Common (DC24V)	
4	SG2	Safety guard chain 2 input; P Common (DC24V)	
5	ESOUT1-	Internal emergency stop output chain 1	Relay contact point output
6	ESOUT1+		
13	ESOUT2+	Internal emergency stop output chain 2	Relay contact point output
14	ESOUT2-		

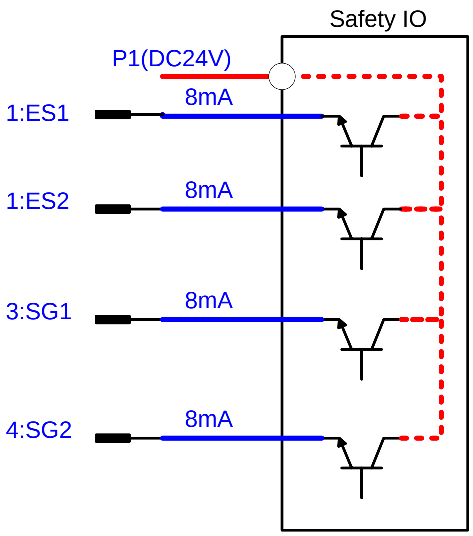


Fig. 4.36 NPN type safety guard connection method and general safety guard connection

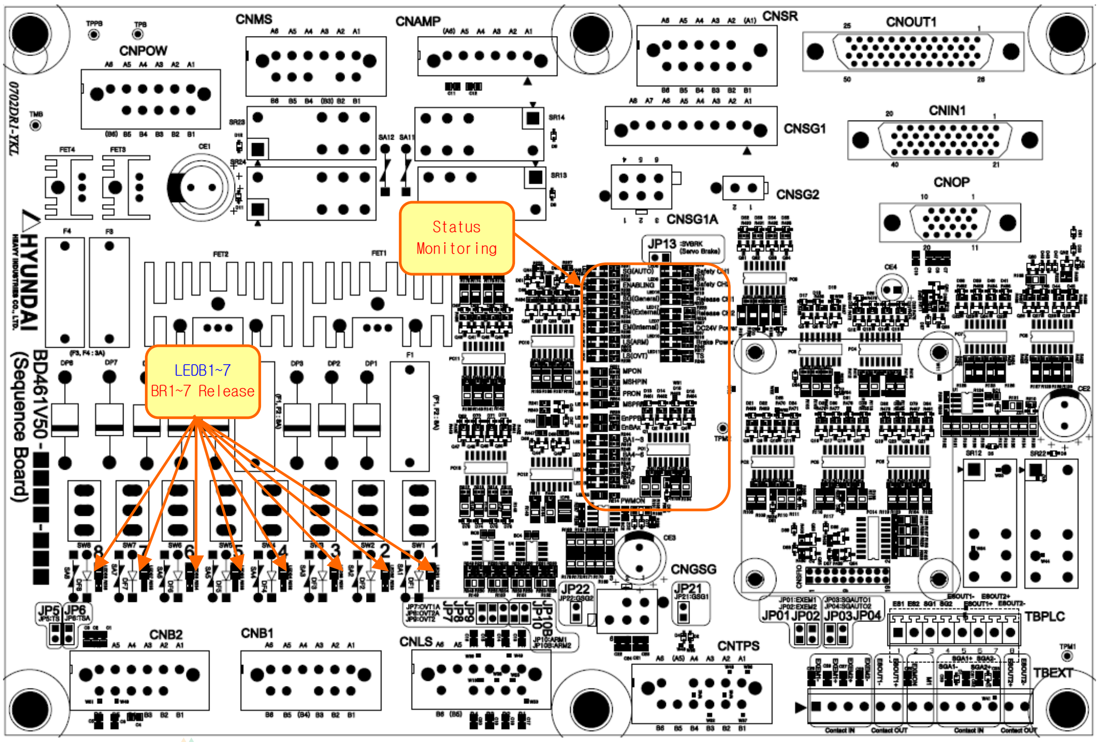


Fig. 4.37 Label device of sequence board (BD461V50/60)

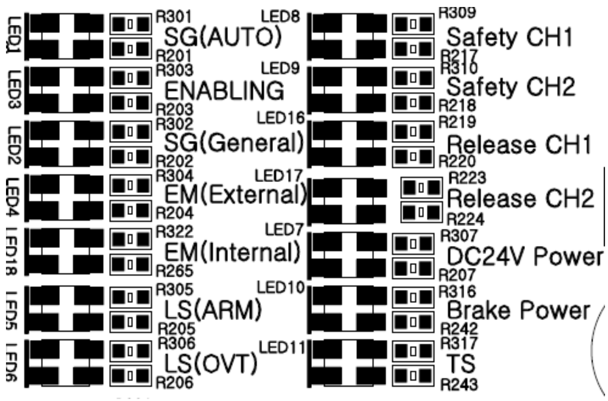


Fig. 4.38 Safety signal LED of sequence board (BD461V50/60)

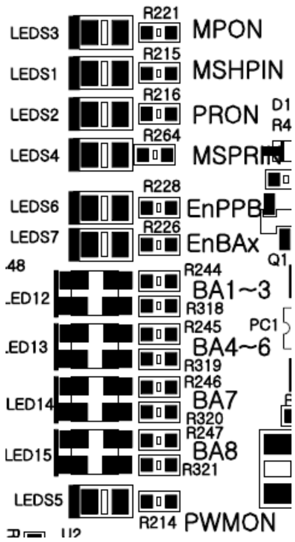


Fig. 4.39 Motor/brake power LED of sequence board (BD461V50/60)

Table 4-32 Sequence board (BD461V50/60) LED description

Name	Label detail	Color	When normal
LEDB1~8	1~8 axes brake deactivate	Yellow	Brake power ON (Brake release)
		Off	Brake power OFF (Brake hold)
LED1	SG(AUTO)	Yellow	AUTO safety guard normal
		Red	AUTO safety guard abnormal
LED3	ENABLING	Yellow	ENABLING DEVICE ON
		Red	ENABLING DEVICE OFF
LED2	SG(General)	Yellow	GENERAL safety guard normal
		Red	GENERAL safety guard abnormal
LED4	EM(External)	Yellow	External emergency stop input normal
		Red	External emergency stop input abnormal
LED18	EM(Internal)	Yellow	Internal emergency stop input normal
		Red	Internal emergency stop input abnormal

Name	Label detail	Color	When normal
LED5	LS(ARM)	Yellow	Arm interference limit switch normal
		Red	Arm interference limit switch abnormal
LED6	LS(OVT)	Yellow	Over-travel limit switch normal
		Red	Over-travel limit switch abnormal
LED8	Safety CH1	Yellow	Safety chain 1 normal
		Red	Safety chain 1 abnormal
LED9	Safety CH2	Yellow	Safety chain 2 normal
		Red	Safety chain 2 abnormal
LED16	Release CH1	Yellow	Emergency Movement chain 1 not operating
		Red	Emergency Movement chain 1 operating
LED17	Release CH2	Yellow	Emergency Movement chain 2 not operating
		Red	Emergency Movement chain 2 operating
LED7	DC24V Power	Yellow	DC 24V (P1) voltage normal
		Red	DC 24V (P1) voltage drop
LED10	Brake Power	Yellow	Brake voltage normal
		Red	Brake voltage drop
LED11	TS	Yellow	Motor temperature normal condition
		Red	Motor temperature overheat condition
LEDS3	MPON	Yellow	Motor power ON condition (Magnetic contactor MSHP1,2 ON output)
		Off	Motor power OFF condition

Name	Label detail	Color	When normal
LEDS1	MSHPIN	Yellow	Motor power ON condition (Magnetic contactor MSHP1,2 ON output)
		Off	Motor power OFF condition
LEDS2	PRON	Yellow	Precharge relay MSPR ON output
		Off	Precharge relay MSPR OFF output
LEDS4	MSPRIN	Yellow	Precharge relay MSPR ON condition
		Off	Precharge relay MSPR OFF condition
LEDS6	EnPPB	Yellow	Brake control power ON
		Off	Brake control power OFF
LEDS7	EnBAx	Yellow	Brake control signal ON
		Off	Brake control signal OFF
LED12	BA1~3	Yellow	Brake BA1~3 output voltage normal
		Red	Brake BA1~3 output voltage drop
LED13	BA4~6	Yellow	Brake BA4~6 output voltage normal
		Red	Brake BA4~6 output voltage drop
LED14	BA7	Yellow	Brake BA7 output voltage normal
		Red	Brake BA7 output voltage drop
LED15	BA8	Yellow	Brake BA8 output voltage normal
		Red	Brake BA8 output voltage drop
LEDS5	PWMON	Yellow	PWMON signal ON condition
		Off	PWMON signal OFF condition

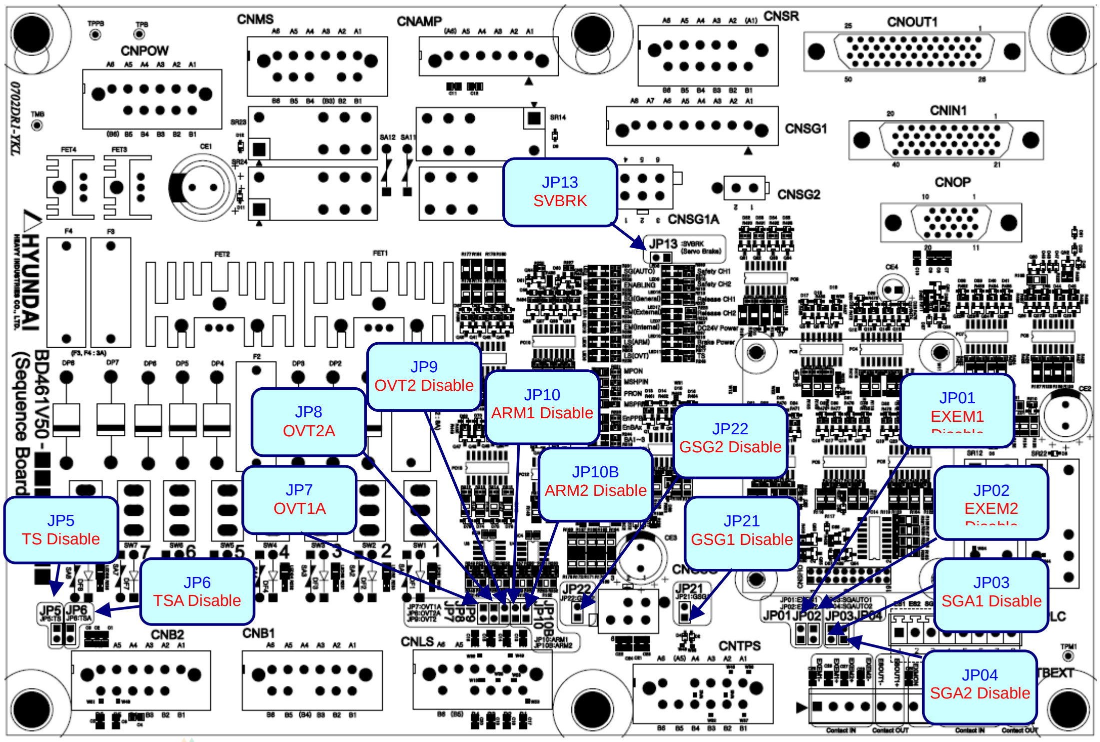


Fig. 4.40 Setup device of sequence board (BD461V50/60)

Table 4-33 Sequence board (BD461V50/60) jumper description

Jumper No.	Jumper name	Usage	SHORT	OPEN	Factory default
JP01	**EXEM1**	External emergency stop chain 1 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT
JP02	**EXEM2**	External emergency stop chain 2 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT
JP03	**ASG1**	AUTO safety guard chain 1 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT
JP04	**ASG2**	AUTO safety guard chain 2 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT
JP05	**TS1**	Setup whether to use basic axis motor temperature sensor.	Invalid (Do not use TS1)	Valid (USE TS1)	SHORT
JP06	**TSA**	Setup whether to use additional axis motor temperature sensor.	Invalid (Do not use TS)	Valid (Use TS)	SHORT
JP07	**OVT1A**	Setup whether to use over-travel limit switch chain 1 of additional axis.	Invalid (Do not use OVT1A)	Valid (Use OVT1A)	SHORT
JP08	**OVT2A**	Setup whether to use over-travel limit switch chain 2 of additional axis.	Invalid (Do not use OVT2A)	Valid (Use OVT2A)	SHORT

Jumper No.	Jumper name	Usage	SHORT	OPEN	Factory default
JP09	**OVT2**	Setup whether to use over-travel limit switch chain 2 of basic axis.	Invalid (Do not use OVT)	Valid (Use OVT)	OPEN
JP10	**ARM1**	Setup whether to use arm interference limit switch chain 1 of device part.	Invalid (Do not use switch)	Valid (Use switch)	SHORT
JP10B	**ARM2**	Setup whether to use arm interference limit switch chain 2 of device part.	Invalid (Do not use switch)	Valid (Use switch)	SHORT
JP13	**SVBRK**	Setup whether to use servo brake signal	Invalid (Do not use SVBRK)	Valid (Use SVBRK)	SHORT
JP21	**GSG1**	General safety guard chain 1 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT
JP22	**GSG2**	General safety guard chain 2 deactivate	Invalid (Do not use input)	Valid (Use input)	SHORT

4.2.1.6. Multi-Communication Board (BD42x ; optional)

This board is provided as optional, and supports DeviceNet, Profibus-DP, and InterBus among field bus.

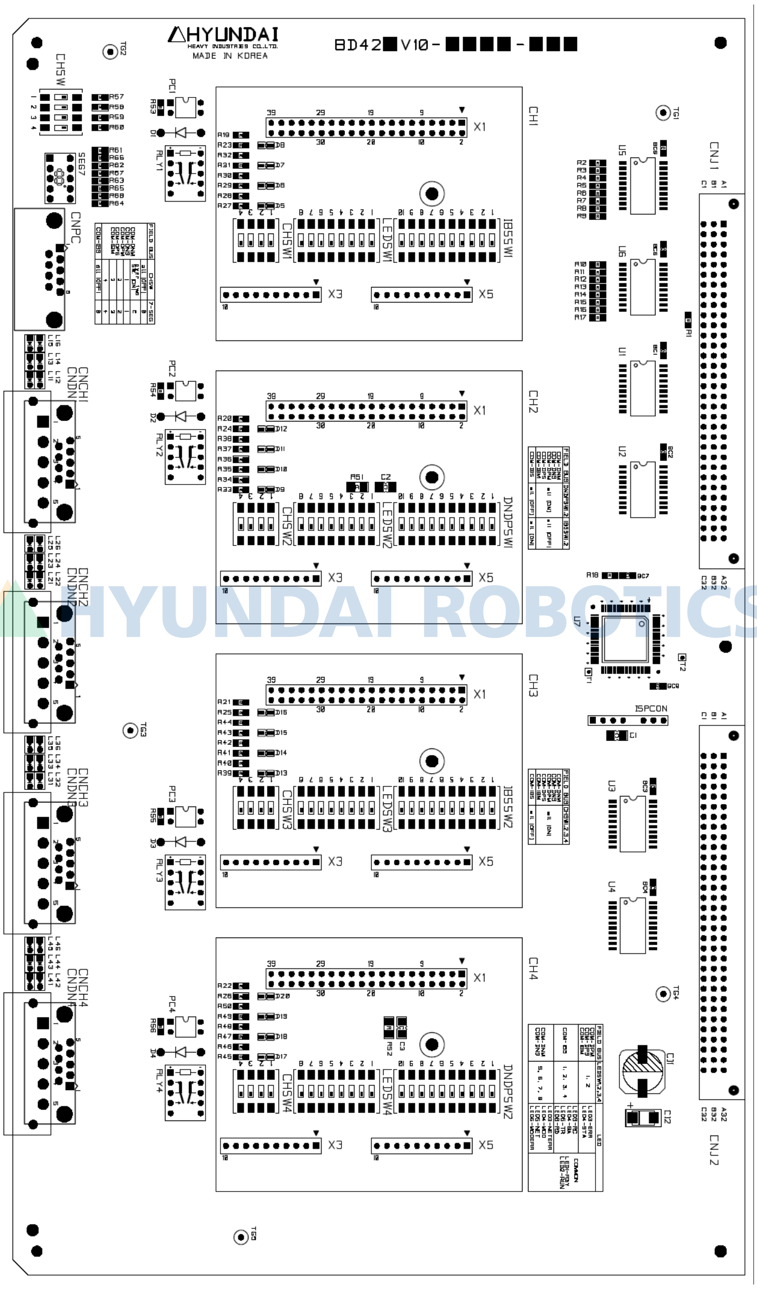


Fig. 4.41 Exterior View of Multi-Communication Board(BD42x)

The name of board is determined depending on the kind of field bus, and the available channels to support are as follows.

Table 4-34 Board Name By Field Bus

Board Name	Field Bus Name	Number of Supporting Port
BD421	DeviceNet	Max. 4 Channels; Master or Slave
BD422	Profibus-DP	Max. 4 Channels; Master or Slave
BD423	InterBus	Max. 2 Channels; Master or Slave

For more details, please make requests for special materials to HHI.
Reference ; [BD42X Multi-Communication Board Function Manual]

4.2.1.7. CAN Board (BD474 ; optional)

This board is provided as optional, and used for I/F with welder.
This board is made as baby board of Main Board(BD412).

Table 4-35 Descriptions of CAN Board(BD474) Connector

Name	Uses	Connection with External Devices
CN1	Connection to CAN communication data with MAIN	Main Board(BD412) CN1
CNCAN	CAN Port Connection	External Device CAN Port Connection

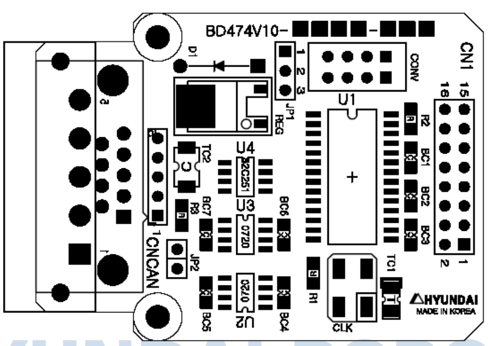


Fig. 4.42 Exterior View(layout) of CAN Board(BD474)

Layout of CAN connector(CNCAN) Pin for users complies with CiA(CAN in Automation) specifications.

Table 4-36 Definition of CNCAN connector Pin

Signal	Details	CNCAN	
		D-Sub 9pin	COMBICON 5pin
-	No Connection	1	
CAN_L	CAN_L bus line (dominant low)	2	2
CAN_GND	CAN Ground	3	
-	No Connection	4	
SHIELD	Optional CAN Shield	5	3
CAN_V-	Optional Ground	6	1
CAN_H	CAN_H bus line (dominant high)	7	4
-	No Connection	8	
CAN_V+	Optional CAN external positive supply	9	5

Jumper Setting

There are 2 jumpers(JP1, JP2) in CAN Board(BD474).
These two Jumpers can be used and operated as users need.

JP1 Jumper is to select whether to use Transceiver power of CAN communication data as external power or internal power.

JP2 Jumper is to determine whether Termination resistance should be disable or enable.

Table 4-37 BD474 Jumper Setting

Classification	JP1	JP2	Details
Setting Details	[1,2]pin SHORT		Using External Power
	[2,3]pin SHORT		Using Internal Power
		SHORT	Termination resistance enable
		OPEN	Termination resistance disable
Delivery SEtting	**OPEN**	**OPEN**	**CAN unavailable / Termination resistance disable**

☞ Caution
If you intend to use CAN, be sure to set JP1 & JP2 up because they have been set to OPEN when delivered from warehouse.

4.2.1.8. ADIO Board (BD481 : optional)

This optional board has built-in functions such as interface of Arc welder, pulse counter for conveyor synchronization, and analog input/output. This board should be mounted on BD430 board to use.

- Universal analog input 4 port
- Universal analog output 4 port
- Encoder pulse input 2 port for conveyor
  ; selecting Line Drive mode and Open collector mode for each port
- Input/output signals for Arc welder 6 points each

■ **Board Layout**

Layout of DIP switch & Jumper for board setting and connectors for connection with the outside is as follows.

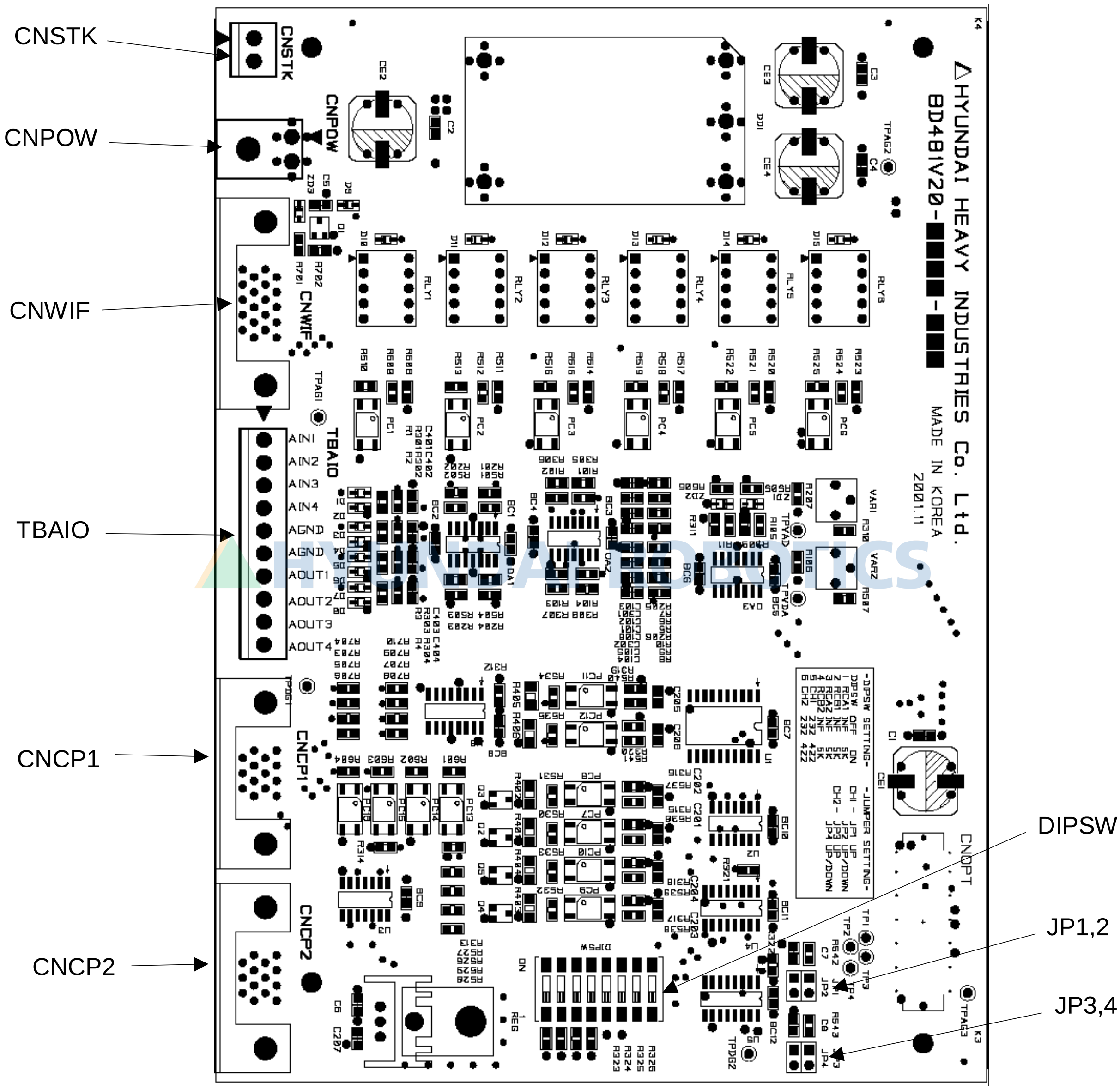


Fig. 4.43 ADIO Board(BD481) Layout

■ **Connectors**

Table 4-38 Descriptions of ADIO Board(BD481) Connector

Name	Uses	Connection with External Devices
CNPOW	Board Drive Power (+24V, GND)	SMPS(HD-180)
CNSTK	Input signal for Arc(Stick Check)	Arc welder, etc.
CNWIF	Arc signal Interface	Arc welder, etc.
CNCP1, 2	Conveyor pulse input	Encoder on the conveyor side
TBAIO	Analog input/output	Arc welder and users need

- CNPOW Connector Specifications

BD481 ***CNPOW*** Connector

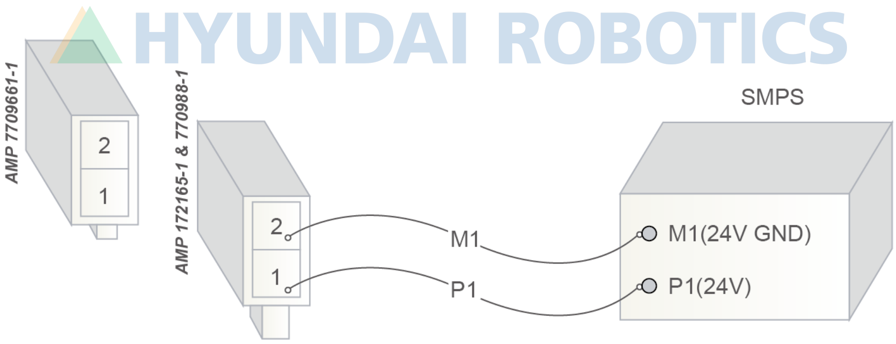


Fig. 4.44 CNPOW Connector Specifications

Fig. 4-39 CNPOW connector Specifications

Item	Manufacturer	Type	Specifications
Connector(Header)	AMP	770966-1	MATE-N-LOCK Header, 2-Pin
Connector(Plug)	AMP	172165-1	MATE-N-LOCK Plug, 2-Pin
Connector(Contact)	AMP	770988-1	MATE-N-LOCK Contact, AWG22

- CNSTK Connector Specifications

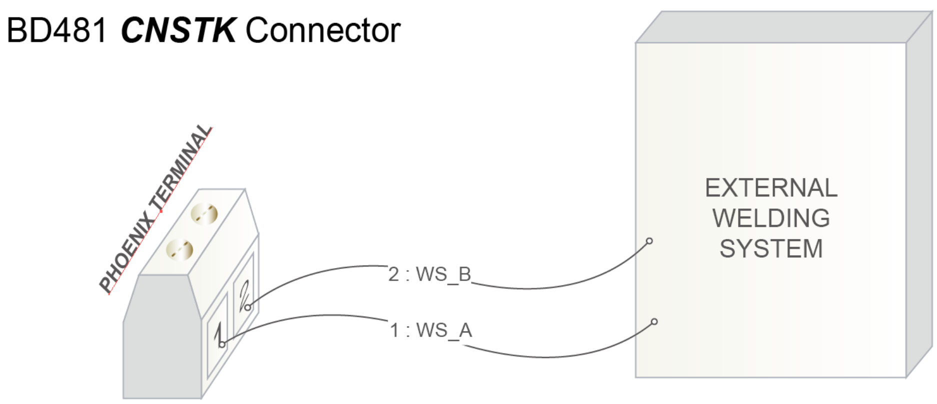


Fig. 4.45 CNSTK Connector Specifications

Table 4-40 CNSTK Connector Specifications

Item	Manufacturer	Type	Specifications
TERMINAL BLOCK	PHOENIX	MKDS 1/2-3.81	2-pin, 3.81mm pitch, Terminal Block

- CNWIF Connector Specifications

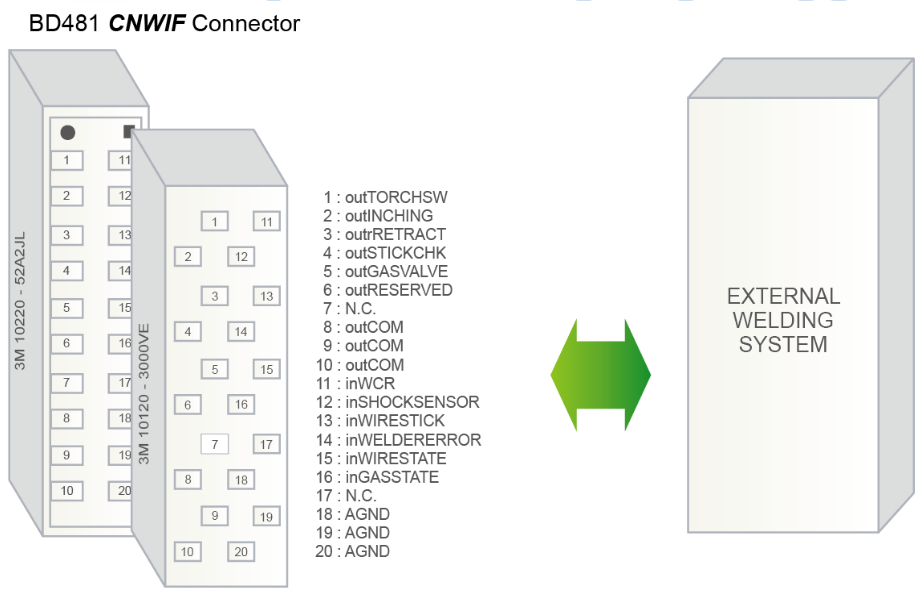


Fig. 4.46 CNWIF connector Specifications

Table 4-41 CNWIF Connector Specifications

Item	Manufacturer	Type	Specifications
Header	3M	10220-52A2JL	MDR system, 20-Pin
Receptacle	3M	10120-3000VE	MDR system, 20-Pin
Hood	3M	10320-52F0-008	MDR system, 20-Pin

<Input signal connecting method>

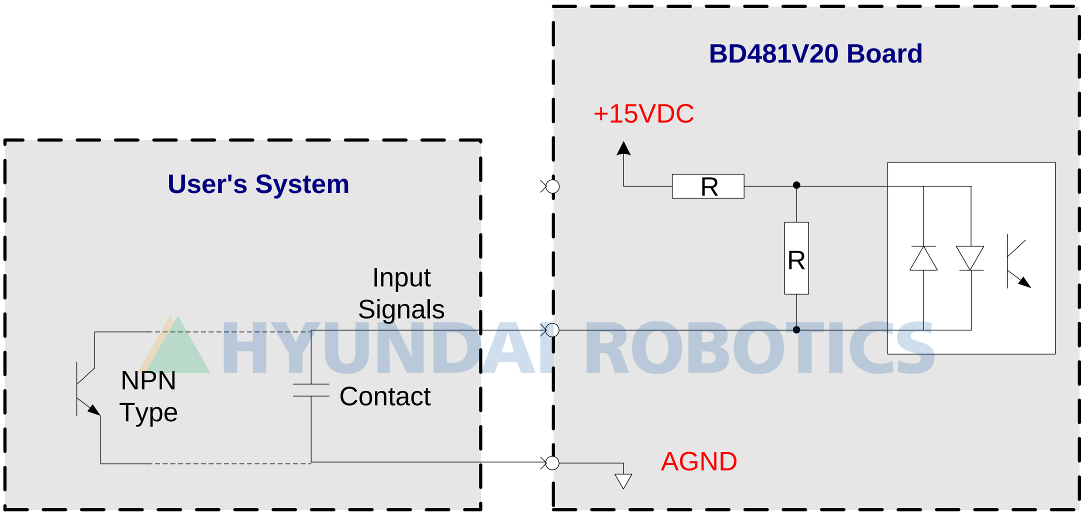


Fig. 4.47 CNWIF Input Signal Connecting Method

< Output signal connecting method >

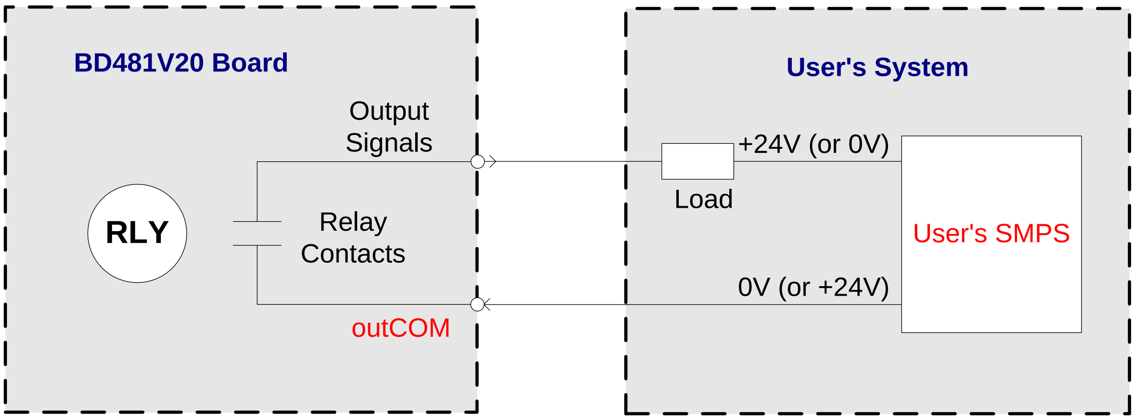


Fig. 4.48 CNWIF Output Signal Connecting Method

- CNCP1, 2 Connector Specifications

BD481 ***CNWIF*** Connector

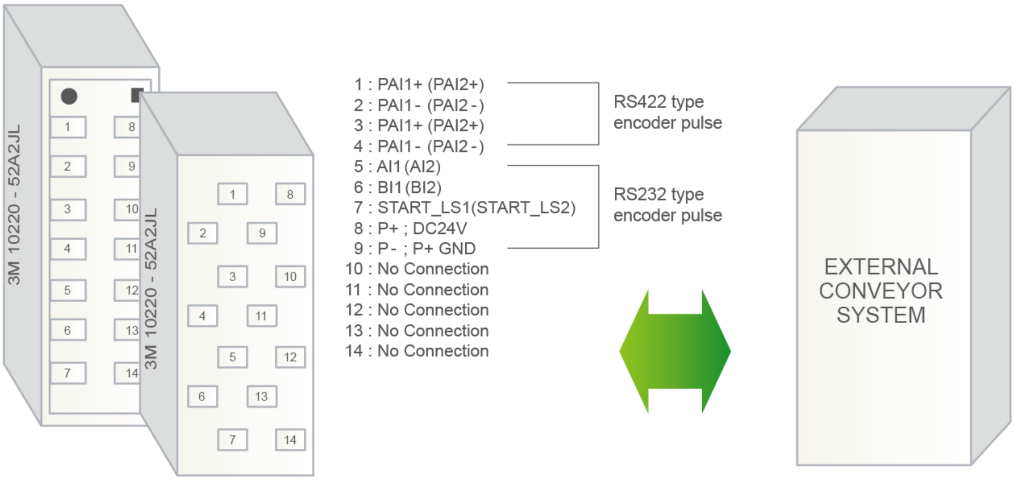


Fig. 4.49 CNCP1, 2 Connector Specifications

Table 4-42 CNCP1, 2 Connector Specifications

Item	Manufacturer	Type	Specifications
Header	3M	10214-52A2JL	MDR system, 14-Pin
Receptacle	3M	10114-3000VE	MDR system, 14-Pin
Hood	3M	10314-52F0-008	MDR system, 14-Pin

－ **TBAIO Terminal Block Specifications**

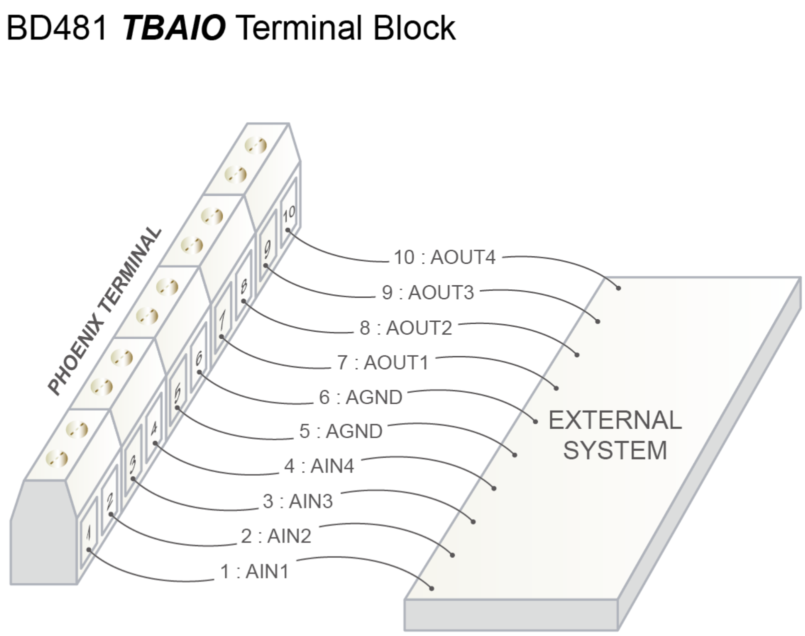


Fig. 4.50 TBAIO Terminal Block Specifications

Table 4-43 TBAIO Terminal Block Specifications

Item	Manufacturer	Type	Specifications
TERMINAL BLOCK (Plug Part)	PHOENIX	MCV1.5/10-ST-3.81	10-pin, 3.81mm pitch, Plug Part
TERMINAL BLOCK (Housing)	PHOENIX	MCV1.5/10-G-3.81	10-pin, 3.81mm pitch, Housing

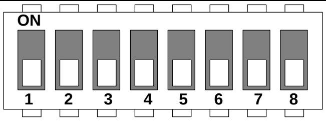
Table 4-44 Pin Specifications

Terminal No.	Terminal Name	Uses
1	AIN1	Analog input channel 1 (-12V ~ +12V)
2	AIN2	Analog input channel 2 (-12V ~ +12V)
3	AIN3	Analog input channel 3 (-12V ~ +12V)
4	AIN4	Analog input channel 4 (-12V ~ +12V)
5	AGND	Analog ground
6	AGND	Analog ground
7	AOUT1	Analog output channel 1 (-12V ~ +12V)
8	AOUT2	Analog output channel 2 (-12V ~ +12V)
9	AOUT3	Analog output channel 3 (-12V ~ +12V)
10	AOUT4	Analog output channel 4 (-12V ~ +12V)

■ DIP Switch Setting

☞ **Caution:** DIP Switch has been set to OFF when delivered from warehouse, so if you intend to change the use of board, make contact with our company.

Table 4-45 Descriptions of ADIO Board(BD481) DIP Switch

Shape									
Switch No.		1	2	3	4	5	6	7	8
Setting Details	**OFF**	(+)swing conveyor pulse A1	(+)swing conveyor pulse B1	(+)swing conveyor pulse A2	(+)swing conveyor pulse B2	Channel 1 RS232 Input	Channel 2 RS232 Input	unchangeable	
	ON	(-)swing conveyor pulse A1	(-)swing conveyor pulse B1	(-)swing conveyor pulse A2	(-)swing conveyor pulse B2	Channel 1 RS422 Input	Channel 2 RS422 Input		
Delivery Setting		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

■ Jumper Setting

☞ **Caution :** Jumper may not be changed randomly by users, so if you intend to change the use of board, make contact with our company.

Table 4-46 Descriptions of ADIO Board(BD481) Jumper

Jumper No.		**JP1**	**JP2**	**JP3**	**JP4**
Setting Details	Channel 1 Conveyor pulse UP count	SHORT	OPEN	unchangeable	
	Channel 1 Conveyor pulse UP/DOWN count	OPEN	SHORT		
	Channel 2 Conveyor pulse UP count	unchangeable		SHORT	OPEN
	Channel 2 Conveyor pulse UP/DOWN count			OPEN	SHORT
Delivery Setting		OPEN	SHORT	OPEN	SHORT

4.2.2. Drive Unit

4.2.2.1. Drive Unit Specifications

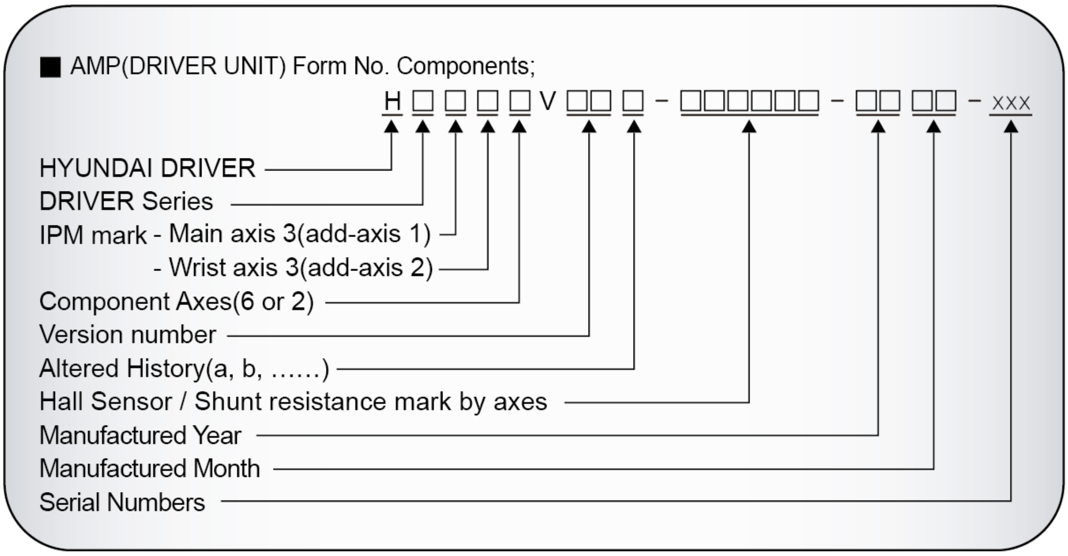


Table 4-47 Driver Series Formal Mark

Classification	Formal Mark
3-Axis type AMP	A
	B
	C
Small/medium sized 6-Axis type AMP	D
Large size 6- Axis AMP	S

Table 4-48 Drive Unit Specifications

Components	Classifications		Application	
IPM Capacity	Main Axis3 (add-axis1)	Wrist Axis3 (add-axis2)		
	L	Y	Special application	6-axis monolithic type
	X	Y	HR120, HR150, HR100P, HX165	
	A	D	HR006, HR015	
	L	Y	Add-axis 1 applied, add-axis 2 servo gun applied	For 2 add-axis type
	X	Y		
	A	D		
6-axis/2-axis	6		6-axis monolithic type	
	2		For 2-axis additional type	
Year	00 ~ 99		Production year : 2000 ~ 2099	
Month	01 ~ 12		Production month : Jan. ~ Dec.	
Serial No.	001 ~ 999		Production per month:1 unit~ 999 units	

Table 4-49 IPM Capacity

Small Size	**A**	(IPM rated current) 30A, (Hall Sensor rated current) 4V/15A
	B	(IPM rated current) 20A, (Hall Sensor rated current) 4V/10A
	C	(IPM rated current) 15A, (Hall Sensor rated current) 4V/10A
	D	(IPM rated current) 10A, (Hall Sensor rated current) 4V/5A
Large/medium sized	**L**	(IPM rated current) 150A, (Hall Sensor rated current) 4V/75A
	X	(IPM rated current) 100A, (Hall Sensor rated current) 4V/50A
	Y	(IPM rated current) 75A, (Hall Sensor rated current) 4V/50A
	Z	(IPM rated current) 50A, (Hall Sensor rated current) 4V/25A

Table 4-50 Hall Sensor/Shunt Resistance Mark

AMP Model	Hall Sensor Mark (specification)	Shunt Resistance Mark (resistance value)	Full Scale Current(Im)	Feedback constant(Iv) of AMP
Large Size 6-axis/add-axis AMP	0 (4V/75A)		140.62Apeak	PM150CSD060(150A)
	1 (4V/50A)		93.75Apeak	PM150CSD060(150A) PM100CSD060(100A) PM75CSD060(75A)
	2 (4V/25A)		46.87Apeak	
	3 (4V/15A)		28.12Apeak	
	4 (4V/10A)		18.75Apeak	
	5 (4V/5A)		9.37Apeak	
Medium Sized 6-axis/add-axis AMP		1 (2mΩ)	93.75Apeak	PM100CSD060(100A) PM75CSD060(75A)
		2 (4mΩ)	46.87Apeak	
		3 (8mΩ)	23.44Apeak	
		4 (12mΩ)	15.58Apeak	
		5 (16mΩ)	11.72Apeak	
Small Size 6-axis/add-axis AMP	1 (4V/15A)		28.12Apeak	PM30CSJ060(30A)
	2 (4V/10A)		18.75Apeak	PM30CSJ060(30A)
	3 (4V/5A)		9.37Apeak	PM30CSJ060(30A) PM10CSJ060(10A)

4.2.2.2. HSXY6(Large Size 6-Axis Monolithic Type of Drive Unit)

Drive Unit performs a power amplifying function to send current to motor in each phase by the instruction for current from servo board. 6-Axis monolithic type of Drive Unit can operate 6 motors simultaneously, and its components are as follows.

Table 4-51 Components of HSXY6(Large Size 6-Axis Monolithic Type of Drive Unit)

Components		Function
BD457A(logic board)		Separating IPM top/bottom drive signals from PWM signal of servo board, and performing error processing & regeneration control
BD457B(converter board)		Generating DC power circuit which is supplied to motor from AC(alternating current) input primary power
BD457	**Gate Drive Module**	Generating IPM gate signal
	Gate Power Module	Generating gate power
	Current Detection Part	Detecting the current in motor
Other parts	**Heat Sink**	Emitting out heat generated from IPM
	IPM	Switching device
	Regeneration TR	Regeneration control
	Diode Module	Adjusting AC power to DC power
	Capacitor	Charging DC power

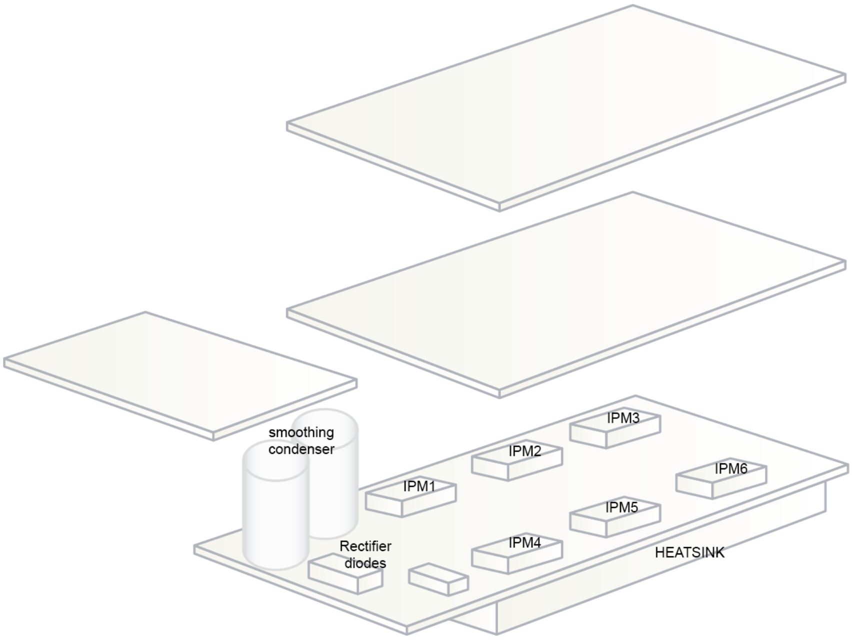


Fig. 4.51 Exterior View of HSXY6 Drive Unit

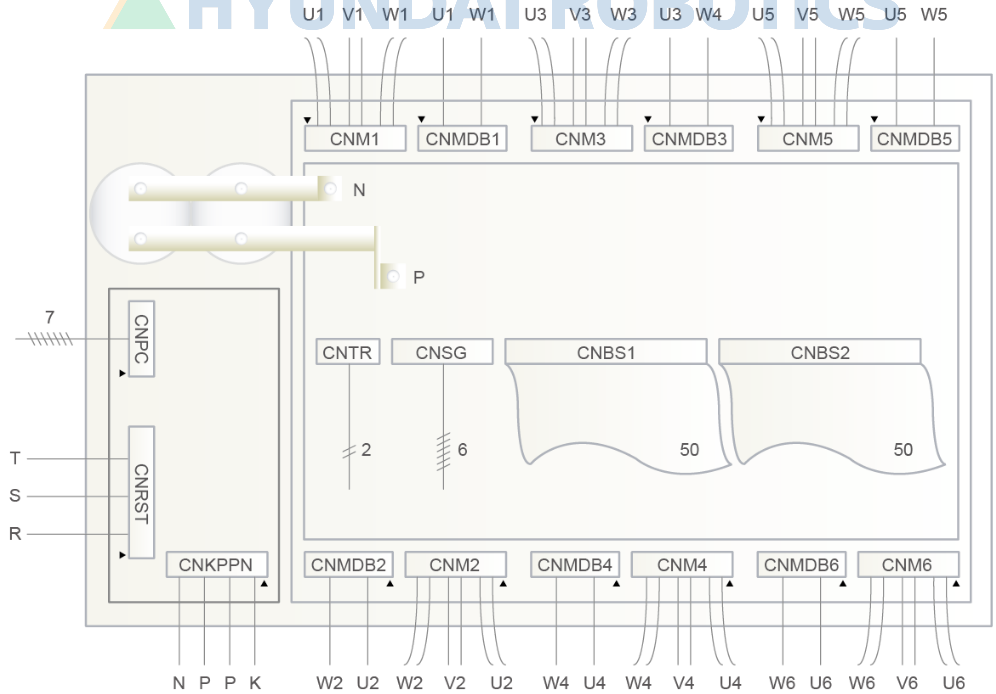


Fig. 4.52 HSXY6 Drive Unit connection

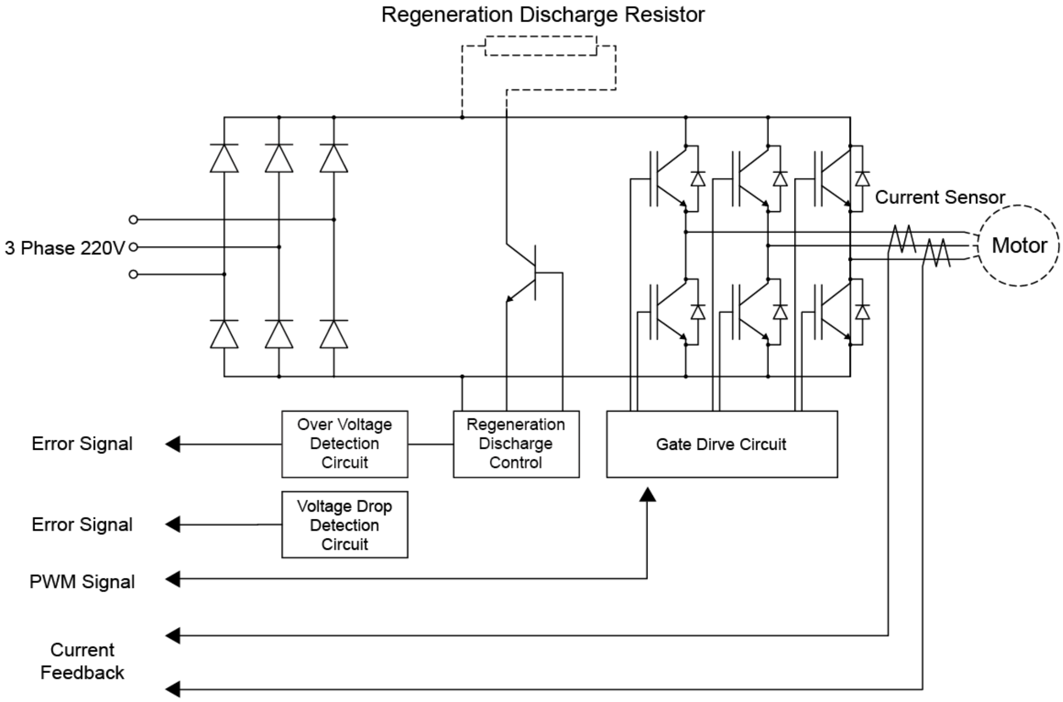


Fig. 4.53 Outline of HSXY6 Drive Unit

☞ **Caution**

In the replacement of drive unit, be sure to its form and type because it varies in robot models.

Table 4-52 Descriptions of HSXY6(Large Size 6-Axis Monolithic Type of Drive Unit) Connector

Name	Uses	Connection with External Devices
CNBS1, 2	PWM signal, Encoder error signal	Servo Board(BD440) CNBS1,2
CNSG	/PWMON, Over-heat, Over-voltage	Sequence Board(BD461) CNSG1
CNPC	Restrict power to inrush current & control signal	Sequence Board (BD461) CNAMP
CNTR	Temperature sensor detecting signal of regeneration resistance	Temperature sensor attached to regeneration resistance
CND1~6	Connecting a dynamic brake	DB1~6
CNM1~6	Connecting a motor	CNR1, CNR2
CNRST	AC power	MSHP2
CNKPPN	DC servo power for regeneration resistance in additional axis	Servo drive unit for regeneration discharge resistance in additional axis

Table 4-53 Descriptions of HSXY6(Large Size 6-Axis Monolithic Type of Drive Unit) LED

Name	Color	Status Display
SB	Yellow	Lighting on when PWM ON
VE	Green	Lighting out when a voltage drop occurs
DR	Red	Lighting up in case of regeneration discharge
AL	Red	Lighting up when Alarm occurs

4.2.2.3. HDAD6(Small Size 6-Axis Monolithic Type of Drive Unit)

Drive Unit performs a power amplifying function to send current to motor in each phase by the instruction for current from servo board. Small sized 6-Axis monolithic type of Drive Unit can operate 6 motors simultaneously, and its components are as follows.

Table 4-54 Components of HDAD6(Small Sized 6-Axis Monolithic Type of Drive Unit)

Components		**Function**
BD453 (AMP Board)	Logic Part	Separating IPM top/bottom drive signals from PWM signal of servo board, and performing error processing & regeneration control
	Gate power Module	Generating gate power
	Current Detecting Part	Detecting the current in motor
BD453B (AMP Board)	Converter Part	Generating DC power circuit which is supplied to motor from AC(alternating current) input primary power
Other parts	Heat Sink	Emitting out heat generated from IPM
	IPM	Switching Device
	Regeneration TR	Regeneration Control

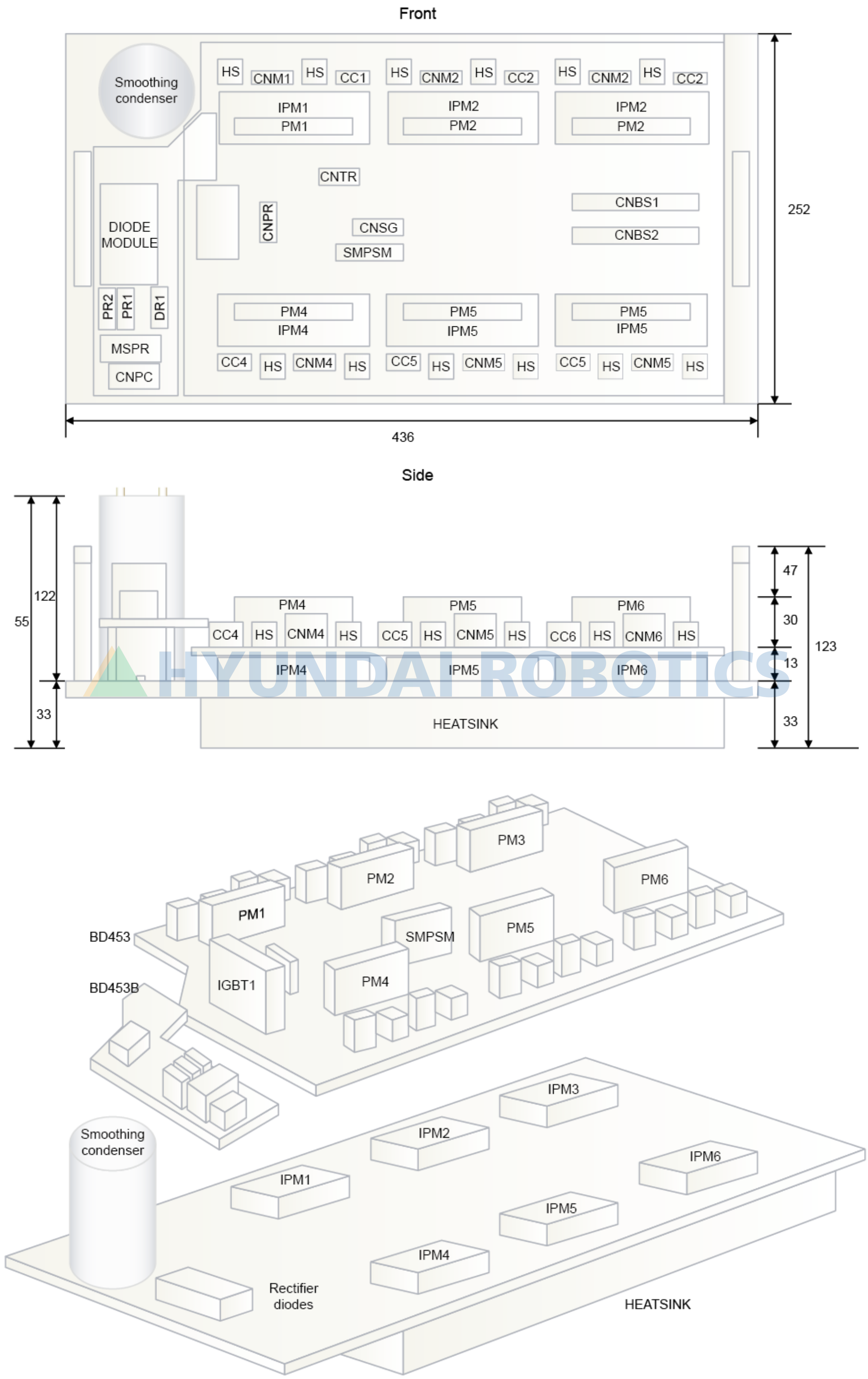
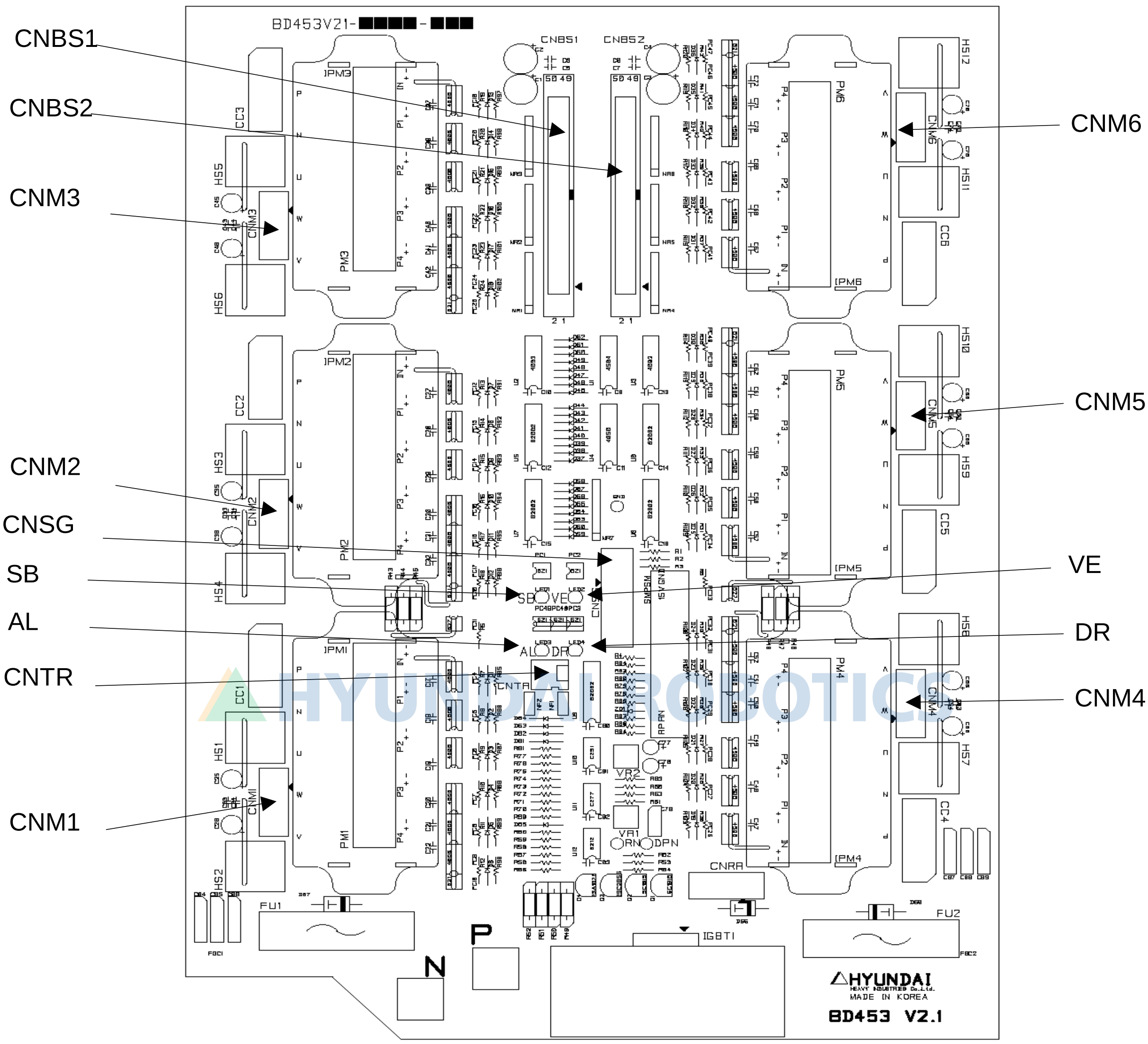


Fig. 4.54 Exterior View of HDAD6 Drive Unit



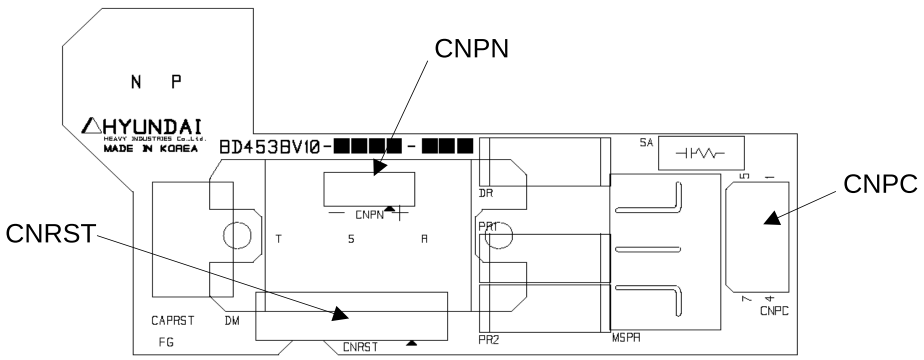


Fig. 4.55 Connection(Schematic Diagram) of HDAD6 Drive Unit

Table 4-55 Descriptions of HDAD6(Small Size 6-Axis Monolithic Type of Drive Unit) Connector

Name	Uses	Connection with External Devices
CNBS1, 2	PWM signal, Encoder error signal	Servo Board(BD440) CNBS1,2
CNSG	/PWMON, Over-heat, Over-voltage	Sequence Board(BD461) CNSG1
CNPC	Restrict power to inrush current & control signal	Sequence Board (BD461) CNAMP
CNTR	Temperature sensor detecting signal of regeneration resistance	Temperature sensor attached to regeneration resistance
CNRST	220V in 3-phase & Frame Ground input	R, S, T of MSHP & FG of BOX
CND1~6	Connecting a dynamic brake	DB1~6
CNRR	Supplying current to resistance in case of regeneration discharge	Regeneration discharge resistance

Table 4-56 Descriptions of HDAD6(Small Size 6-Axis Monolithic Type of Drive Unit) LED

Name	Color	Status Display
SB	Yellow	Lighting on when PWM ON
VE	Green	Lighting out when a voltage drop occurs
DR	Red	Lighting up in case of regeneration discharge
AL	Red	Lighting up when Alarm occurs

4.2.2.1. HSXY2(Large Size 2-Axis Drive Unit ; optional)

Drive Unit performs a power amplifying function to send current to motor in each phase by the instruction for current from servo board. Medium sized 2-Axis monolithic type of Drive Unit can operate 2 motors simultaneously, and its components are as follows.

Table 4-57 Components of HSXY2(Large Size 2-Axis Drive Unit ; optional

Components		Function
BD458A(Logic Board)		Separating IPM top/bottom drive signals from PWM signal of servo board, and performing error processing & regeneration control
BD458	Gate Power Module	Generating gate power
	Current Detecting Part	Detecting a current in motor
Other Parts	Heat Sink	Emitting out heat generated from IPM
	IPM	Switching Device

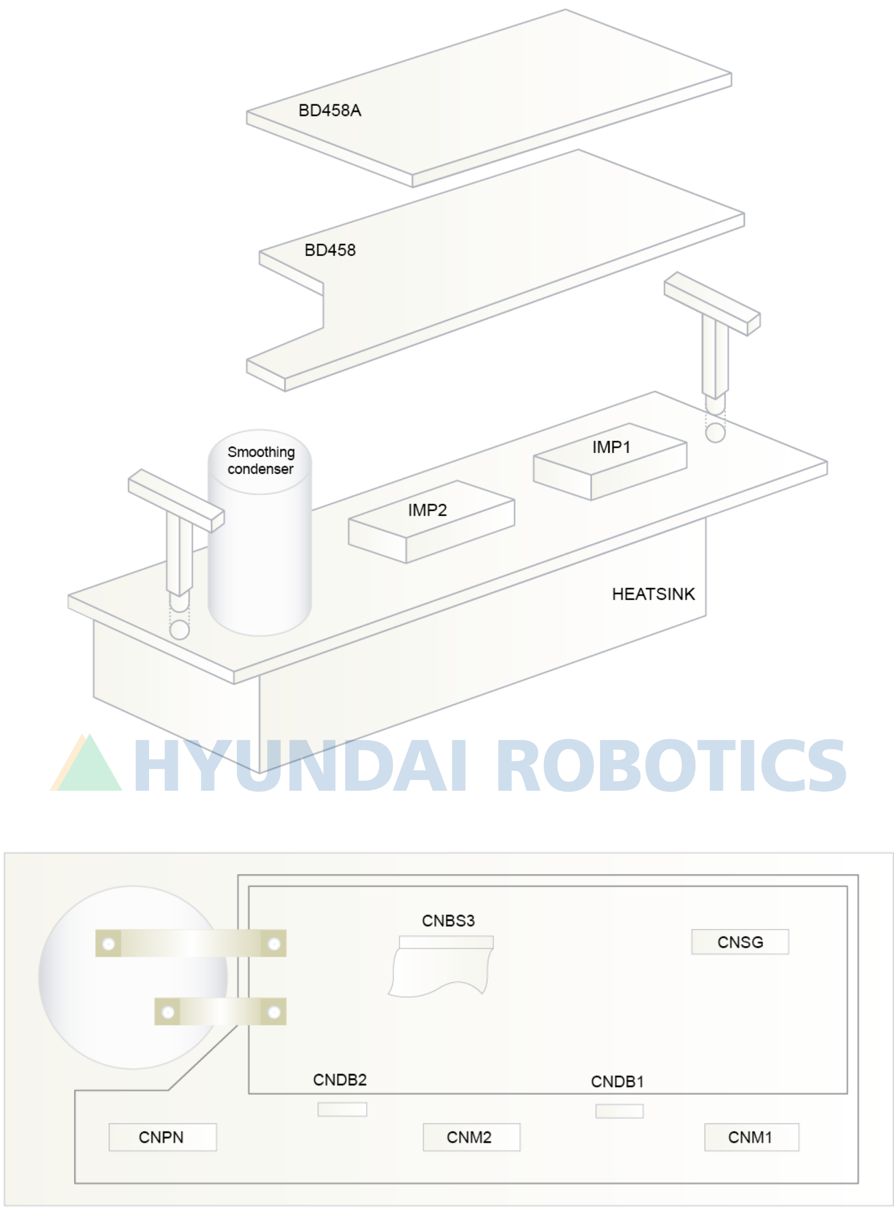


Fig. 4.56 Parts Configuration of HSXY2 Drive Unit

4.2.2.1. HDAD2(Small Size 2-Axis Drive Unit ; optional)

Drive Unit performs a power amplifying function to send current to motor in each phase by the instruction for current from servo board. Small sized 2-Axis monolithic type of Drive Unit can operate 2 motors simultaneously, and its components are as follows.

Table 4-58 Components of HDAD2(Small Size 2-Axis Drive Unit ; optional)

Components		**Function**
BD456 (AMP Board)	**Logic Parts**	Separating IPM top/bottom drive signals from PWM signal of servo board, and performing error processing & regeneration control
	Gate Power Module	Generating gate power
	Current Detecting Part	Detecting a current in motor
Other Parts	**Heat Sink**	Emitting out heat generated from IPM
	IPM	Switching device

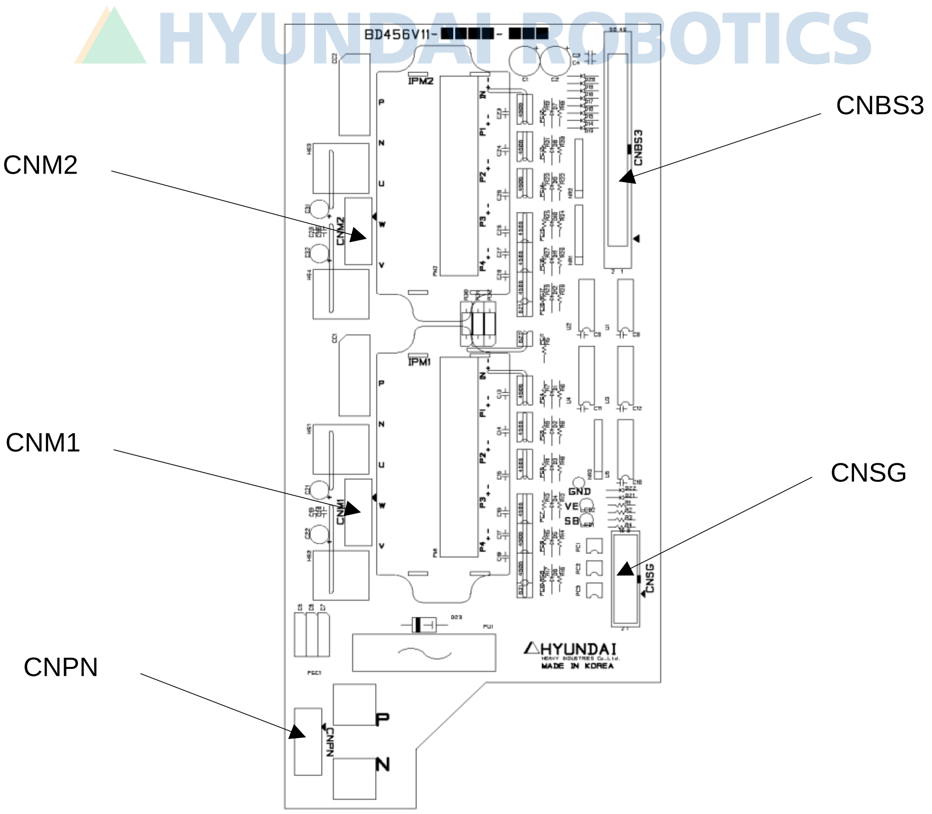


Fig. 4.57 Parts Configuration of HDAD2 Drive Unit

Table 4-59 Descriptions of HDAD2(Small Size 2-Axis Drive Unit ; optional) Connector

Name	Uses	Connection with External Devices
CNBS3	PWM signal, Encoder error signal	Servo Board(BD440) CNBS3
CNSG	/PWMON	Sequence Board(BD461) CNSG2
CNPN	PN voltage input from HDAD6	CNPN of HDAD6
CNM1~2	Current output to additional axis motor	CNR5

Table 4-60 Descriptions of HDAD2(Small Size 2-Axis Drive Unit ; optional) LED

Name	Color	Status Display
SB	Yellow	Lighting up in case of PWM ON
VE	Green	Lighting out when voltage drop occurs

4.2.3. DC Power Unit

It supplies DC power to all parts in the controller.

4.2.3.1. SMPS(SR1)

It is a power supply unit that generates several kinds of stable direct current with AC(45V~50V) power input, and supplies it to board, drive unit, and Teach Pendant.

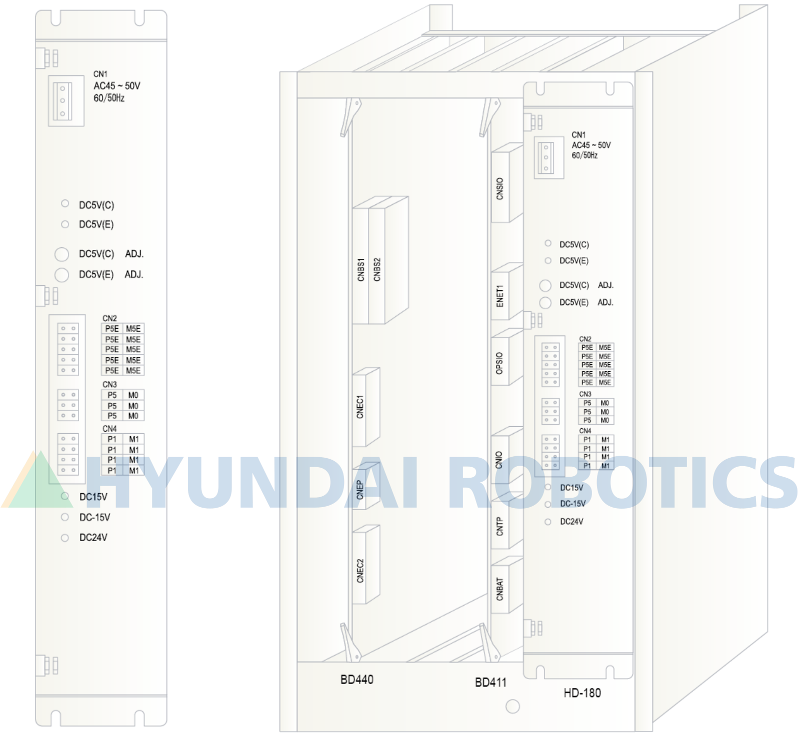


Fig. 4.58 Exterior View of SMPS SR1 & Its Location in Rack

Table 4-61 SMPS(SR1) Standard (Input Voltage ; AC 45V~50V, 50/60Hz)

Rated Output		Uses	Connection
Voltage	**Current**	Drive power for board in Rack	Mother Board(BD400)
DC+5V(C)	**8.29A**	Drive power for board in Rack	Mother Board (BD400)
DC+15V	**3.5A**	Control power for analog part in servo board	Mother Board (BD400)
DC-15V	**0.8A**	Control power for drive unit	Mother Board, DSP Board CNBS1
DC+24V	**1.87A**	Sequence, I/O, Teach Pendant power	Dispersed supply & direct connection through Terminal Block
DC+5V(E)	**4A**	Motor Encoder Power	CNR4

5
Troubleshooting

5.1. Troubleshooting cases

Hi4a controller emphasizes on high-precision and high-speed(promptness). So, it is designed to facilitate troubleshooting when troubles occur.
Please be fully aware of this MANUAL for troubleshooting.

5.1.1. E0002 H/W LMT switch on
5.1.2. E0004 Arm interference switch on

5.1.2.1. Outline

The limit switch that is installed at the end of the operation area of each axis of the robot has been activated. The robot will be immobilized immediately for safety reasons and will not be operational until it is moved to a safe operation area through an appropriate method.

5.1.2.2. Causes and checking methods

(1) Please confirm if the robot actually went out of the operation area.
- Methods for recovery when deviating from the operation area

(2) If an error occurs even though the robot is in the operation area
- Checking method from a system board connector (CNLS)
- Checking method from a wire harness (CNR4 or CNR04)
- Checking method by examining the limit switch and the internal wiring of the main frame

(1) Please confirm if the robot actually went out of the operation area.

Please confirm if the robot actually went out of the operation area. If a soft limit error has occurred simultaneously, the robot did go out of the operation area.
Please take an appropriate action to move the robot back into the operation area.
The operation area may vary depending on each robot model, so as the installed location of limit switches. Please refer to the corresponding robot's maintenance manual, "Limitations of Operation Area."

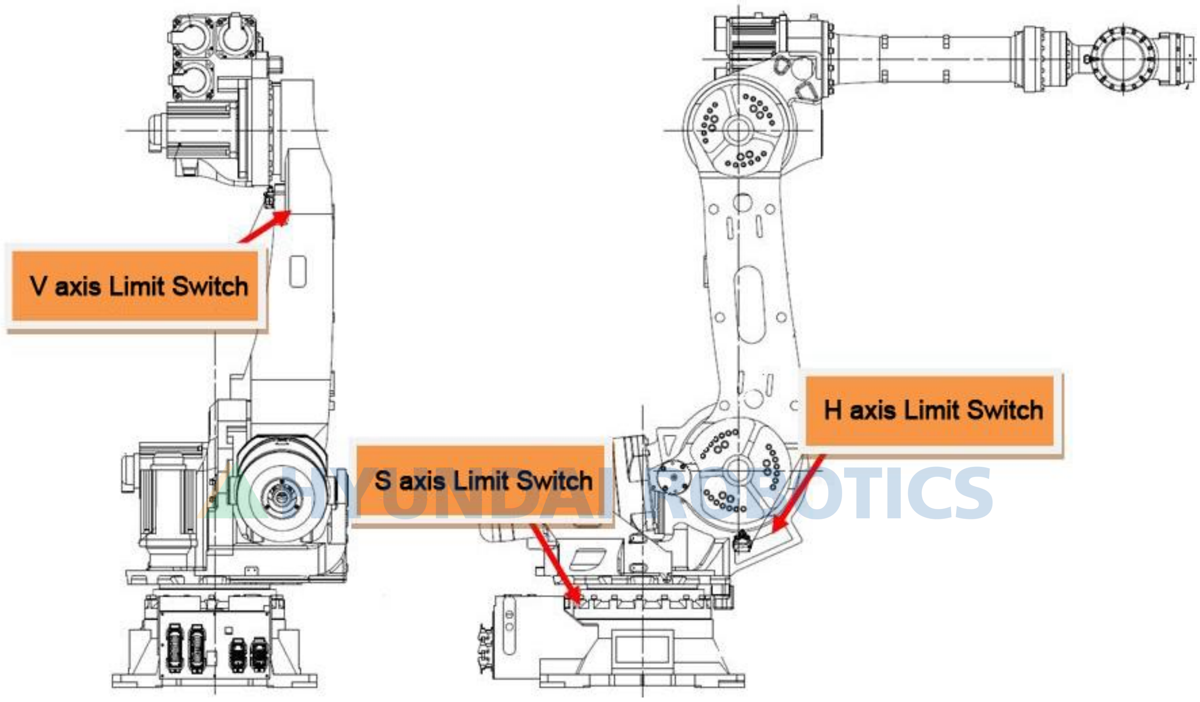


Fig. 5.1 Installed locations of the hardware limit switches

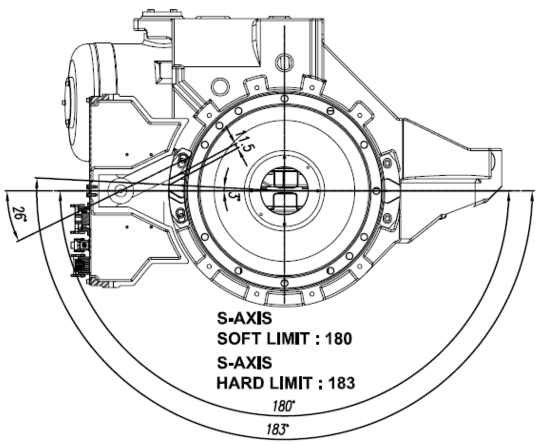


Fig. 5.2 Operation area for the S-axis limit switch

- **Methods for recovery when deviating from the operation area**

Please take the following actions to move a robot while the hardware limit switch is on. First, enter the system on manual mode, and turn on the enabling switch of the teach pendant.

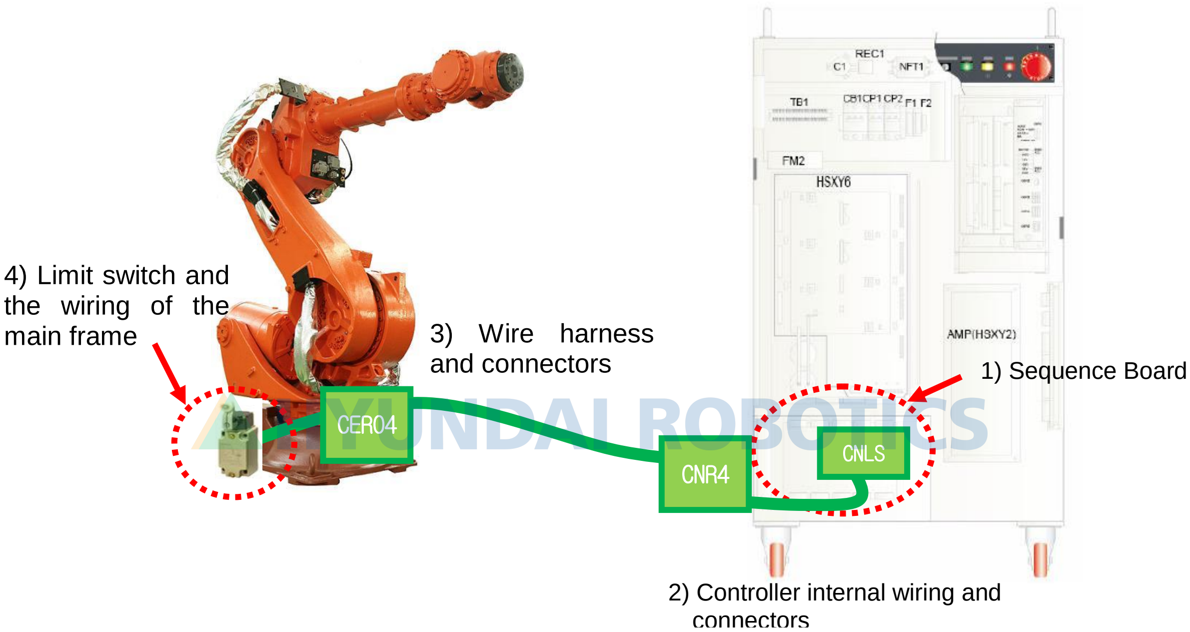
Manual mode	+	**System**	+	**Turn on the TP's enabling switch**

From this stage, execute the motor on command, and move the robot back into the operation area by using a jog key.

(2) If an error occurs even though the robot is in the operation area

First, check if the limit (over-travel) is being entered consecutively from the Private input signal window of the teach pendant.
This window can be accessed by selecting “[F1]: Service” → “1: Monitoring” → “2: Input/output signal” → “1: Private input signal.”
A yellow color on the limit (over-travel) indicates an error status.

In these cases, the cause of this error can be found from the components that are related to the limit switch. As shown in the diagram below, the limit switch is connected to a controller’s system board from a main frame by using “CER1–CEC1” cables.



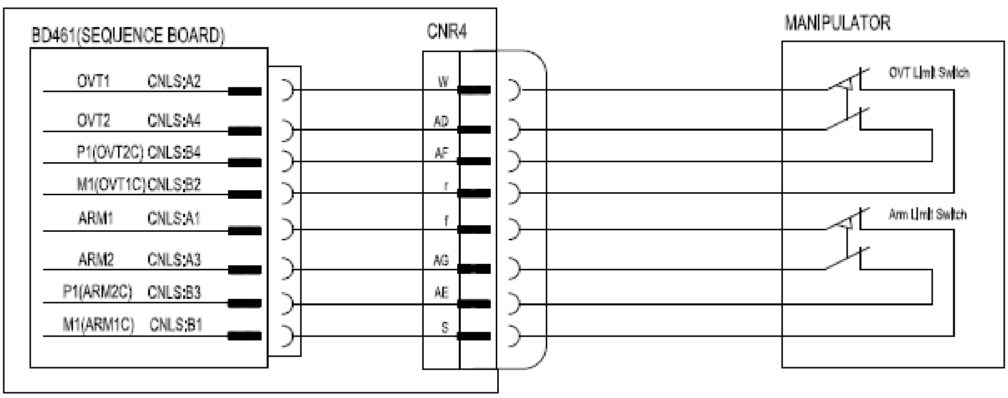


Fig. 5.3 Wirings that are related to a limit switch status input

The main checkpoints and their orders are as follows

① Sequence Board
② Controller internal wiring and connectors
③ Wire harness and connectors
④ Limit switch and the wiring of the main frame

and please jump the input line of the limit switch at an appropriate point to check if a limit (over-travel) from the monitoring windows turns to white color.

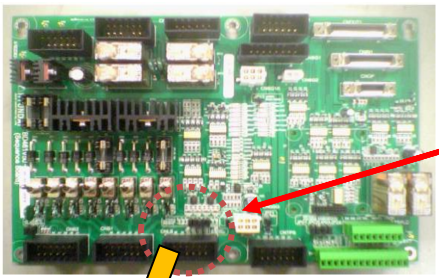
Please proceed as follows.

■ **Checking method from a system board connector (CNLS)**

Warning
Please make sure that the power of a controller has been completely turned off before you connect or remove any cable. Electrocution may cause physical injuries or damage of properties.

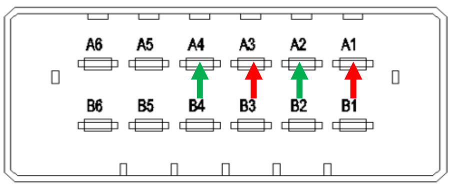
This method uses the CNLS connector of the system board to judge if board malfunction caused this error.
Please jumper short the pins that are related to the limit switch's input from a CNLS connector, as shown below. At this stage, please check the limit (over-travel) from the Private input signal monitoring window.

① If it turned to white, system board malfunction caused this error. Please replace the board.
② If it still turned to yellow, please search a problem that caused this error in an area between the system board and the limit switch of main frame.



※ *Refer to Sequence board (BD530)*

CNLS Connector



Arm limit switch
Safety chain "1" input : A1 – B1 pin jumper short
Safety chain "2" input: A3 – B3 pin jumper short

Overtravel limit switch
Safety chain "1" input : A2 – B2 pin jumper short
Safety chain "2" input : A4 – B4 pin jumper short

■ Checking method from a wire harness (CNR04 or CNR41)

Warning
Please make sure that the power of a controller has been completely turned off before you connect or remove any cable. Electrocution may cause physical injuries or damage of properties.

This method uses a wire harness connector (CNR04 or CNR4) to judge if cable malfunction caused this error.
Please remove the CNR4 wire harness, and jumper short the pins that are related to the limit switch from the CNR4 connector that is attached to a controller. At this stage, please check the limit (over-travel) from the Private input signal monitoring window.

① If it turned to non-inverting,
the internal CNR4 connector (of a controller) – system board cable or a connector malfunction caused this error. Please examine or replace them.

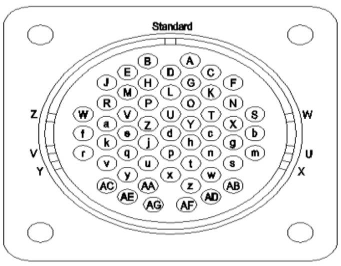
② If it is still inverting, which indicates that the error persists,
please search the problem that caused this error in the area between the CNR4 connector and the limit switch of the main frame.

Please reconnect the CNR4 wire harness, and remove the CNR04 wire harness from the main frame. After that, please jumper short the pins that are related to the limit switch from the CNR04 connector.
At this stage, please check the limit (over-travel) from the Private input signal monitoring window.

① If it turned to non-inverting,
the wire harness cable between the CNR04 connector – CNR4 connector or a connector malfunction caused this error. Please examine or replace them.

② If it is still inverting, which indicates that the error persists,
please search the problem that caused this error in the area between the main frame side's CNR04 connector and the limit switch.

CNR4



Arm limit switch
Safety chain "1" input : f – S
Safety chain "2" input : AG – AE

Overtravel limit switch
Safety chain "1" input : r – W
Safety chain "2" input : AF – AD

- **Checking method by examining the limit switch and the internal wiring of the main frame**

Warning
Please make sure that the power of a controller has been completely turned off before you connect or remove any cable. Electrocution may cause physical injuries or damage of properties.

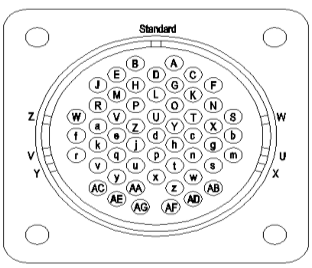
Please remove the CNR04 wire harness from the main frame, and use a multimeter to run a short (shortage) test to examine the lines that are related to the limit switch from the main frame's CNR04 connector.

① If the resistance is measured as open status,
a limit switch or a limit switch – CNR01 connector, or a connector malfunction is suspected. Please examine or replace them.

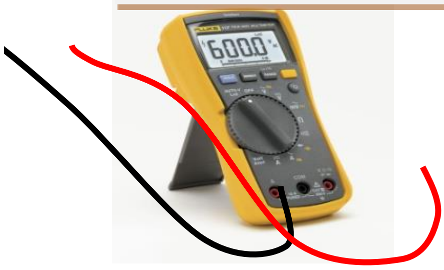
② If the resistance is measured as short (shortage) status,
other parts need to be examined. Please make an inquiry to our office.

Arm limit switch
Safety chain "1" input : f – S
Safety chain "2" input : AG – AE

CNR4



Overtravel limit switch
Safety chain "1" input : r – W
Safety chain "2" input: AF – AD



5.1.3. E0003 Overload relay or CP tripped

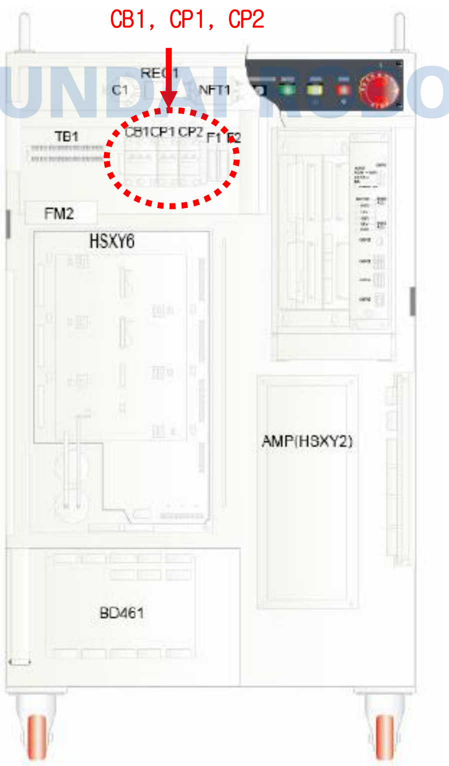
5.1.3.1. Outline

Because of overload, the 220 V circuit protector was disconnected. Recover the circuit protector on top of the controller. If the error persists, replace the sequence board. If the error still exists, contact our office because there is internal short circuit.

5.1.3.2. Causes and checking methods

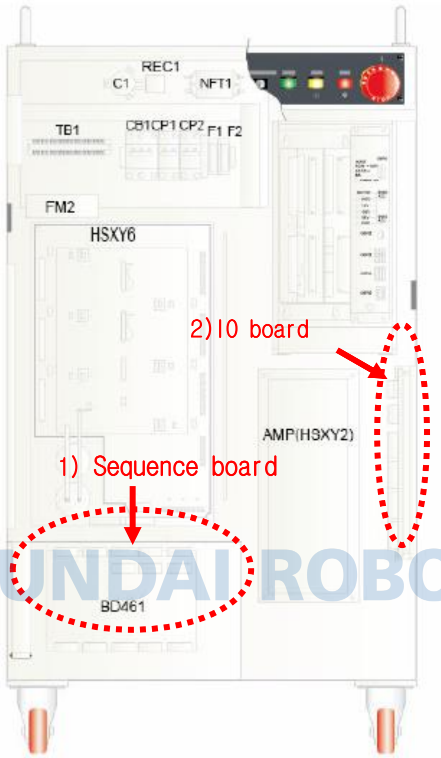
1. Recover the circuit protector. **2. If the problem persists,** **2.1 Replace the sequence or IO board.** **2.2 Contact our office.**

1. Recover the circuit protector.



2. If the problem persists,

1) Replace the sequence board.
2) Replace the IO board.
3) Contact our office.



5.1.4. E0008 Motor temperature is risen

5.1.4.1. Outline

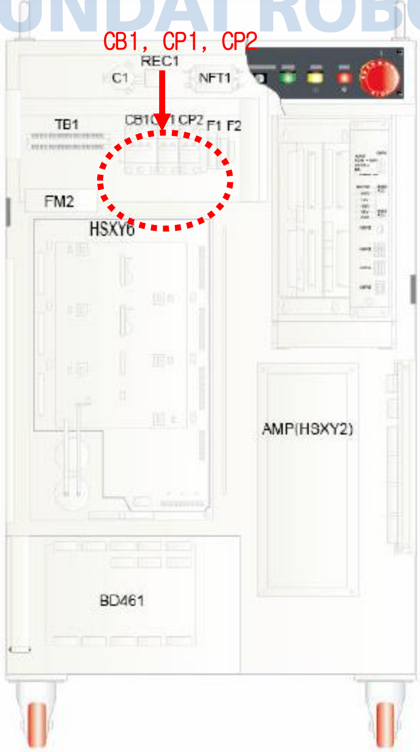
Motor temperature exceeded the normal value so the embedded temperature sensor was activated. If the error occurs without the motor temperature increase, there must be a problem with the input system.

5.1.4.2. Causes and checking methods

1. **Check the circuit protector.**
2. **Ignore the TS input signal.**
3. **Check the voltage of the power generator of the brake section.**
   - **3.1 Replace the sequence board or IO board.**
   - **3.2 Contact our office.**

1. **Check the circuit protector.**

As circuit disconnection may occur, check if the circuit is disconnected on top of the controller and repair it if necessary.

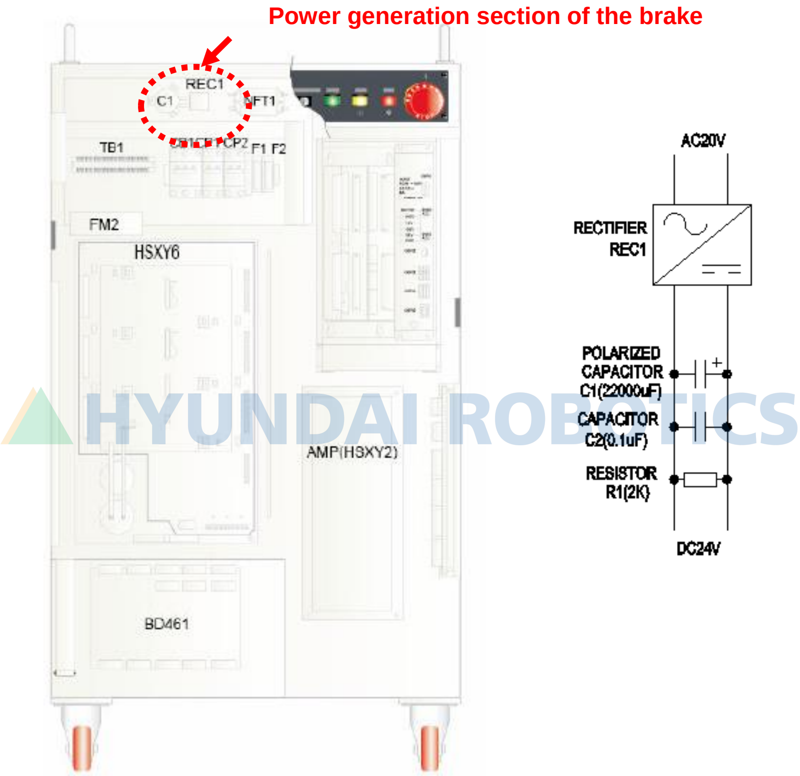


2. Ignore the TS input signal.

Ignore the TS input signal, and check the input line. Refer to the Sequence Board section of the Maintenance Manual on how to ignore the TS input signal.

3. Check the voltage of the power generator of the brake section.

There may be a problem with the power generation section of the brake. The capacitor and rectifier are installed on top of the controller. A DC24V power is generated from the 20 V one. Check if the DC24V is generated by using a tester.



If the problem persists, take actions in the following order.

1) Replace the sequence board.
2) Replace the IO board.
3) Contact our office.

5.1.5. E0010 Discharge resister overheated(AMP)

5.1.5.1. Outline

The recovery electric power that was generated when the robot reduces speed or moves toward the direction of gravity is discharged by resistance.
This error is related to an overheat caused by the resistance.
This error may occur due to a reduced performance of the cooling fan, an overheat detection sensor’s circuit malfunction, a disconnection of the resistor, an overload of the recovery discharge capacity caused by momentary rapid movement, or the continuous movement of the robot.

5.1.5.2. Causes and checking methods

< Case: Error always occurs even when the motor is off.>

(1) Check the parts related to the overheating error detection.

- Please examine the resistor of the CNTR cable.
- Please replace the CNSG cable and examine it.
- Please replace the Servo drive unit and examine it.
- Please replace the BD461/BD430 board and examine it.

< Case: Error always occurs at the moment when the motor is turned on.>

(2) Please examine the components that are related to power.

- Check the resistance value of the regenerative resistor connection cable.
- Please replace the Servo drive unit and examine it.
- Please examine the internal three-phase voltage of the controller.
- Please examine the input three-phase voltage of the controller

< Case: Error occurs at a certain step according to the robot’s operation speed.>

(3) Change the robot playback speed and then check the error.

- Please reduce the speed of the robot’s operation to confirm the error.
- Check the regenerative discharge resistor value.

< Case: Error occurs after five minutes from the start of the robot’s operation.>

(4) Please examine the controller’s cooling system and recovery electric power level

- Please examine the operational status of each fan.
- Please examine the power voltage of each fan.
- Please reduce the speed of the robot’s operation to confirm the error.

(1) Check the parts related to the overheating error detection.
The recovery resistance overheat error is detected by the Servo drive unit. Each end's on/off status of the overheat sensor that is attached to a recovery resistor is being monitored by the CNTR connector. Detected error will be sent through the CNSGC cable to be handled by the software at the BD461/BD430 board.

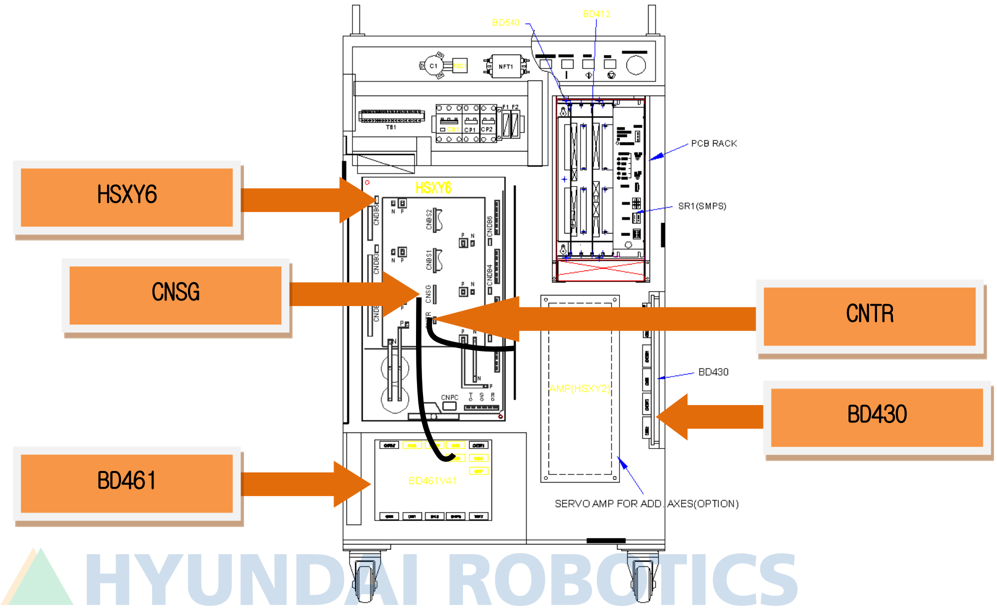


Fig. 5.4 Locations of components in the Hi4a-0000 controller that are related to the recovery resistance overheat error

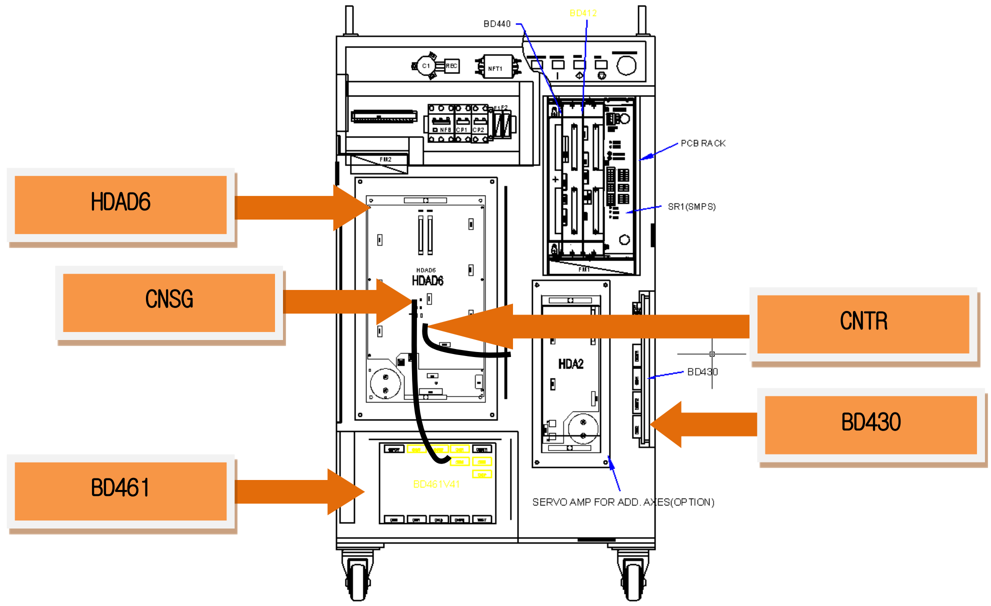


Fig. 5.5 Locations of components in the Hi4a-0010/0012 controller that are related to the recovery resistance overheat error

- Examining the CNTR cable
  Please examine the sensor from the CNTR connector that connects the overheat detection sensors. In a normal status, the sensor must be measured as less than 0.1 Ω. Make sure to turn off the controller before inspecting it.

  Medium-size robot's Servo drive unit : HSXY6
  Small-size robot's Servo drive unit : HDAD6

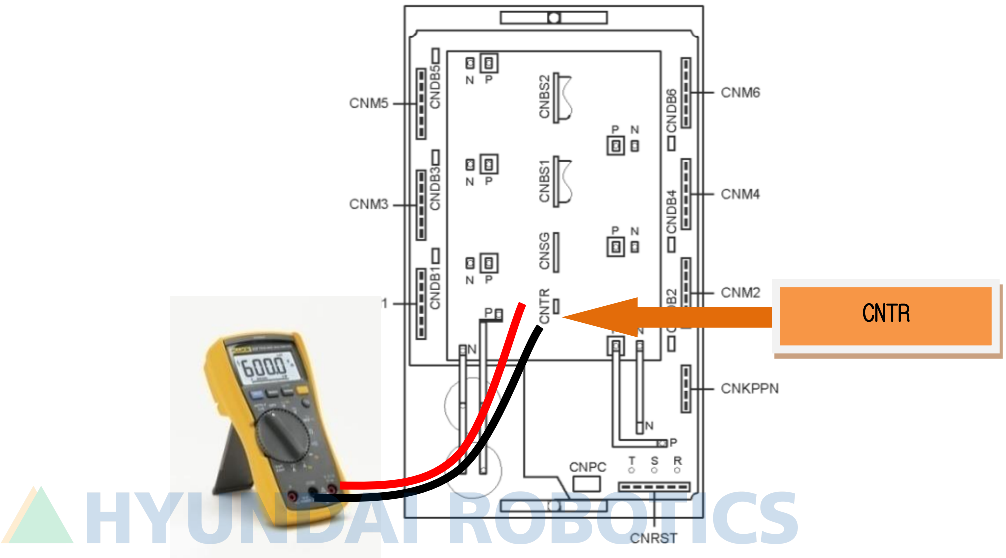


Fig. 5.6 Measuring the resistance value from the Hi4a-0000 controller's CNTR

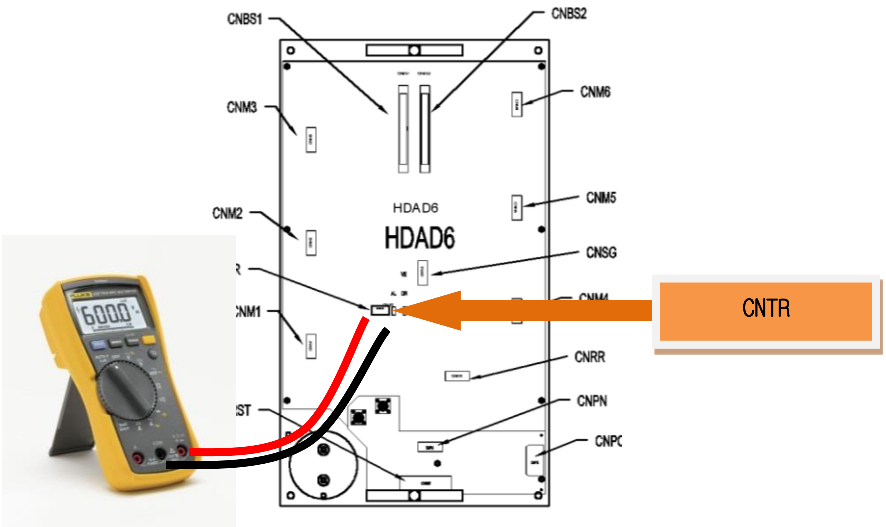


Fig. 5.7 Measuring the resistance value from the Hi4a-0012/0012 controller's CNTR

- Replacement and examination of the CNSG cable
  Replace the CNSG cable with a new one and test it. If the error does not persist, cable connection problem caused this error. Please replace the CNSG cable with a new one.

- Replacement and inspection of servo drive unit
  The components that detect the recovery discharge resistance overheat error are the HSXY6 (medium size) and the HDAD6 (small size). Please check the components in the controller that you are currently using and examine it. Please replace it with a new one and see if the error persists.

  Medium-size robot's Servo drive unit : HSXY6
  Small-size robot's Servo drive unit : HDAD6

- Replacement and examination of the BD461/BD430
  Replace the BD461/BD430 with a new one and test it. If the error does not persist, board malfunction caused this error. Please replace the BD530/BD531 with a new one.

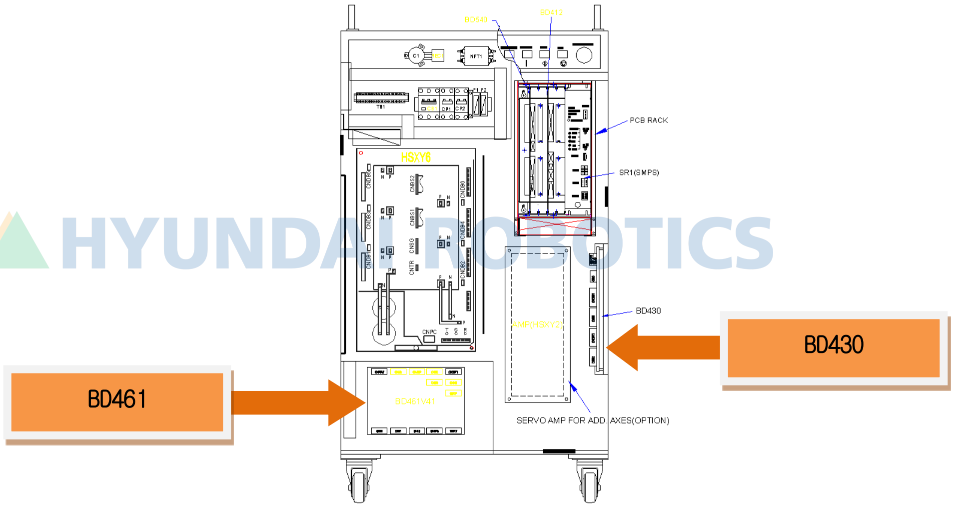


Fig. 5.8 Replacement of the Hi4a-0000 controller's BD461/BD430

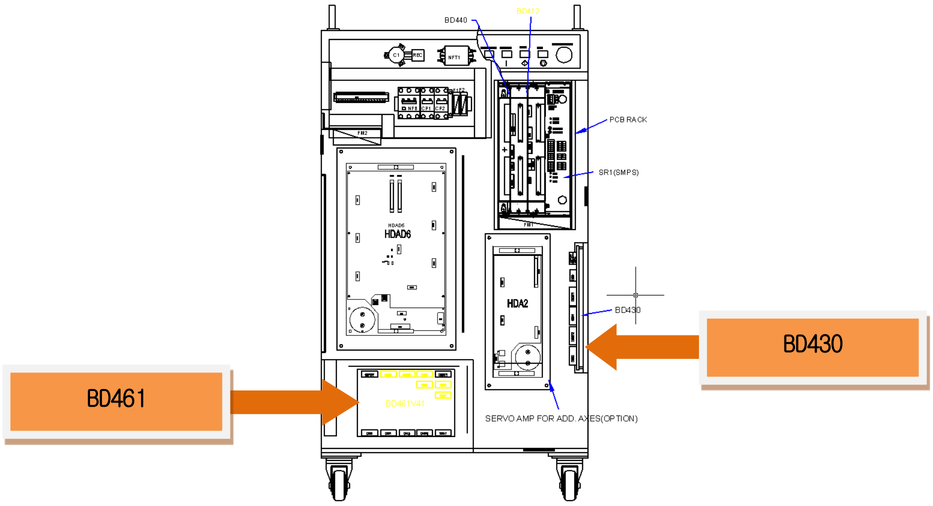


Fig. 5.9 Replacement of the Hi4a-0010/0012 controller's BD461/BD430

(2) Check the parts related to the power.

The overheating error could also occur due to the disconnection of the resistor or an abnormality with the discharge control. In addition, the error could occur due to an increase in the regenerative discharge resistor value or the three-phase power voltage.

- Examining the recovery discharge resistor’s disconnection
  If the measured resistance value at the end of the cable for connecting the recovery discharge resistance is several M ohms(mega-ohm, MΩ), the resistor’s disconnection or connection problem of internal wiring caused this error. Please replace the recovery resistor with a new one or repair the wiring. Make sure to turn off the controller before inspecting it.

  Medium-size (HSXY6) recovery discharge resistance value: 7.5 Ω (Between K and P of the CNKPPN connector)
  Hi4a-0010 recovery discharge resistance value : 25 Ω (Between K and P of the CNRR connector)
  Hi4a-0012 recovery discharge resistance value : 15 Ω (Between K and P of the CNRR connector)

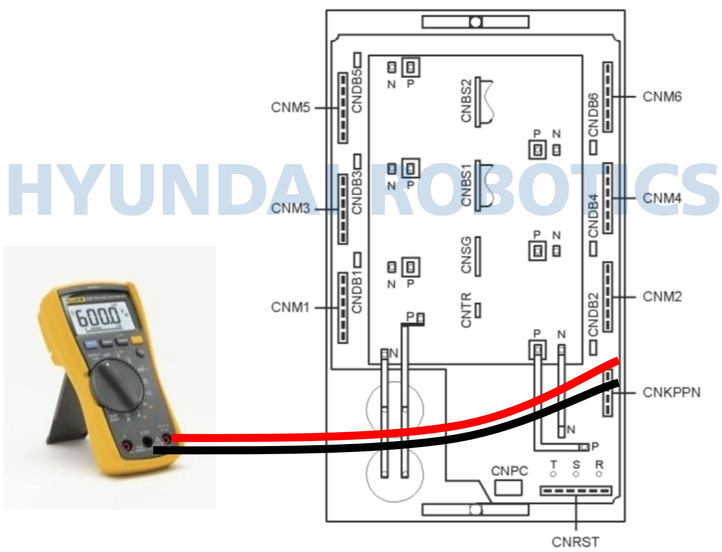


Fig. 5.10 Measuring the resistance value from the Hi4a-0000 controller’s CNKPPN

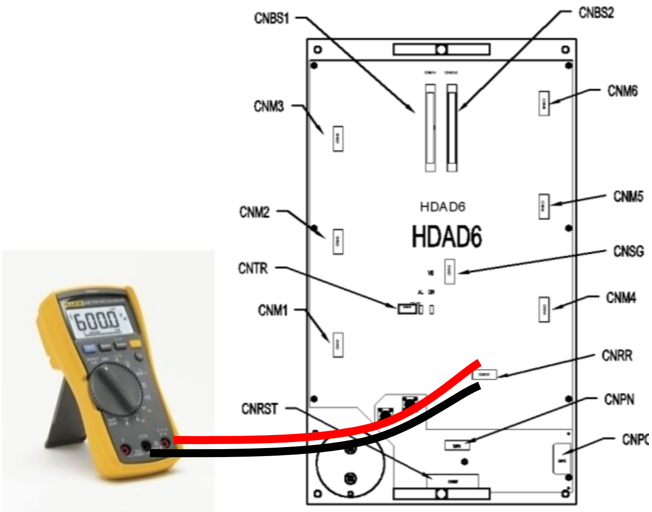


Fig. 5.11 Measuring the resistance value from the Hi4a-0010/0012 controller’s CNKPPN

- Replacement and inspection of servo drive unit
  Please replace the module (HSXY6 for medium size, HDAD6 for small size) that detects the recovery discharge resistance overheat error, and check if an error persists. An error may occur continuously due to the module’s internal circuit malfunction.

  Medium-size robot’s Servo drive unit : HSXY6
  Small-size robot’s Servo drive unit : HDAD6

- Examine the three-phase voltage (inside the controller)
  Recovery discharge operation activates from approximately DC 375 V. If a voltage of more than AC 242 V enters the Servo drive unit, a recovery discharge resistance overheat error may occur when the motor is turned on. If the input voltage exceeds the allowed range, please examine according to the controller’s input voltage examination procedures and three-phase internal voltage examination procedures.

  - Servo drive unit input voltage specification: Three-phase AC220V
  - Allowable range when the motor is on: Three-phase AC 198V ~ 242V

(3) Change the robot playback speed and then check the error.

In case the robot's speed is reducing or moving toward the direction of gravity, the direct current voltage of a Servo drive unit increases, and the voltage will be discharged with a recovery discharge resistance to prevent damage on the components that may be caused by voltage increase.
If a robot reduces its speed rapidly, or makes a high-speed movement toward the direction of gravity, it may cause this error. Please confirm if this error occurs according to the speed of the robot's operation.

- Make changes on the speed of the robot's operation.
  If the recovery electric power that was generated by the robot's operation exceeds the controller's designed specification, recovery resistance overheat error may occur. Please reduce the speed of the step in which the error occurs and re-operate to confirm if the error persists.

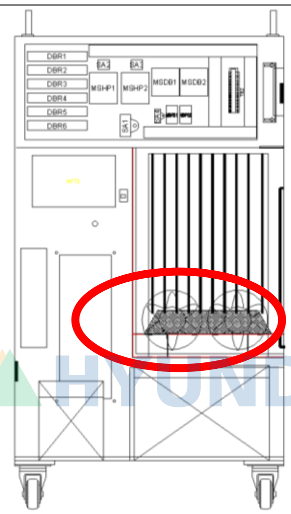
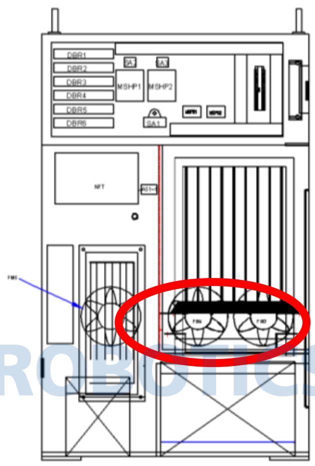
- Examining the recovery discharge resistance value
  If the resistance value measured at the end of the regenerative resistor connection cable exceeds the value stated in the manual by 10% or more, the resistor has a flaw. Please replace the resistor. Make sure to turn off the controller before inspecting it. Please refer to the previous page for the measuring method.

  Medium-size (HSXY6) recovery discharge resistance value : 7.5 Ω (Between K and P of the CNKPPN connector)
  Hi4a-0010 recovery discharge resistance value : 25 Ω (Between K and P of the CNRR connector)
  Hi4a-0012 recovery discharge resistance value : 15 Ω (Between K and P of the CNRR connector)

(4) Please examine the controller's cooling system and recovery electric power level.

If the recovery resistance overheat error occurs five minutes after the start of the robot's activation, the cause would be either the controller's cooling system has experienced a malfunction or the speed of the robot's operation exceeded the designed specification of the controller. Fans are being used at the rear of the controller to cool down the Servo drive unit's heat sink and the recovery discharge resistor.

Table 5-1 Location of the fans for each controller

Hi4a-0000	Hi4a-0010/0012
	

- Examining the operational status of each fan
  Please replace a fan if it does not spin or the speed is abnormally slow. The life span of a fan may vary according to the operating environment or the amount of operation hours.

- Examining a fan's power voltage
  Please check the input voltage of fans if all of them do not operate. The input voltage of a fan is set to AC 220 V, and the allowed range is within 10% of the standard voltage. If the voltage is lower than 10% of the standard voltage, the cooling effect will be reduced due to the slow spinning speed of a fan. In case when the voltage is low, please check the input voltage for the fan's power and the controller.

- Please confirm an occurrence of an error according to the speed of the robot's operation.
  If an overheat error occurs during a continuous operation of more than five minutes, it is because the consecutive operation of the robot exceeded the cooling capacity of the controller. Please reduce the speed of the robot's operation, and check if the error persists. To resolve this error, if you had to reduce the operation speed too much just to resolve this error, please inquire at our office.

5.1.6. E0011 Overvoltage in the drive unit

5.1.6.1. Outline

The direct current voltage (P-N) of the Servo drive unit that drives the motor exceeded the set value.

5.1.6.2. Causes and checking methods

< Case: Error always occurs even when the motor is off. >

(1) Check the parts related to the overvoltage error detection.
- Please replace the CNSG cable and examine it.
- Please replace the BD461/BD430 board and examine it.
- Check after replacing the servo drive unit.

< Case: Error always occurs at the moment when the motor is turned on. >

(2) Please examine the components that are related to power.
- Check after replacing the servo drive unit.
- Check the controller internal three-phase voltage.
- Check the controller input three-phase voltage.

< Case: Error occurs at a certain step according to the robot’s operation speed>

(3) Change the robot playback speed and then check the error.
- Please reduce the speed of the robot’s operation to confirm the error.
- Check the regenerative discharge resistor value.

(1) Check the parts related to the overvoltage error detection.

AMP overvoltage occurrence error is detected by the diode module when the direct current voltage (P-N) that has been supplied to the Servo drive unit exceeds the configured level. Detected error will be sent through the CNSG cable to be handled by the BD461/BD430 board.

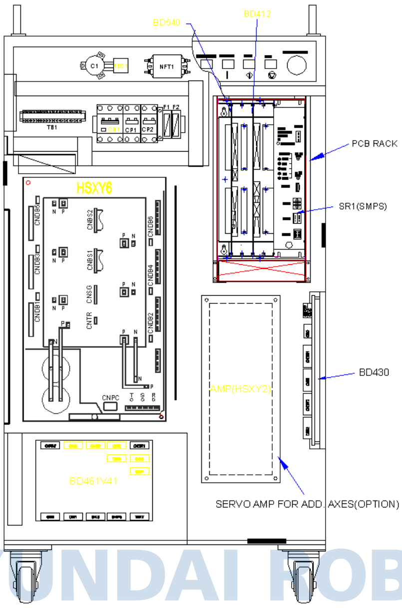


Fig. 5.12 Locations of components in the Hi4a-0000 controller that are related to the overvoltage occurrence error

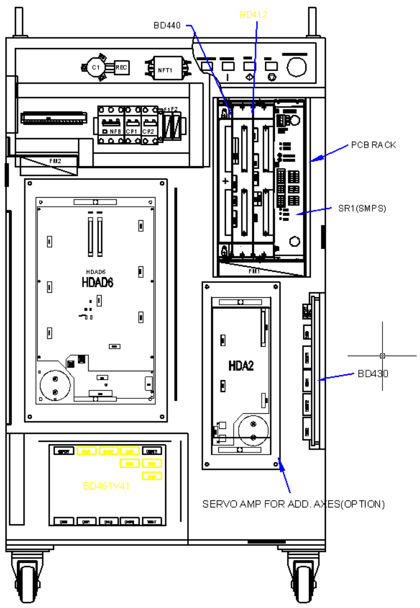


Fig. 5.13 Locations of components in the Hi4a-0010/0012 controller that are related to the overvoltage occurrence error

- Replacement and examination of the CNSG cable
  Replace the CNSG cable with a new one and test it. If the error does not persist, cable connection problem caused this error. Please replace the CNSG cable with a new one.

- Replacement and inspection of servo drive unit
  The components that detect the overvoltage occurrence error are the HSXY6 (medium size) and the HDAD6 (small size). Please check the components in the controller that you are currently using and examine it. Please replace it with a new one and see if the error persists.

  Medium-size robot’s Servo drive unit: HSXY6
  Small-size robot’s Servo drive unit: HDAD6

- Replacement and examination of BD461/BD430
  Replace the BD461/BD430 with a new one and test it. If the error does not persist, board malfunction caused this error. Please replace the BD461/BD430 with a new one.

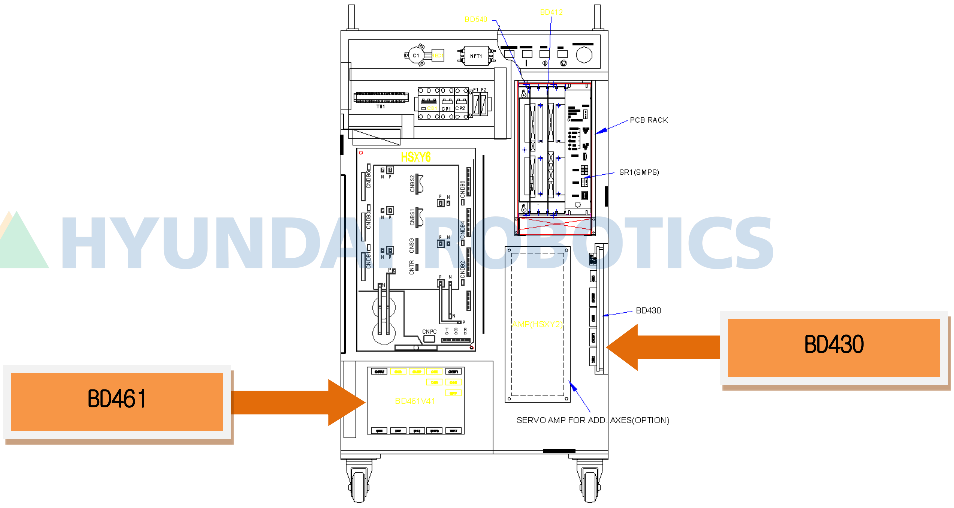


Fig. 5.14 Replacement of the Hi4a-0000 controller’s BD461/BD430

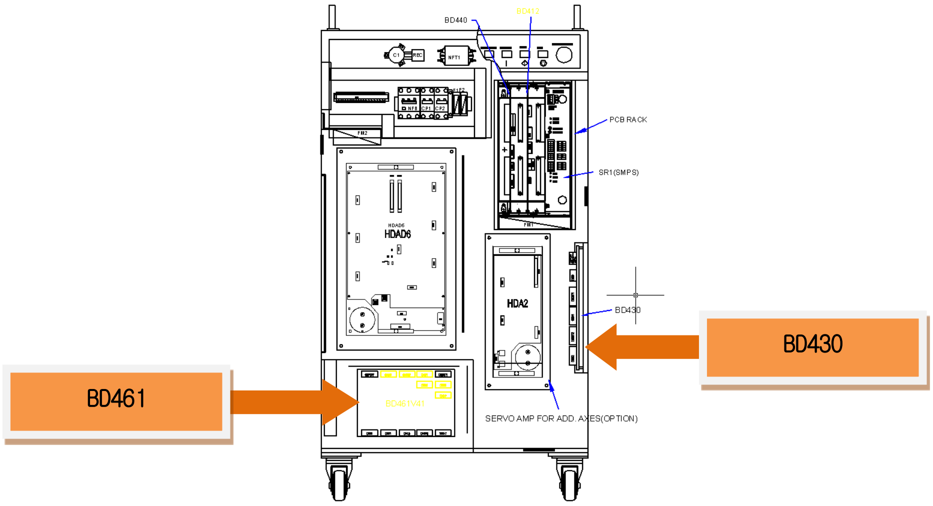


Fig. 5.15 Replacement of the Hi4a-0010/0012 controller’s BD461/BD430

(2) Please examine the components that are related to power..

Overvoltage error occurs when the direct current voltage that exceeds DC 395 V due to the three-phase input voltage over AC 220 V enters the Servo drive unit.

- Replacement and inspection of servo drive unit

  The components that detect the overvoltage occurrence error are the HSXY6 (medium size) and the HDAD6 (small size). Please check the components in the controller that you are currently using and examine it. Please replace it with a new one and see if the error persists.

  Medium-size robot's Servo drive unit: HSXY6
  Small-size robot's Servo drive unit: HDAD6

- Examine the three-phase voltage.

  AMP overvoltage error is activated from approximately DC 395 V. If a voltage over AC 242 V enters the Servo drive unit, a recovery discharge resistance overheat error may occur when the motor is turned on. If the input voltage exceeds the allowed range, please examine according to the controller's input voltage examination procedures and three-phase internal voltage examination procedures.

  - Servo drive unit input voltage specification: Three-phase AC220V
  - Allowable range when the motor is on: Three-phase AC 198V ~ 242V

(3) Please confirm the occurrence of error according to the speed of the robot's operation.
If the robot reduces speed rapidly or makes a high-speed movement toward the direction of gravity, it can cause an overvoltage error. Please confirm if an error occurred according to the speed of the robot's operation. AMP overvoltage occurrence error can also be caused by an invalid recovery discharge resistance value or recovery discharge control malfunction. In case when a robot's speed is reducing or moving toward the direction of gravity, the voltage of the Servo drive unit increases and will be discharged with a recovery discharge resistance to prevent damages on the components that may be caused by an increased voltage.

- Make changes on the speed of the robot's operation.
  If a recovery electric power that was generated by the robot's operation exceeds the controller's designed specification, overvoltage error may occur. Please reduce the speed of the step in which the error occurs, and re-operate to confirm if the error persists. If the error does not occur when the speed is reduced, please change the speed of the step and use it.

- Examining the recovery discharge resistance value
  If the recovery resistance value is greater than the specification, the recovery discharge does not perform well, and it will cause the overvoltage error. Please replace the recovery discharge resistor with a new one or repair the wiring. Make sure to turn off the controller before inspecting it.

  Medium size (HSXY6) recovery discharge resistance value: 7.5Ω (Between K and P of the CNKPPN connector)
  Hi4a-0010 recovery discharge resistance value : 25 Ω (Between K and P of the CNRR connector)
  Hi4a-0012 recovery discharge resistance value : 15 Ω (Between K and P of the CNRR connector)

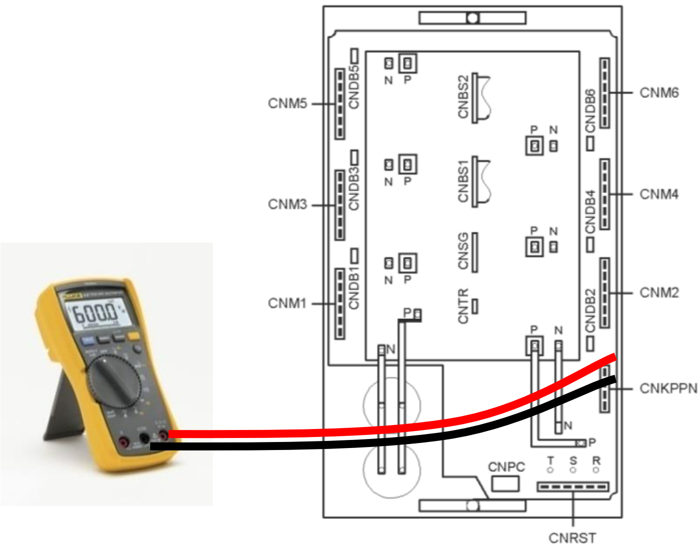


Fig. 5.16 Measuring the resistance value from the Hi4a-0000 controller's CNKPPN

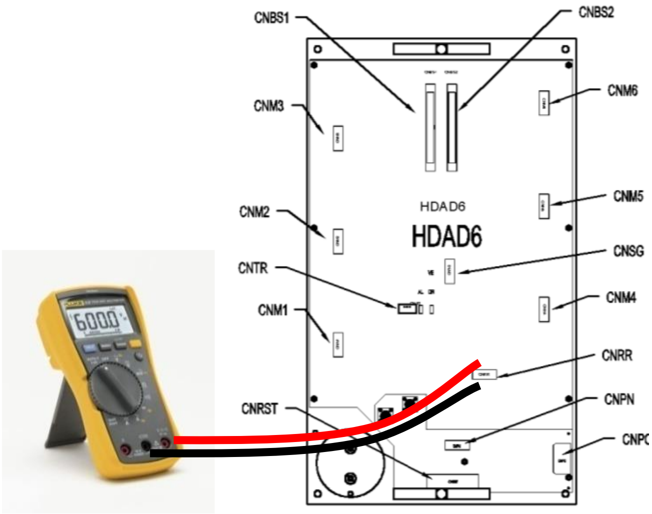


Fig. 5.17 Measuring the resistance value from the Hi4a-0010/0012 controller's CNKPPN

5.1.7. E0012 Brake power error

5.1.7.1. Outline

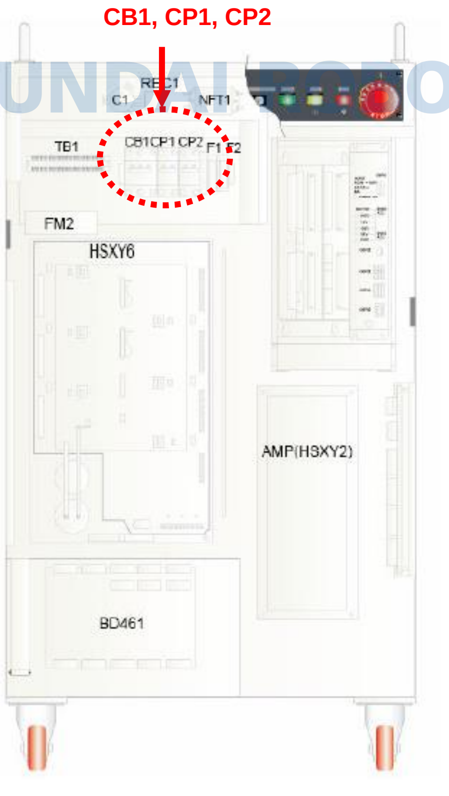
There is a problem with the power to operate the brake.

5.1.7.2. Causes and checking methods

1. **Check the circuit protector.**
2. **Check the voltage of the power generator of the brake section.**
3. **Please replace the sequence board or IO board.**
4. **Contact our office.**

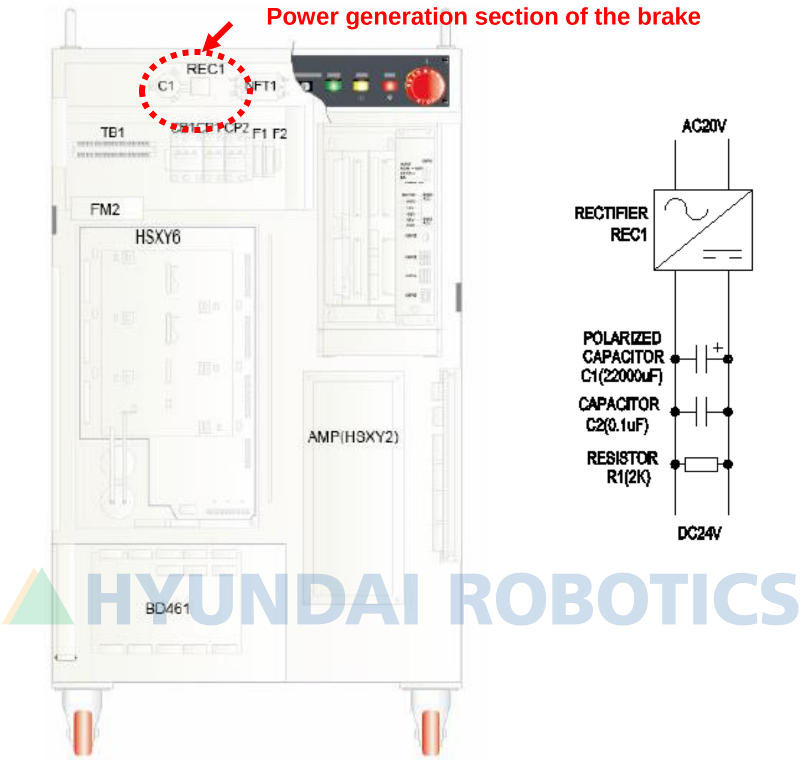
1. **Check the circuit protector.**

   As circuit disconnection may occur, check if the circuit is disconnected on top of the controller and repair it if necessary.



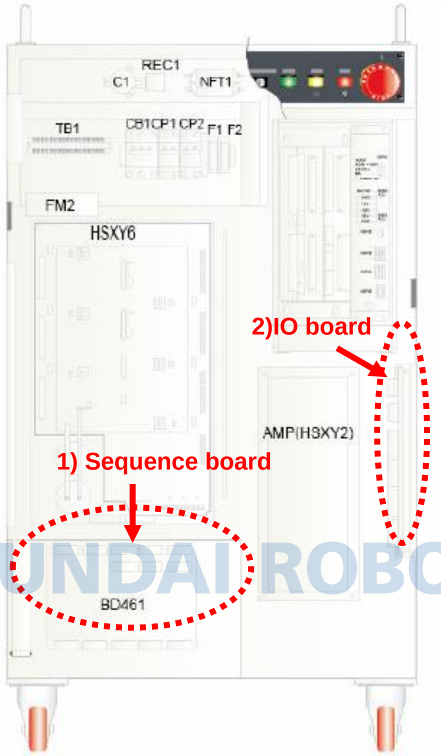
2. Check the voltage of the power generator of the brake section.

There may be a problem with the power generation section of the brake. The capacitor and rectifier are installed on top of the controller. A DC24V power is generated from the 20 V one. Check if the DC24V is generated by using a tester.



If there is no problem with generating brake power (DC24V), take actions in the following order.

1) Replace the sequence board.
2) Replace the IO board.
3) Contact our office.



5.1.8. E0015 Teaching pendant does not work

5.1.8.1. Outline

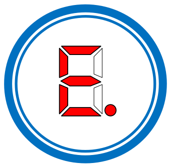
This error occurs when the communication is disconnected between the mainboard (BD412) and the teaching pendant (TP300), and it distinguishes causes for the mainboard and teaching pendant on the screen by displaying different error messages when transmitting or receiving data.

5.1.8.2. Causes and checking methods

1. **Please check the following information.**
   This is to check if the connection line is normal between the mainboard and teaching pendant.

   1) DC24V output voltage of SMPS
   2) CNRTP connector: Voltage between E,F (DC24V) and G,H (GND)
   3) Connection of CNRTP connector
   4) Check the TP cable for any damage

2. **Communication Line error**
   "Receive Line Error!" & 7-Seg. from the main board → [E.]

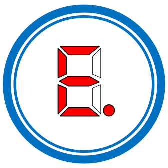


If the initial screen of TP is the same as the picture above

▶ Causes
: Short circuit of the received data line system of the TP cable → [CNTP] pin(A, B)

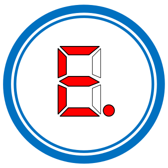
▶ Measures
(1) Replace the TP cable. If the problem persists, replace the TP300.
(2) If it persists, replace the mainboard.
(3) If the same status persists, please contact our AS department.

“Receive Data Error!” & 7-Seg. from the main board → [E.]



or

Warning) The teaching pendant does not work.” & 7-Seg. from the main board : [.]

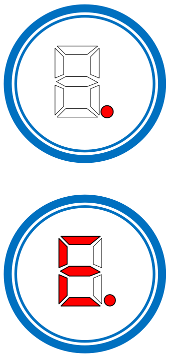


If the initial screen of TP is the same as the picture above

▶ Causes
- Short circuit of the transmit data line system of the TP cable → [CNTP] pin(C, D)
- Data error is received in the mainboard

▶ Measures
(1) Replace the TP cable. If the problem persists, replace the TP300.
(2) If it persists, replace the mainboard.
(3) If the same status persists, please contact our AS department.

“Receive Data Error!” & 7-Seg. from the main board → [.] or [E.]



If the initial screen of TP is the same as the picture above

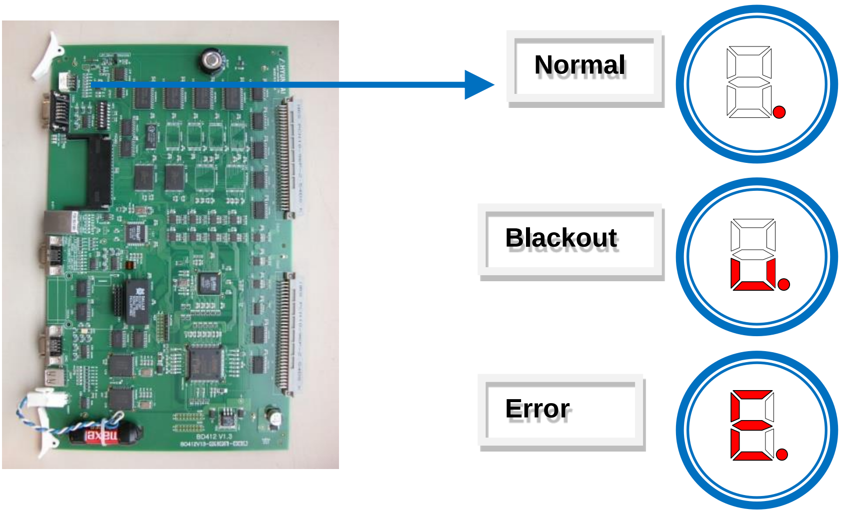
▶ Causes

- Short circuit of the Rx/Tx data line system of the TP cable → [CNTP] pin(A, B, C, D)
- Data error is transmitted in the mainboard

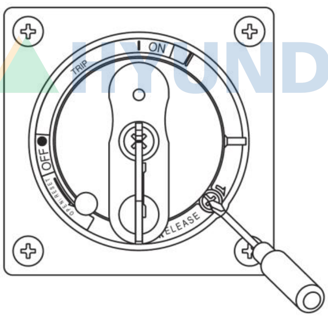
▶ Measures

(1) Replace the TP cable. If the problem persists, replace the TP300.
(2) If it persists, replace the mainboard.
(3) If the same status persists, please contact our AS department.

- **Reference: 7-segment from the main board**



If a controller's door is shut when the power is on, please refer to the diagram below to open the door to check.



※Turn the "release" screw that is located below the external control handle on the controller's door clockwise.

How to open the door while the power is on

Caution
Once the controller is opened, please check only the main board's status, and do not touch anything else for safety reasons.
Please make sure to close it after you check the main board's status.

5.1.9. E0022 Check up I/O board communi. cable

5.1.9.1. Outline

The IO board of the controller exchanges data with the mainboard through RS232 communication. The E0022 is the communication error code detected between the mainboard and the IO board.

Fig. 5.18 Communication between the mainboard and the IO board

The IO board is a module that controls the input/output of the controller's power sequence. Once this error occurs, all functions related to this will be stopped, and the main board stops the communication. To reactivate all the functions, a controller must be restarted.

5.1.9.2. Causes and checking methods

1. General examination
1.1 Check the CNIO communication cable connection state.
1.2 Please check the power status (the power voltage or the connection status of the cable).

2. If an error persists even after restarting the controller
2.1 Replace the IO board
2.2 Replace the CNIO communication cable
2.3 Replace the main board.

1. **General examination**

If this error occurred while the system is normally operating, please examine the following for a start.

Reference

Once "E0022 communication error among inner modules" occurs, the main board will not establish a communication with the system board even if the system board initiates communication. The controller must be restarted to reestablish a communication.

1.1 Check the communication cable (CNIO) connection state.

Please check if the communication cable (CNIO) between the main board and the system boards are well-connected. Please remove and reconnect the CNIO connectors of the main board and the system board, and check if an error persists, to check the connector's connection status.

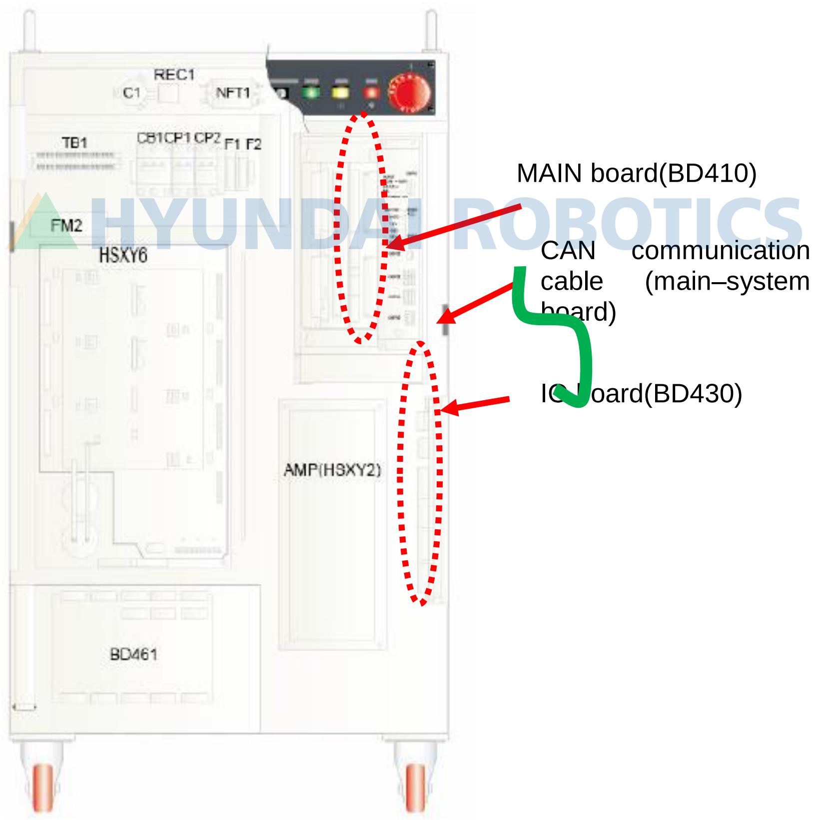


Fig. 5.19 Communication cable connection between the main board and the IO board

1.2 Please check the power status (the power voltage or the connection status of the cable).

Please check if a DC 5 V control power is being supplied to the system board properly. If there is a problem with power, this error may occur as the system board will not operate.

Please check if the DC 5 V control power from output terminal in the SMPS is in the range of 5.0–5.3 V. If the voltage is out of this range, it may affect the communication. Checkpoints are as in the diagram below, and if the voltage is out of range, please configure it to a range of 5.0–5.3 V from the SMPS.

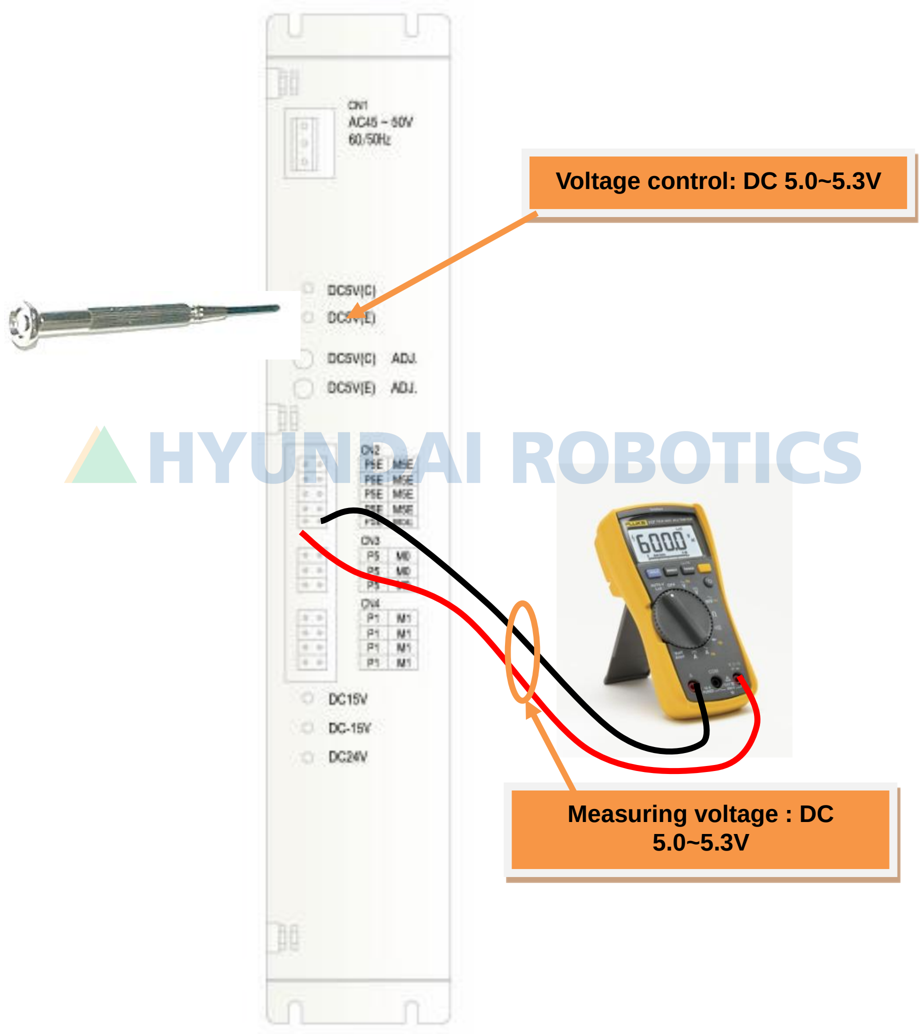
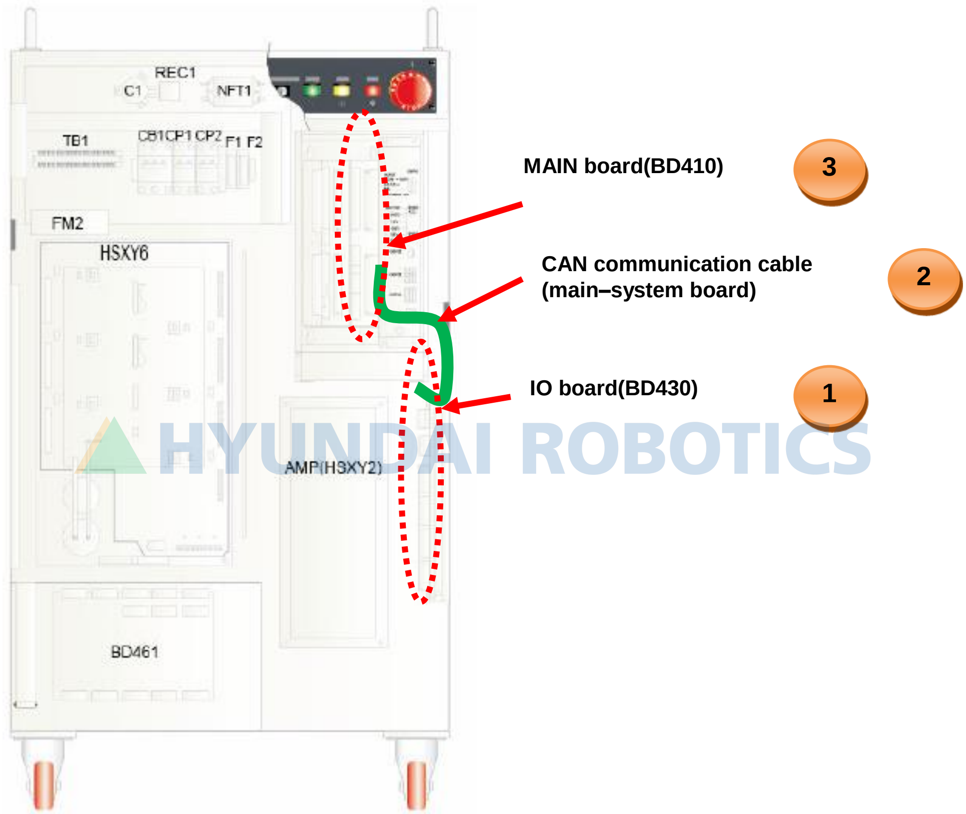


Fig. 5.20 Measuring a voltage of DC 5 V and the controlling method

2. If an error persists even after restarting the controller

If the error message still appears even after rebooting the controller power, replace the board or cable in the following order to check for any problem.

2.1 Replace the IO board.
2.2 Replace the CNIO cable.
2.3 Replace the MAIN board.



5.1.10. E0103 (axis ○) Enc Err:Process time over

5.1.10.1. Outline

The servo board did not receive the data from the absolute encoder. The data of the absolute encoder are received twice when the power of the controller is turned on and when the motor is turned on for the first time. The E0103 error is detected only when the power is turned on and when the motor is first turned on. However, a new error may be detected when the CPU board is rebooted and initialized for another problem.

5.1.10.2. Causes and checking methods

1. Check the encoder supply voltage.
2. Check if the motor brake is released.
3. Replace the servo board and then test it.
4. Please examine the wiring.
5. Replace the motor and then test it.

1. Check the encoder supply voltage.

The power supply voltage to the encoder must be in the range of 5 V ± 5% (4.75–5.25 V) – (encoder side connector's supply voltage). If the voltage is reduced to below 4.75 V, the encoder may not operate normally, and it will cause this error.

Please measure the voltage of the encoder side's connector pin (G-H).

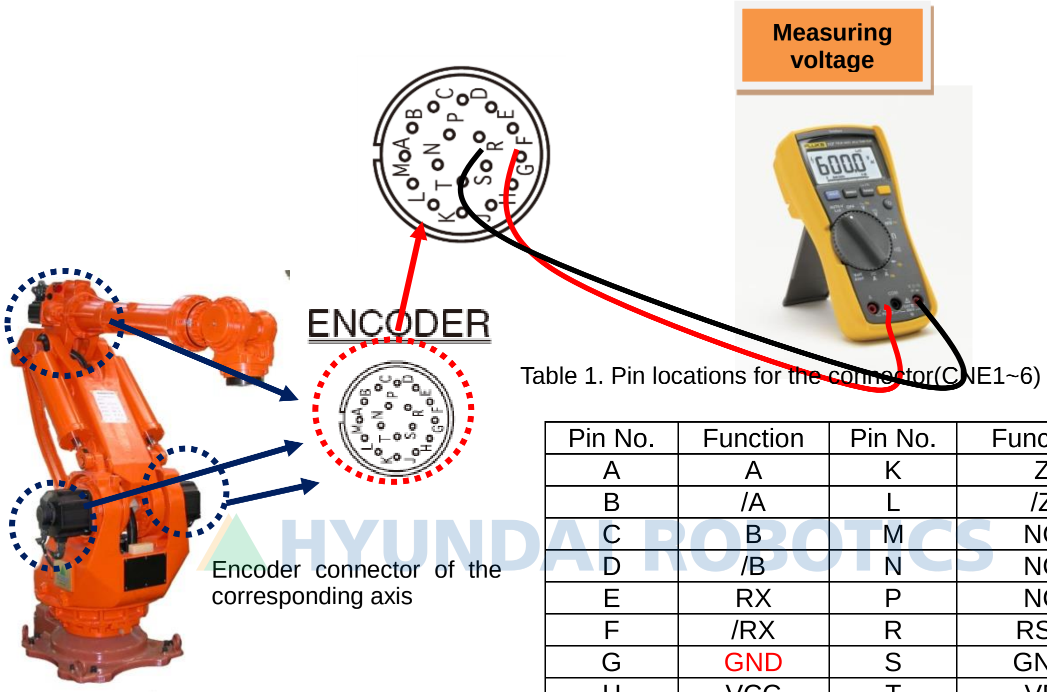


Table 1. Pin locations for the connector(CNE1~6)

Pin No.	Function	Pin No.	Function
A	A	K	Z
B	/A	L	/Z
C	B	M	NC
D	/B	N	NC
E	RX	P	NC
F	/RX	R	RST
G	GND	S	GND
H	VCC	T	VB
J	CASE GND		

Fig. 5.21 How to measure the input power of the encoder

If the measured voltage is lower than the reference voltage, turn the +5V ADJ(E) voltage control terminal of the power supply of the encoder to adjust the voltage of the encoder-side connector within the reference voltage.

Fig. 5.22 How to adjust the power of the encoder

2. **Check if the motor brake is released.**

With the motor turned off, trigger the brake switch of the BD461 sequence board to see if the motor brake is released. The robot axis will fall if the brake is released so take necessary precaution and press and release the brake switch quickly to minimize falling of the robot axis.

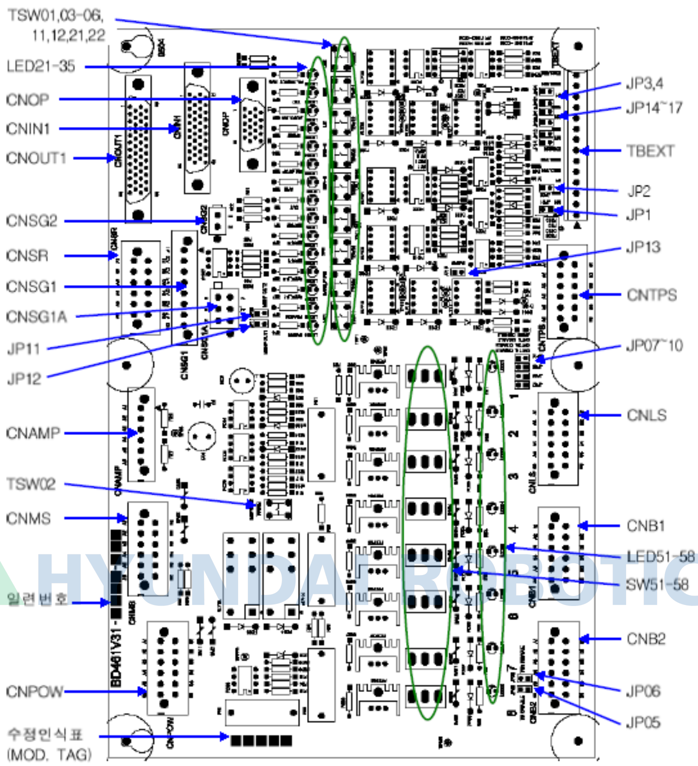


Fig. 5.23 Exterior of BD461 board

TSW03 : Forced output of the main axis (1, 2, and 3) brake release power
TSW04 : Forced output of the wrist axis (4, 5, and 6) brake release power
TSW05 : Forced output of the additional axis (7) brake release power
TSW06 : Forced output of the additional axis (8) brake release power

3. Replace the servo board and then test it.

After the replacement of the Servo board, if the error does not persist, the Servo board is faulty. Please replace the Servo board with a new one.

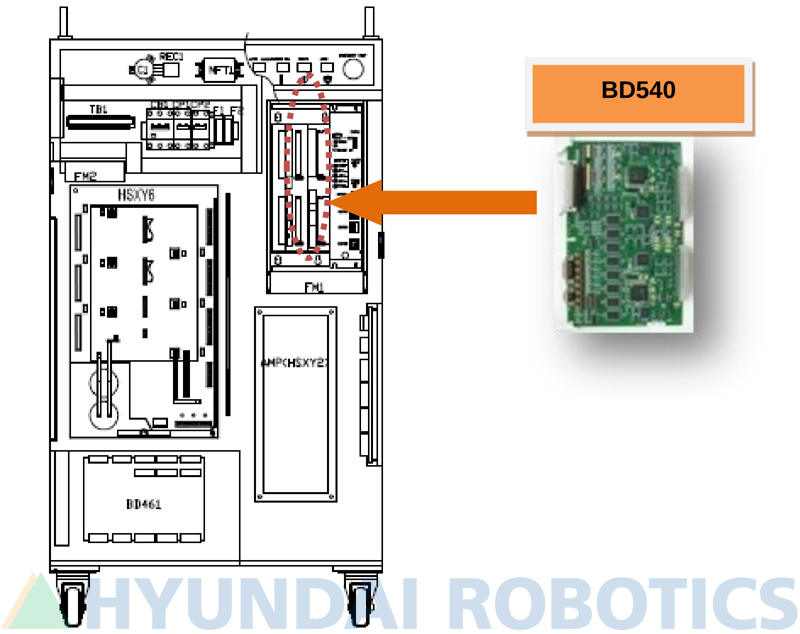


Fig. 5.24 How to replace the BD540 servo board

4. Replace the motor and then test it.

If the error does not persist after the replacement of the Servo motor, the Servo motor is faulty. Please replace the Servo motor with a new one. The diagram below describes the locations of each axis' motor (HX165 robot). For other robots, please refer to the robot's maintenance manual to replace them.

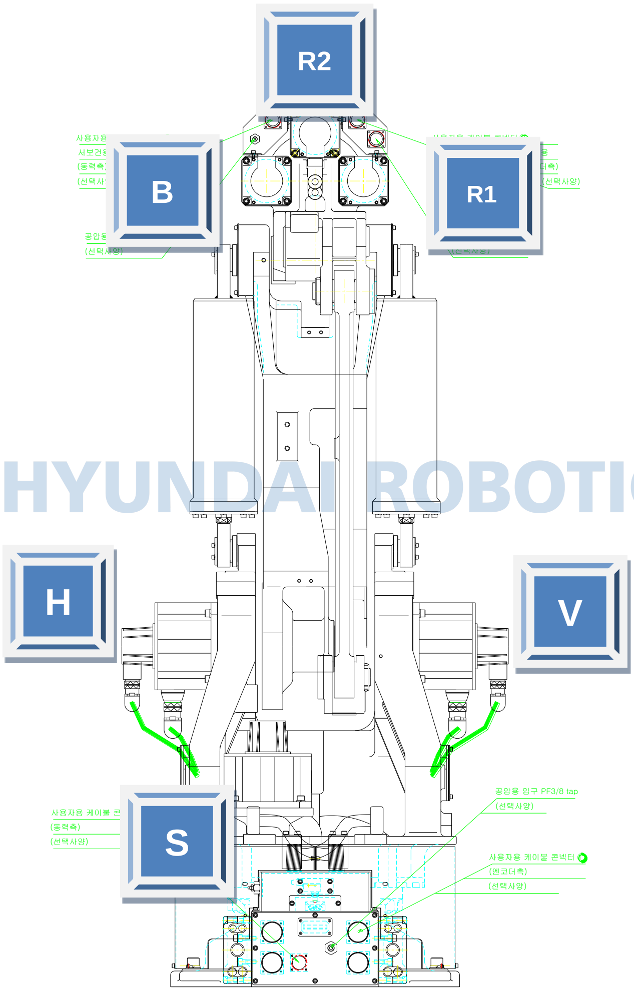


Fig. 5.25 Locations of each axis' motor (HX165 robot)

5. Please examine the wiring.

Encoder's wiring examination orders are as below.

First, examine the loose contact of connectors that are related to the encoder's wiring.
Second, examine the short-circuit of the encoder's wiring. Please use equipment, such as a multimeter (tester), and examine each phase's wiring one by one.
Third, replace the encoder's wiring and test it.

If the encoder's wiring has not been disconnected, and if the error caused by certain problems (loose contact of the shield line, a contact between the encoder's signal line and other electric power line, or a contact with the metal part of the robot's main frame), it cannot be detected through a short-circuit test. Please replace the wiring and test it.

1) Check the internal wiring of the controller.
■ Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the SMPS(P5E, M5E).
■ Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the CNR4.

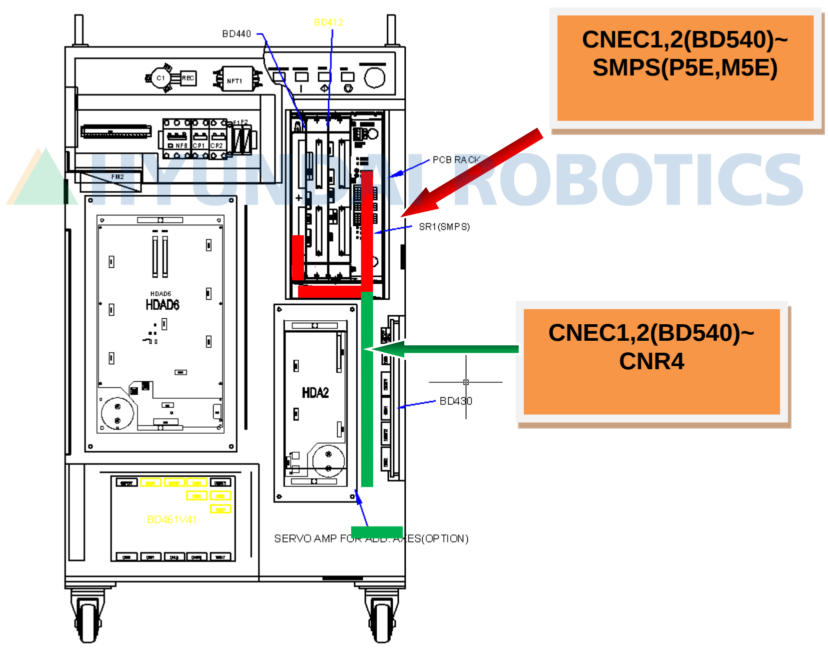


Fig. 5.26 Controller internal encoder wiring

2) Please examine the wiring between the controller and the robot.
■ Please examine the wiring between the CNR04 and the CNR4.

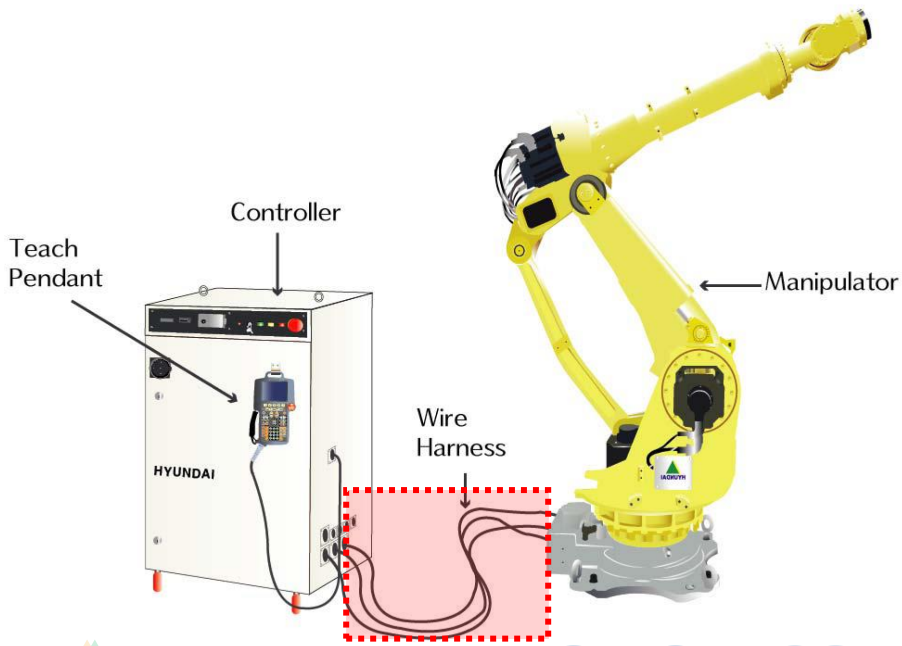


Fig. 5.27 Basic installation diagram between the robot and the controller.

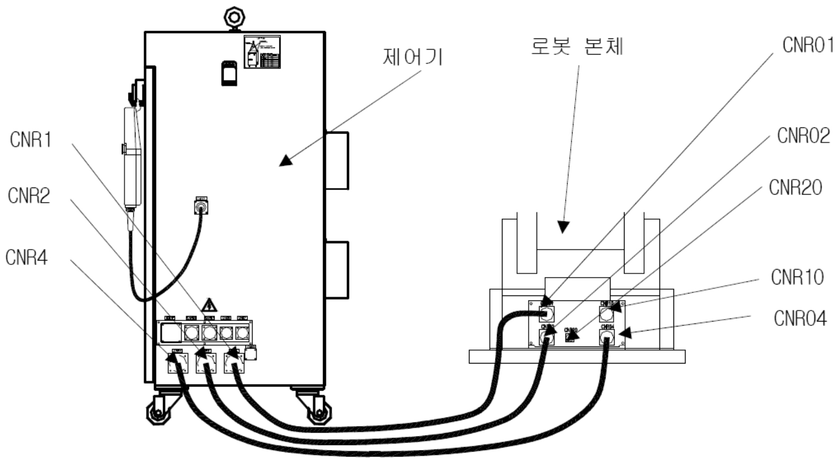


Fig. 5.28 Connection between the robot’s main frame and the controller

3) Examine the wiring of the main frame.

■ Please examine the wiring between CER1 and CNE1–6 (encoder side's connector).

Please refer to the wiring diagram of the robot's maintenance manual.

Fig. 5.29 Robot's internal wiring

5.1.11. E0104 (axis ○) Enc Err:Imperfect data frame
5.1.12. E0106 (axis ○) Enc Err:Bad input data
5.1.13. E0107 (axis ○) Enc Err:Bad bit sequence

5.1.13.1. Outline

The absolute encoder data have been received from the servo board, but they are not in the defined format. If the problem persists even after the encoder is reset, check the communication state of the encoder. The error may occur when noise flows into the encoder cable so check the encoder's condition.

5.1.13.2. Causes and checking methods

1. **Reset the encoder.**
2. **Please check the supply voltage to the encoder.**
3. **Replace the servo board and then test it.**
4. **Please replace the motor and test it.**
5. **Please examine the wiring.**

1. Reset the encoder.

To reset the encoder, connect the RST and P5E terminals of the encoders of the axes for 3 min with the controller on. Open the cover at the back of the robot's body to find encoder and dedicated reset connectors.

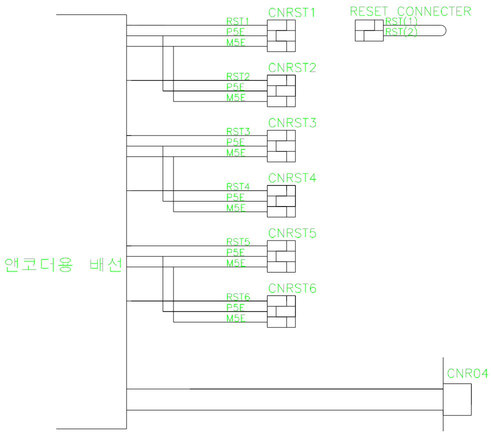
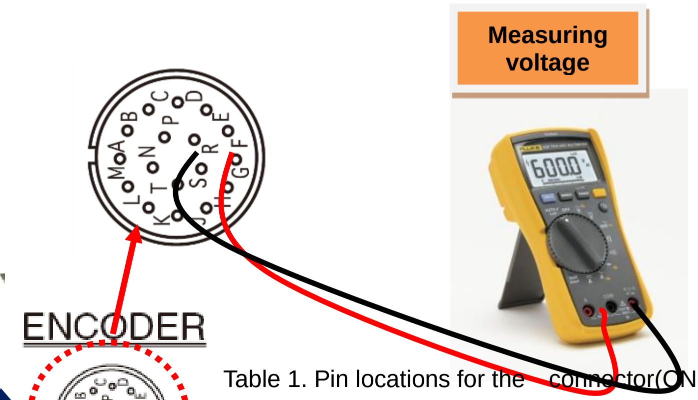


Fig. 5.30 Connector for resetting of the encoder

2. Check the encoder supply voltage.

The power supply voltage to the encoder must be in the range of 5 V ± 5% (4.75–5.25 V) – (encoder side connector’s supply voltage). If the voltage is reduced to below 4.75 V, the encoder may not operate normally, and it will cause this error.

Please measure the voltage of the encoder side’s connector pin (G-H).



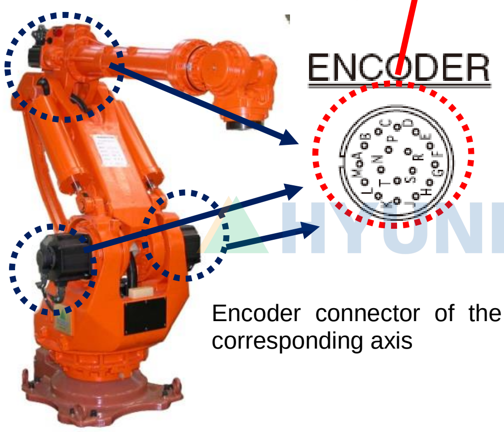


Table 1. Pin locations for the connector(ONE1~6)

Pin No.	Function	Pin No.	Function
A	A	K	Z
B	/A	L	/Z
C	B	M	NC
D	/B	N	NC
E	RX	P	NC
F	/RX	R	RST
G	GND	S	GND
H	VCC	T	VB
J	CASE GND		

Fig. 5.31 How to measure the input power of the encoder

If the measured voltage is lower than the reference voltage, turn the +5V ADJ(E) voltage control terminal of the power supply of the encoder to adjust the voltage of the encoder-side connector within the reference voltage.

Fig. 5.32 How to adjust the power of the encoder

3. Replace the servo board and then test it.

After the replacement of the Servo board, if the error does not persist, the Servo board is faulty. Please replace the Servo board with a new one.

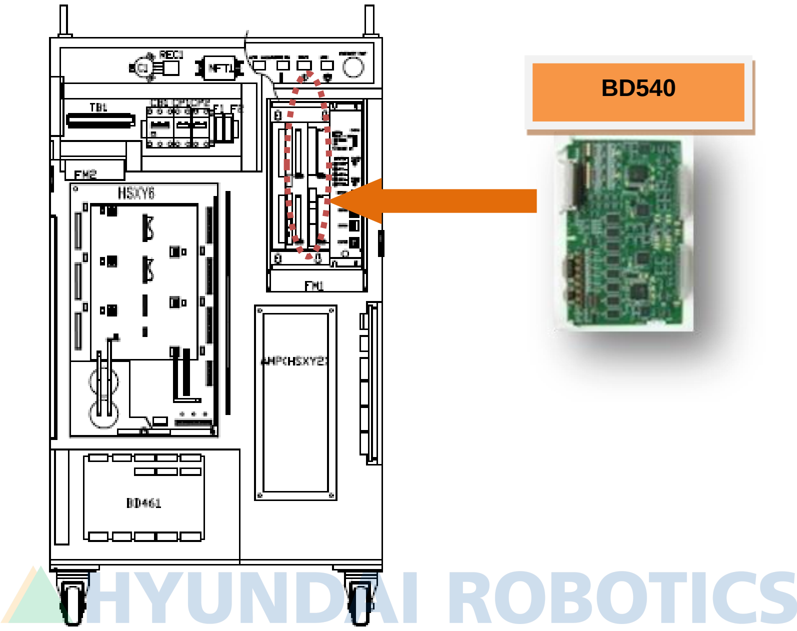


Fig. 5.33 How to replace the BD540 servo board

4. Replace the motor and test it.

If the error does not persist after the replacement of the Servo motor, the Servo motor is faulty. Please replace the Servo motor with a new one. The diagram below describes the locations of each axis' motor (HX165 robot). For other robots, please refer to the robot's maintenance manual to replace them.

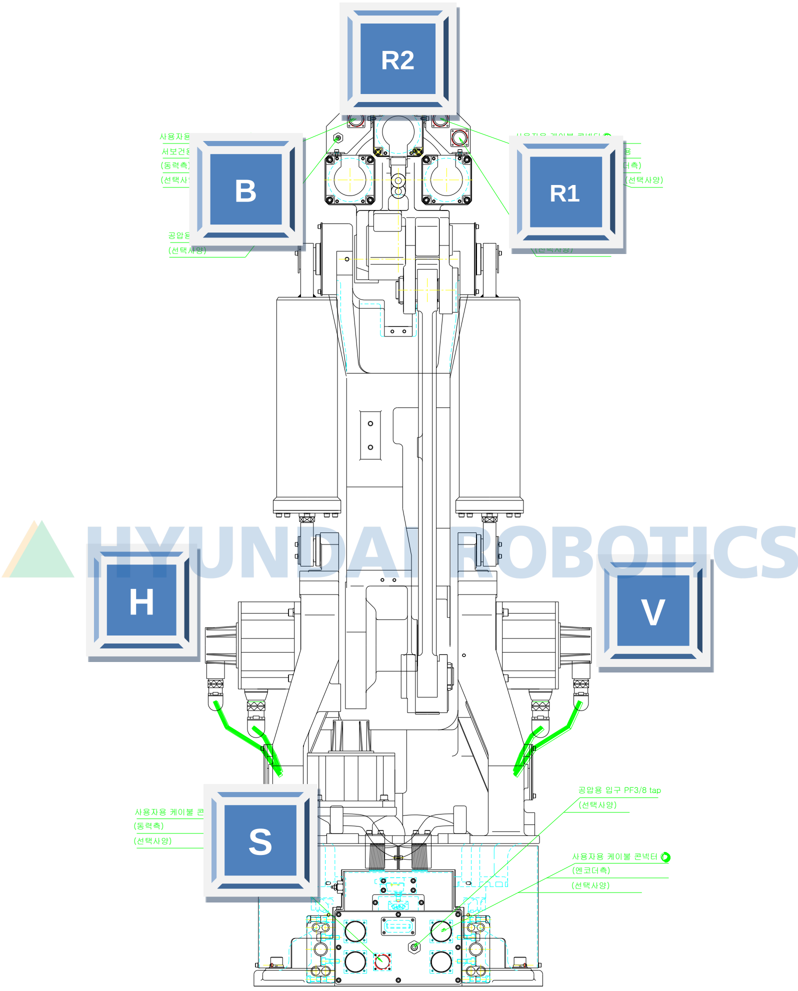


Fig. 5.34 Locations of each axis' motor (HX165 robot)

5. Examine the wiring.

Encoder’s wiring examination orders are as below.

First, examine the loose contact of connectors that are related to the encoder’s wiring. Second, examine the short-circuit of the encoder’s wiring. Please use equipment, such as a multimeter (tester), and examine each phase’s wiring one by one.
Third, replace the encoder’s wiring and test it.

If the encoder’s wiring has not been disconnected, and if the error caused by certain problems (loose contact of the shield line, a contact between the encoder’s signal line and other electric power line, or a contact with the metal part of the robot’s main frame), it cannot be detected through a short-circuit test. Please replace the wiring and test it.

1) Check the internal wiring of the controller.

- ■ **Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the SMPS(P5E, M5E).**
- ■ **Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the CNR4.**

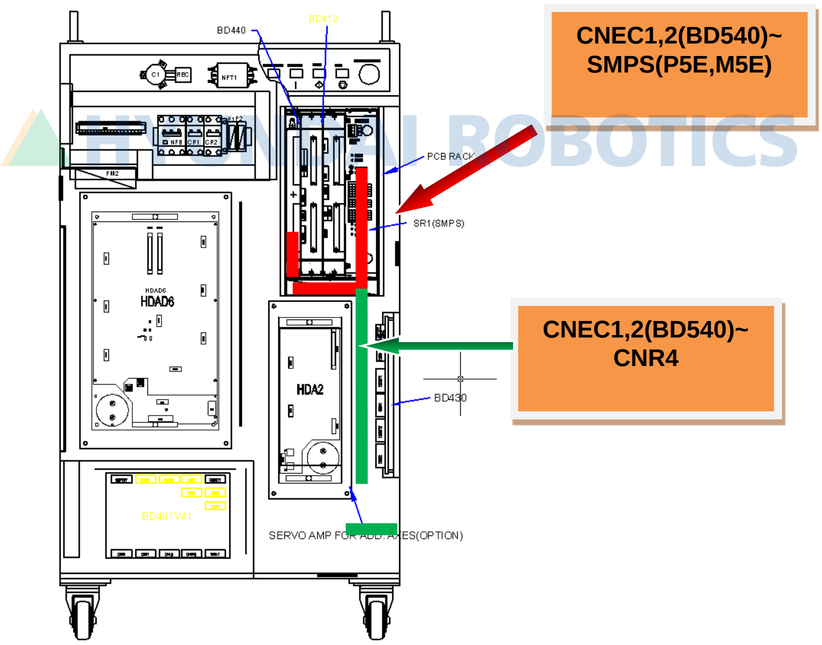


Fig. 5.35 Controller internal encoder wiring

2) Examine the wiring between the controller and the robot.

■ Please examine the wiring between the CNR04 and the CNR4.

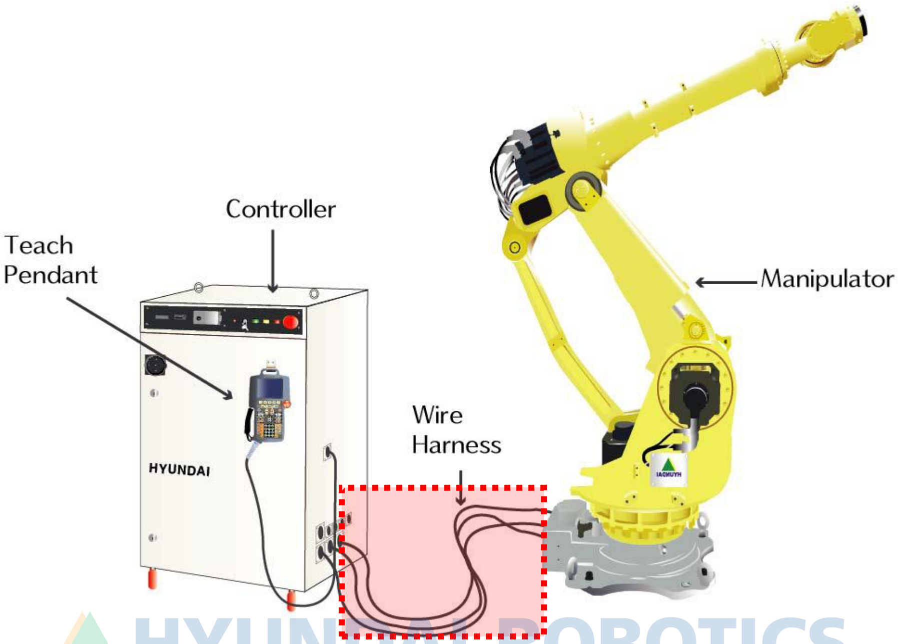


Fig. 5.36 Basic installation diagram between the robot and the controller.

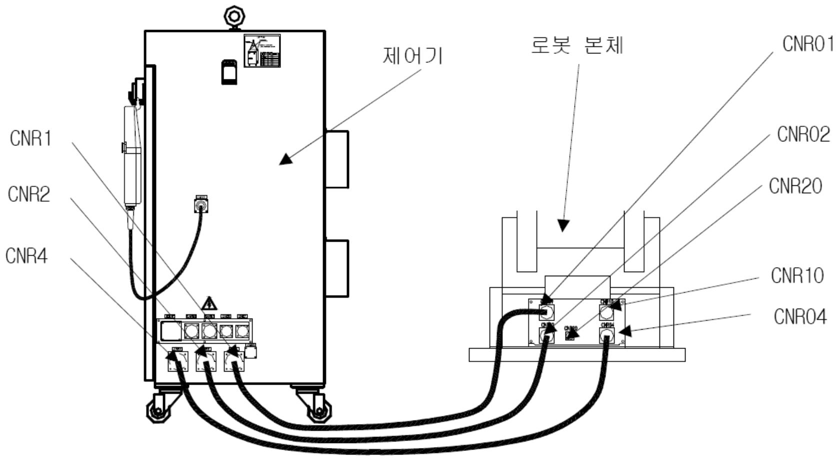


Fig. 5.37 Connection between the robot’s main frame and the controller

3) Examine the wiring of the main frame.

■ **Please examine the wiring between CER1 and CNE1–6 (encoder side's connector).**

Please refer to the wiring diagram of the robot's maintenance manual.

Fig. 5.38 Robot's internal wiring

5.1.14. E0105 (axis ○) Enc Err:Cable not connected

5.1.14.1. Outline

Encoder error is generated by detecting hardware disconnection (or no signal) through the line received from the encoder of the motor on the servo board.
This error may occur due to a fault of the components that received the data from the encoder or problems in the encoder shield lines or the wiring.

5.1.14.2. Causes and checking methods

1. **Please check the supply voltage to the encoder.**
2. **Replace the servo board and then test it.**
3. **Please examine the wiring.**
4. **Please replace the motor and test it.**

1. Check the encoder supply voltage.

The power supply voltage to the encoder must be in the range of 5 V ± 5% (4.75–5.25 V) – (encoder side connector's supply voltage). If the voltage is reduced to below 4.75 V, the encoder may not operate normally, and it will cause this error.

Please measure the voltage of the encoder side's connector pin (G-H).

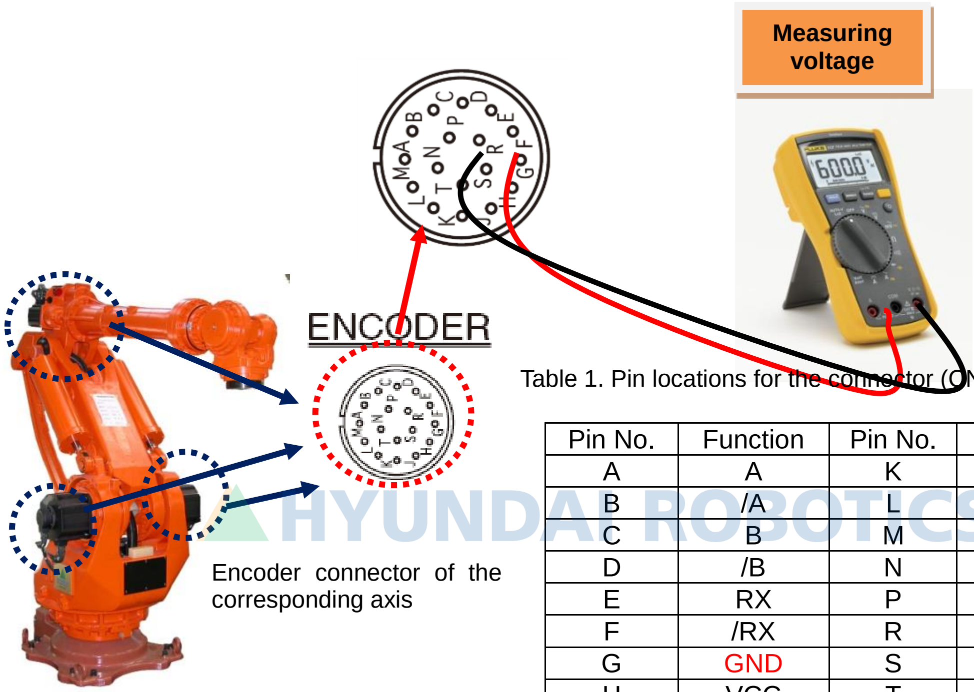


Table 1. Pin locations for the connector (CNE1~6)

Pin No.	Function	Pin No.	Function
A	A	K	Z
B	/A	L	/Z
C	B	M	NC
D	/B	N	NC
E	RX	P	NC
F	/RX	R	RST
G	GND	S	GND
H	VCC	T	VB
J	CASE GND		

Fig. 5.39 How to measure the input power of the encoder

If the measured voltage is lower than the reference voltage, turn the +5V ADJ(E) voltage control terminal of the power supply of the encoder to adjust the voltage of the encoder-side connector within the reference voltage.

Fig. 5.40 How to adjust the power of the encoder

2. Replace the servo board and then test it.

After the replacement of the Servo board, if the error does not persist, the Servo board is faulty. Please replace the Servo board with a new one.

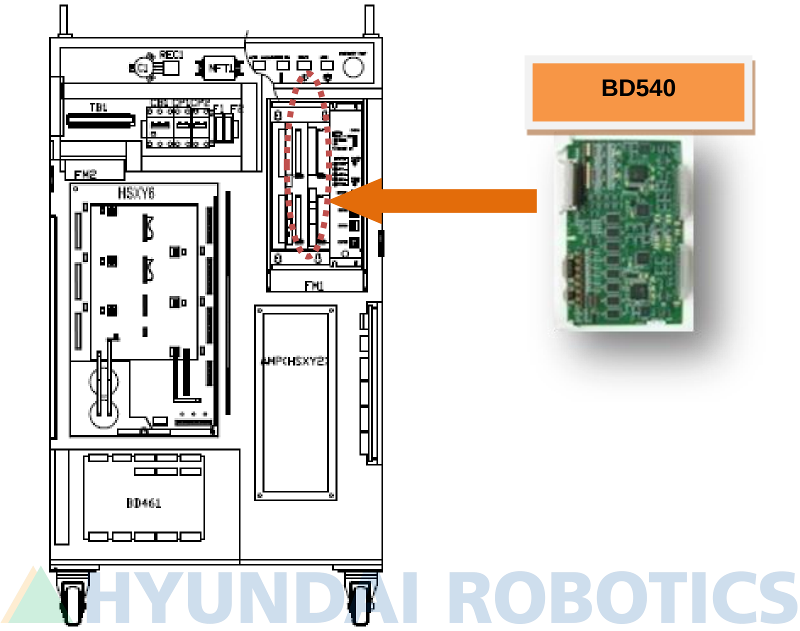


Fig. 5.41 How to replace the BD540 servo board

3. Replace the motor and test it.

If the error does not persist after the replacement of the Servo motor, the Servo motor is faulty. Please replace the Servo motor with a new one. The diagram below describes the locations of each axis' motor (HX165 robot). For other robots, please refer to the robot's maintenance manual to replace them.

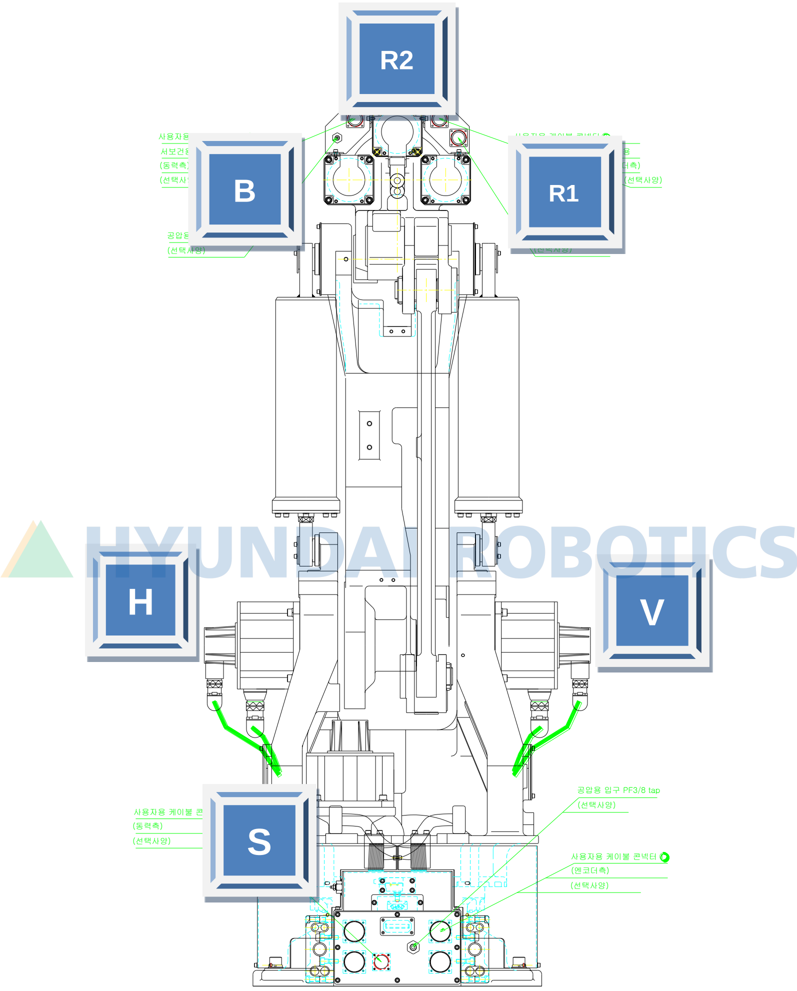


Fig. 5.42 Locations of each axis' motor (HX165 robot)

4. Examine the wiring.

Encoder’s wiring examination orders are as below.

First, examine the loose contact of connectors that are related to the encoder’s wiring.
Second, examine the short-circuit of the encoder’s wiring. Please use equipment, such as a multimeter (tester), and examine each phase’s wiring one by one.
Third, replace the encoder’s wiring and test it.

If the encoder’s wiring has not been disconnected, and if the error caused by certain problems (loose contact of the shield line, a contact between the encoder’s signal line and other electric power line, or a contact with the metal part of the robot’s main frame), it cannot be detected through a short-circuit test. Please replace the wiring and test it.

1) Check the internal wiring of the controller.

■ Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the SMPS(P5E, M5E).

■ Please examine the wiring between the CNEC1 and 2 (BD540) connectors, and the CNR4.

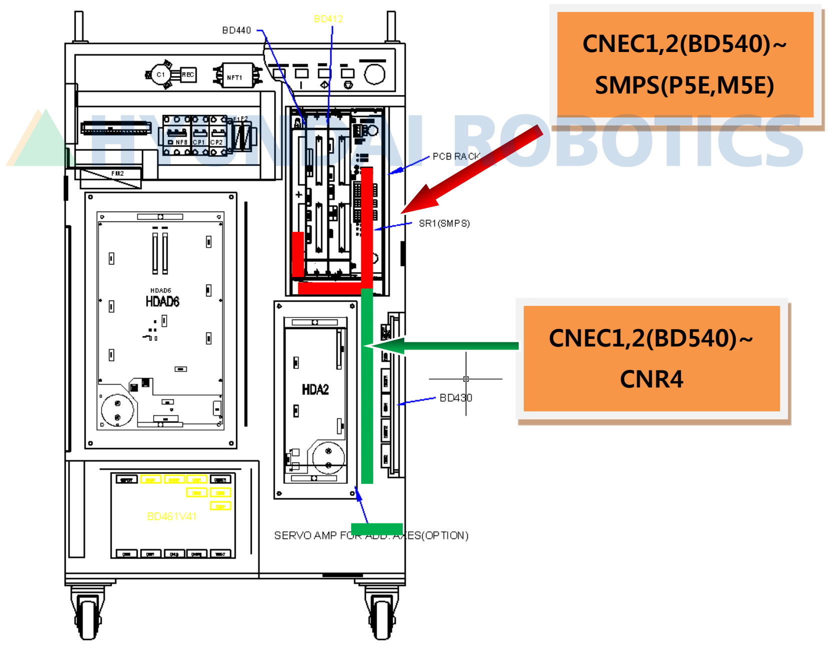


Fig. 5.43 controller’s internal encoder wiring

2) Please examine the wiring between the controller and the robot.
■ Please examine the wiring between the CNR04 and the CNR4.

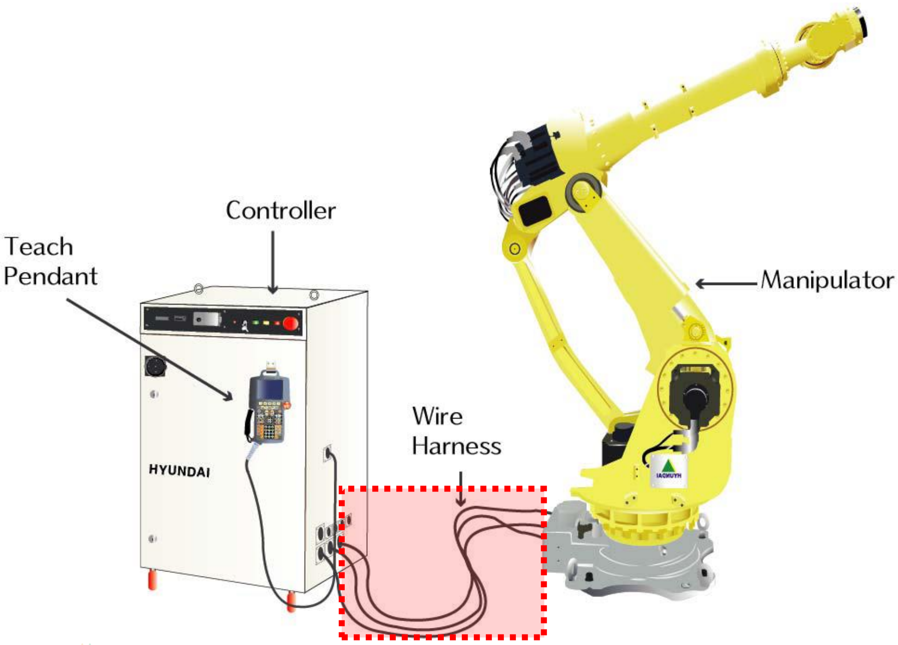


Fig. 5.44 Basic installation diagram between the robot and the controller.

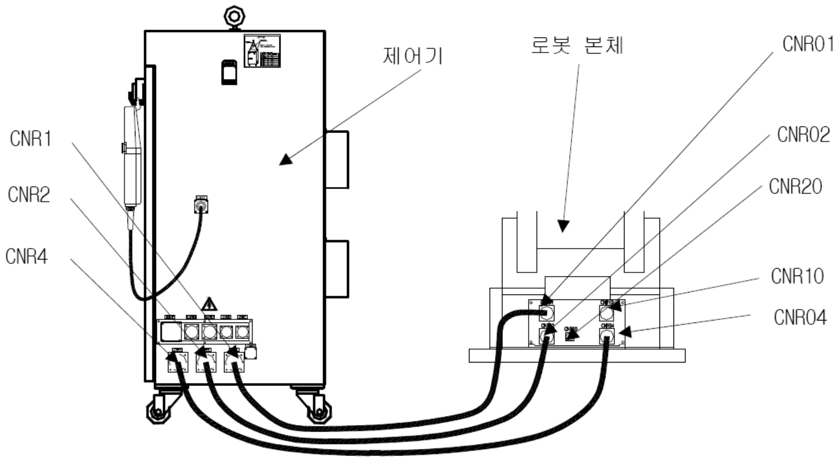


Fig. 5.45 Connection between the robot's main frame and the controller

3) Please examine the wiring of the main frame.

■ Please examine the wiring between CER1 and CNE1–6 (encoder side's connector). Please refer to the wiring diagram of the robot's maintenance manual.

Fig. 5.46 Robot's internal wiring

5.1.15. E0108 (axis ○) Enc Err:Encoder reset needed

5.1.15.1. Outline

When turning on the controller power, the absolute encoder data from the encoder exceeded the working range limit of the encoder. It may occur if a new motor is installed. Place the robot on the reference position and then reset the encoder to use it in the normal working range.

5.1.15.2. Causes and checking methods

1. Reset the encoder. 2. Set the encoder setting to offset again.

1. Reset the encoder.

To reset the encoder, connect the RST and P5E terminals of the encoders of the axes for 3 min with the controller on. Open the cover at the back of the robot's body to find connectors for resetting of the encoders.

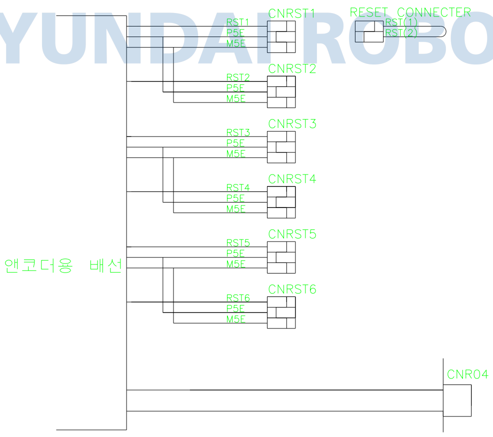
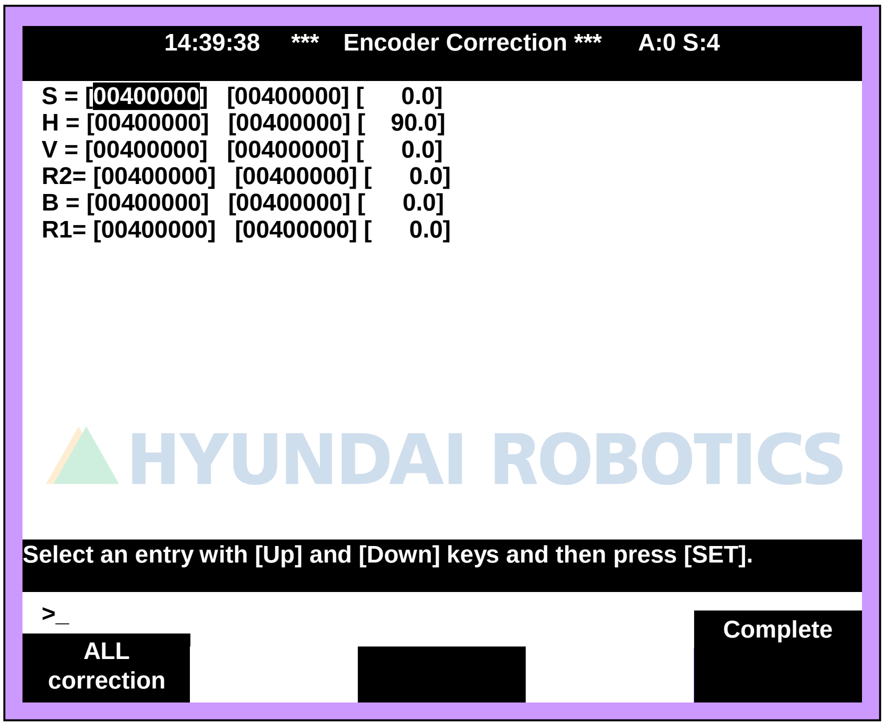


Fig. 5.47 Connector for resetting of the encoder

2. Set the encoder setting to offset again.

If the encoder is reset, the axis position will be lost. Send the robot to the reference position and set the encoder to offset again. It is recommended that the encoder is reset again just before offsetting at the robot reference position. The robot has an interference coefficient between axes so send all axes to the reference positions and set them to offset.
To set the encoder to offset, select System> 3: Robot Parameter> 5: Encoder Offset Setting> Encoder Correction (Record Position) in manual mode.
Note that pressing the ALL correction key will correct the encoder offset for all axes.



5.1.16. E0112 (axis ○) Fuse blown or IPM fault(6Amp)

5.1.16.1. Outline

A fault output has occurred from an intelligent power module (IPM)—a switch device inside the Servo drive unit that drives the motor. Or, a fuse is disconnected in the servo drive for small robots. IPM fault may occur due to an increased temperature of the heat sink, IPM’s control voltage reduction, or an overcurrent output.

5.1.16.2. Causes and checking methods

< An error occurs non-periodically when the motor is turned on>

1. Examine the components that are related to the motor drive.
- **１) Please examine the output cable that connects to the Servo drive unit.**
- **２) Please examine the terminal (socket) of the switching device in the Servo drive unit.**
- **３) Please replace the CNBS1, 2, and 3 cables and confirm the error.**
- **４) Please replace the Servo drive unit and confirm the error.**
- **５) Please replace the Servo board (BD540/BD541) and confirm the error.**
- **６) Please replace the Servo motor and confirm the error.**

< An error occurs at a certain step >

2. Examine the robot at the step in which an error occurs.
- **１) Please examine the robot’s wiring at the location where the error occurs.**
- **２) Please reduce the speed of the robot’s operation to confirm the error.**
- **３) Please make changes on the teached step’s interpolation, and confirm the error.**

1. Examine the components that are related to the motor drive.

The Servo drive unit that drives the motor receives a command from the Servo board (BD540/BD541) through the CNBS cable, and the current output of the internal amplification circuit will be transferred to the motor through wirings that are connected to each connector of the axis.

1) Examine the output cable that connects to the Servo drive unit
Examine the wirings that connect the Servo drive unit to the motor. Please turn off the power of the controller, remove the connector from the Servo drive unit, and measure the resistance value between the grounds to inspect the occurrence of short-circuit.

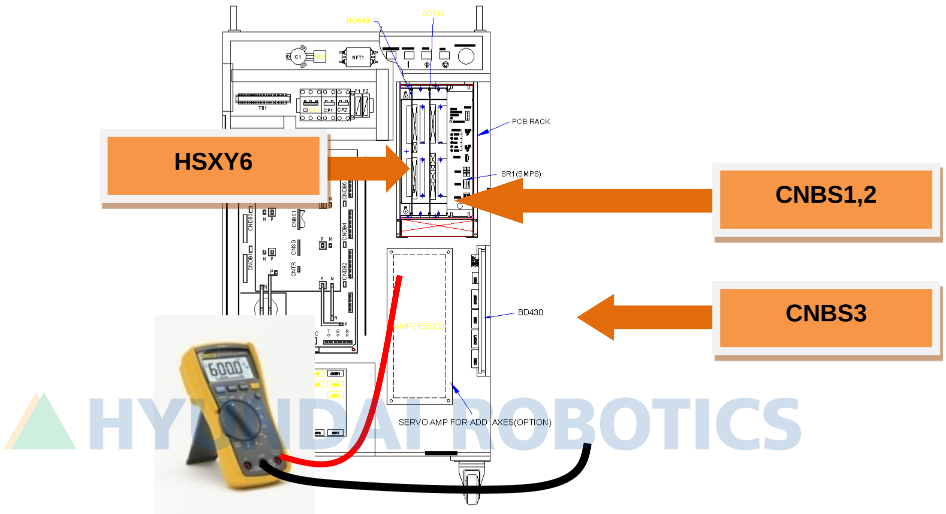


Fig. 5.48 Examining the output cable of the Servo drive unit (Hi4a-0000 controller)

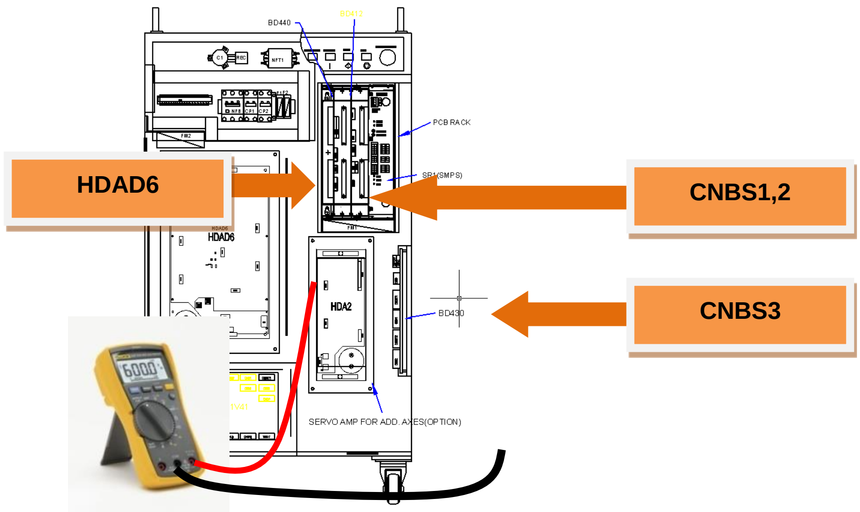


Fig. 5.49 Examining the output cable of the Servo drive unit (Hi4a-0010/0012)

2) Examine the switch device of the Servo drive unit
The switch device of the Servo drive unit switches the direct current voltage that is supplied from the diode module and outputs the alternating current for each phase. If a short-circuit occurs at the internal terminal of the switch device, overcurrent will flow, and it will cause an IPM fault error. Please remove the connector and check if a short-circuit has occurred between the output terminal in the switch device of the Servo drive unit and the P (or N).
If a short-circuit exists, the Servo drive unit needs to be replaced, and the cable that connects the Servo drive unit to the motor needs to be examined.

Medium-size robot's Servo drive unit : HSXY6
Small-size robot's Servo drive unit : HDAD6

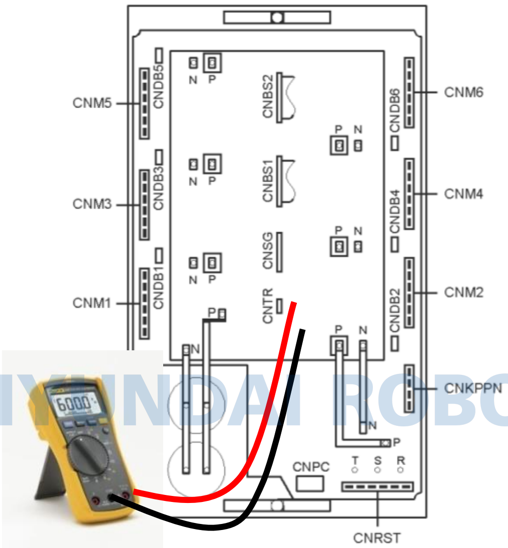


Fig. 5.50 Short-circuit test on the switching device of HSXY6

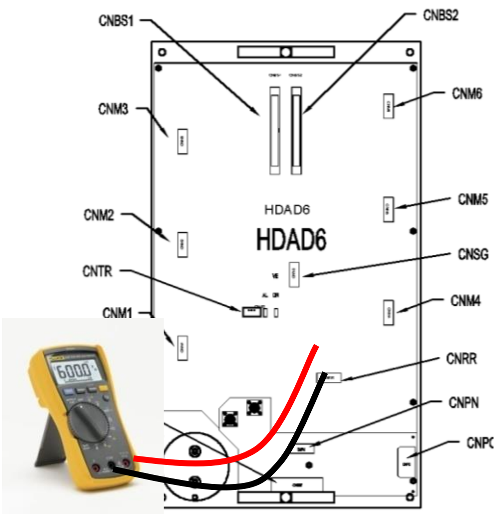


Fig. 5.51 Short-circuit test on the switching device of HDAD6

3) Replacement of the CNBS cable and examination of the error
The Servo drive unit that drives the motor receives a command from the Servo board (BD540/BD541) through the CNBS cable, and the current output of the internal amplification circuit will be transferred to the motor through wirings that are connected to each connector of the axis.
If the error does not persist after the replacement of the cable, the cable is faulty. Please replace the CNBS cable with a new one.

4) Replacement and examination of the Servo board (BD540/BD541)
If the error does not persist after the replacement of the Servo board (BD540/BD541), the Servo board is faulty. Please replace the Servo board with a new one.

5) Replacement and inspection of servo drive unit
If the error does not persist after the replacement of the Servo drive unit, the Servo drive unit is faulty. Please replace the Servo drive unit with a new one.

Medium-size robot’s Servo drive unit : HSXY6
Small-size robot’s Servo drive unit : HDAD6

6) Replacement and examination of the Servo motor
If the error does not persist after the replacement of the Servo motor, the Servo motor is faulty. Please replace the Servo motor with a new one.

2. Examine the robot at the step in which an error occurs.

If an IPM fault error occurs at a certain step, it may occur when the device wiring has been damaged at the teached step or the axis speed changed significantly when the teached program changes the position.

1) Examine the internal wiring at the location of an error.
Examine the wiring status of the corresponding axis that is connected to the motor (inside of the robot). During the examination, please turn off the controller's power, and remove the output connector from the Servo drive unit. After that, please measure the resistance value between the grounds of each phase (cable side) to test for a short-circuit.

2) Reduce the speed of the robot's operation to confirm the error
If an error occurs at the step that generates rapid changes in the axis speed, which are caused by the position changes of the robot, reduce the operation speed to confirm the error. If the error does not persist after the speed is reduced, please change the teach speed of the corresponding step, and record the job program to use.

3) Change the teached step's interpolation to confirm the error.
If the axis speed changes rapidly even after the operation speed is reduced by 75%, please change the teached step's interpolation to "P" and confirm the error. If the changes on interpolation resolve the error (at the same operation speed), please modify the teach.

5.1.17. E0113 (axis ○) Overcurrent

5.1.17.1. Outline

The current that flows in the motor or the drive unit exceeds the allowed voltage range. When the current that was generated by the Servo control to operate the robot (or the drive unit) exceeds the allowed safe voltage range, the Servo board will detect an error and immobilize the robot.

5.1.17.2. Causes and checking methods

1. **Check if the axis with an error has mechanical interference with other equipment.**

2. **Check the motor power line.**
   1) **Check the wiring that connects the robot and the controller.**
   2) **Check the internal wiring of the robot.**
   3) **Check the internal wiring of the controller.**

3. **Examine the CNBS cable between the controller's internal Servo board and the drive unit.**

4. **Replace other components.**

1. Check if the axis with an error has mechanical interference with other equipment.

This error may occur if the robot had a mechanical interference or collisions. If the robot is out of the operation area, please move it back into the operation area by using a manual control.

2. Check the motor power line.

Please turn off the primary power and remove the U, V, and W of the drive unit for the corresponding axis, and examine if short-circuit exists in each phase. Please use equipment, such as a multimeter (tester), and examine each phase's wiring one by one.

Warning
Be cautious. Conducting an examination while the power is on may result to electrocution.

1) Check the wiring that connects the robot and the controller.
   Please remove the wirings that connect the controller, robot, or drive unit to examine each phase (U, V, W) for ground or a short-circuit. If a short-circuit is found, please replace the wire.

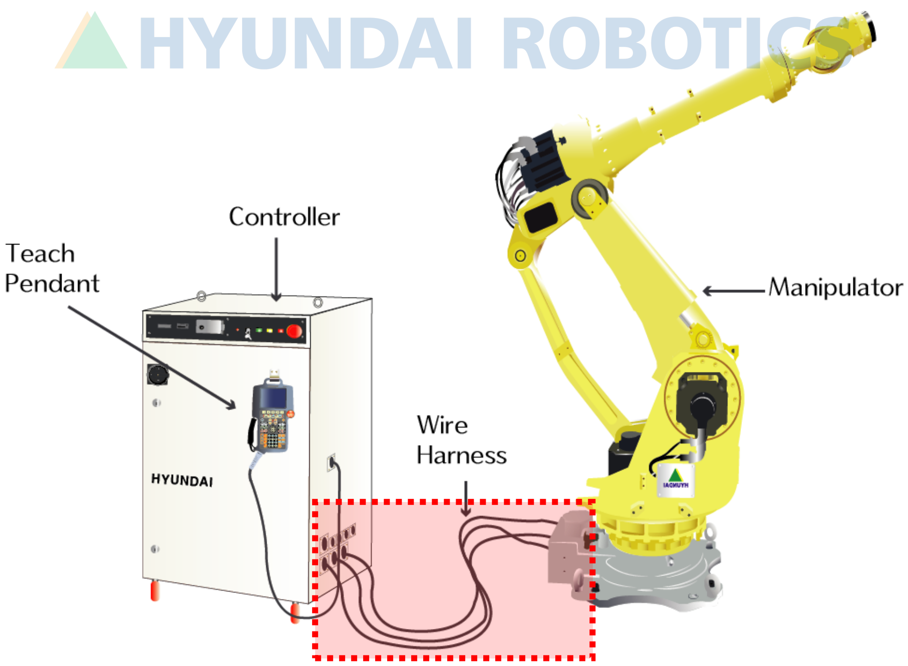


Fig. 5.52 Basic installation diagram between the robot and the controller

2) Check the robot's internal wiring
Examination for a short-circuit, faulty wiring that is connected to the robot's internal motor is required.

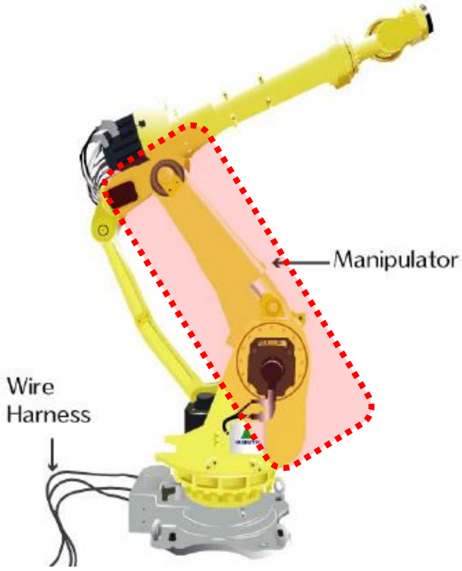


Fig. 5.53 Robot's internal wiring

3) Check the controller's internal wiring
An examination on the controller's internal AMP and installed wiring is required.

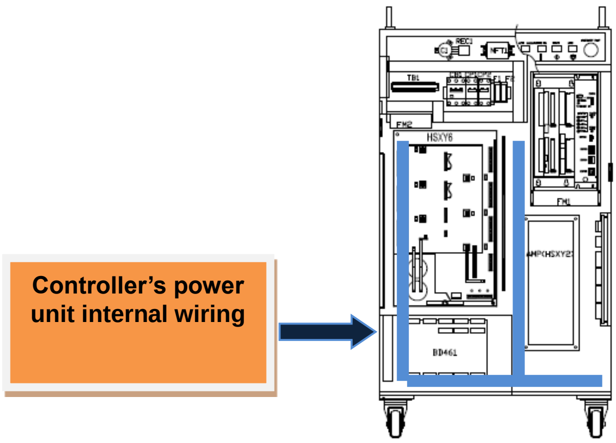


Fig. 5.54 Controller internal side (power section)

3. Examine the CNBS cable between the controller's internal Servo board (DSP board) and the drive unit.

Please examine if the CNBS cable is installed properly. If the cable is not installed properly or is faulty, this error may occur.

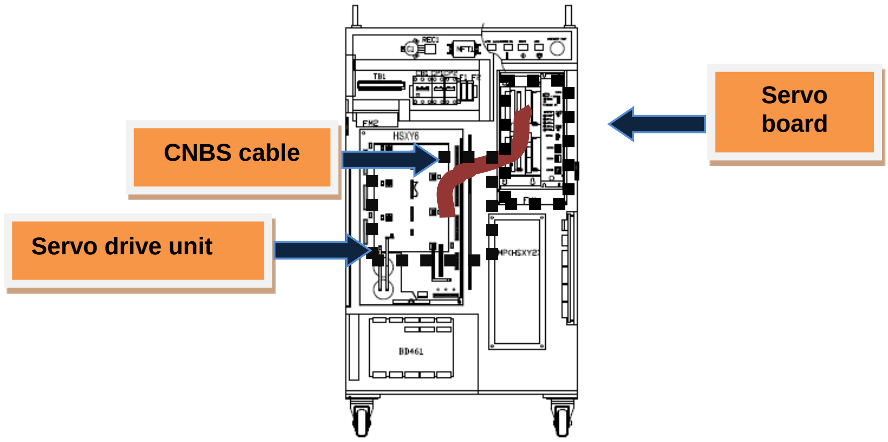
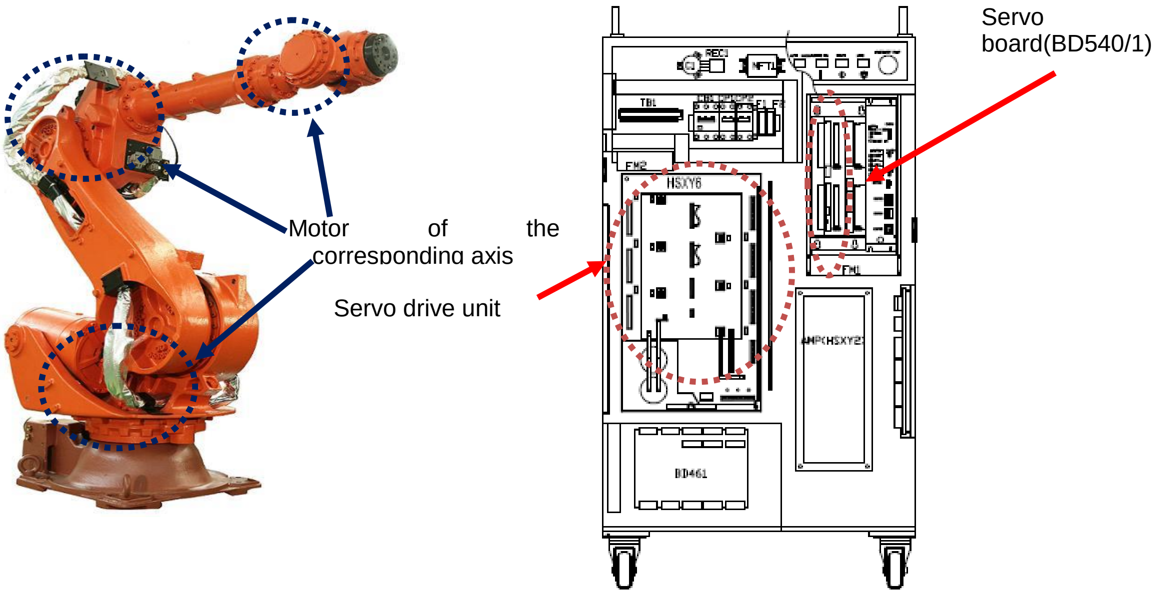


Fig. 5.55 Controller internal side (CNBS cable)

4. Replace other components.

Replace the component of the Servo board (BD540/1) → Servo drive unit → Motor to confirm the occurrence of an error.



5.1.18. E0114 Control voltage drop(AMP)

5.1.18.1. Outline

The control power that was supplied to the Servo drive unit (+15 V) has been reduced. This error is detected by the Servo drive unit and transferred to the Servo board through the CNBS cable.

5.1.18.2. Causes and checking methods

1. Check the power indicator LED.
- **A. Please check the “VE” LED of the Servo drive unit.**
- **B. Please check the “+15 V” LED of SR1 (control power supply unit).**

< Case: Both of the module’s LEDs are off. >

2. Check the output of SR1 (control power supply unit).
- **A. Please remove the CNBS cable, and check the LED.**
- **B. Please remove the Servo board from the rack, and check the LED.**

3. Examine the SR1 (control power supply unit).
- **A. Please check the input voltage to SR1.**
- **B. Please replace the SR1 and check the LED.**

< Case: Only the Servo drive unit’s “VE” LED is off. >

4. Replace the related components and check the power indicator LED.
- **A. Please replace the CNBS cable and check the LED.**
- **B. Please replace the Servo board and check the LED.**
- **C. Please replace the Servo drive unit and check the LED.**

1. Check the power indicator LED.

Drive unit control voltage reduction error is caused by a reduction of the control voltage (+15 V). This error will be detected by the Servo drive unit and transferred to the Servo board (BD540/BD541) through the CNBS1, 2, and 3 cables to be handled.

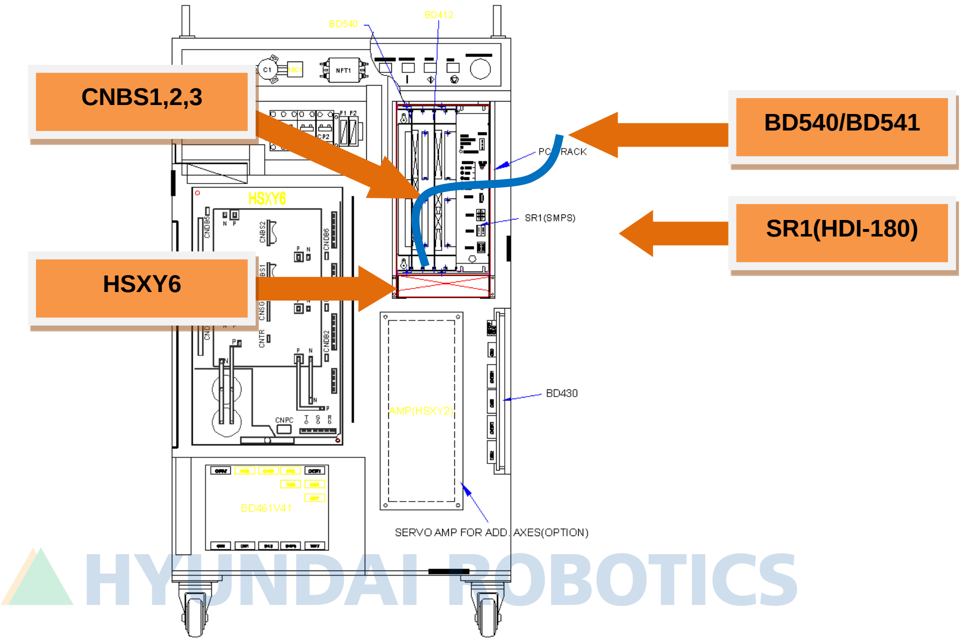


Fig. 5.56 Locations of the components in the Hi4a-0000 controller that are related to the drive unit control voltage reduction

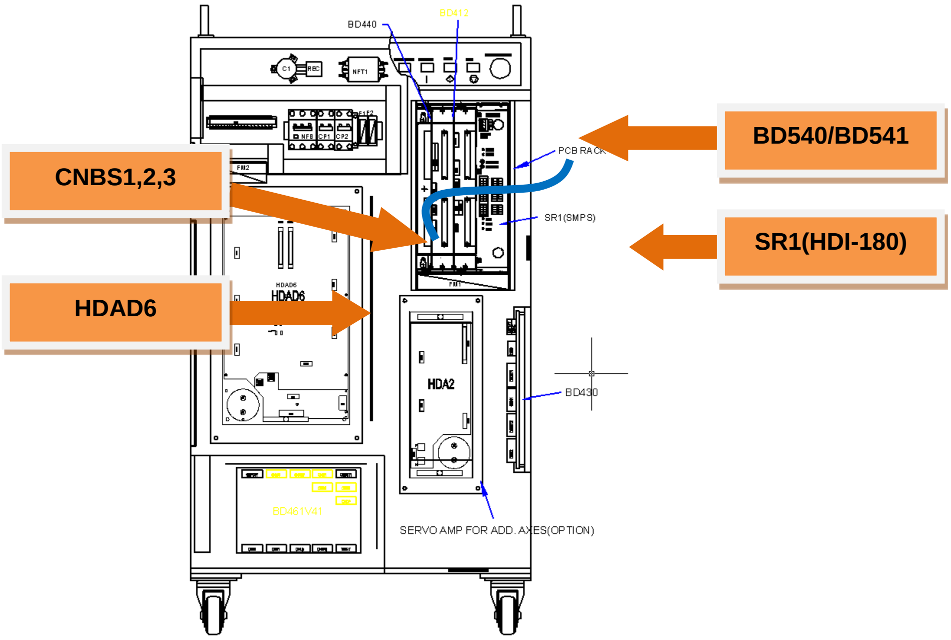


Fig. 5.57 Locations of the components in the Hi4a-0010/0012 controller that are related to the drive unit control voltage reduction

1) Examine the “VE” LED of the Servo drive unit.

Please check the “VE” of the drive unit control voltage error detection module (HSXY6, medium; and HDAD6, small). If the power is being supplied normally, the LED light should be staying on.
Medium-size robot’s Servo drive unit : HSXY6
Small-size robot’s Servo drive unit : HDAD6

2) Examine the “+15 V” LED of SR1

Please check the LED of SR1 if the Servo drive unit’s “VE” LED light is off.
Please check if the LED of SR1 and that of the Servo drive unit are both off at the same time.

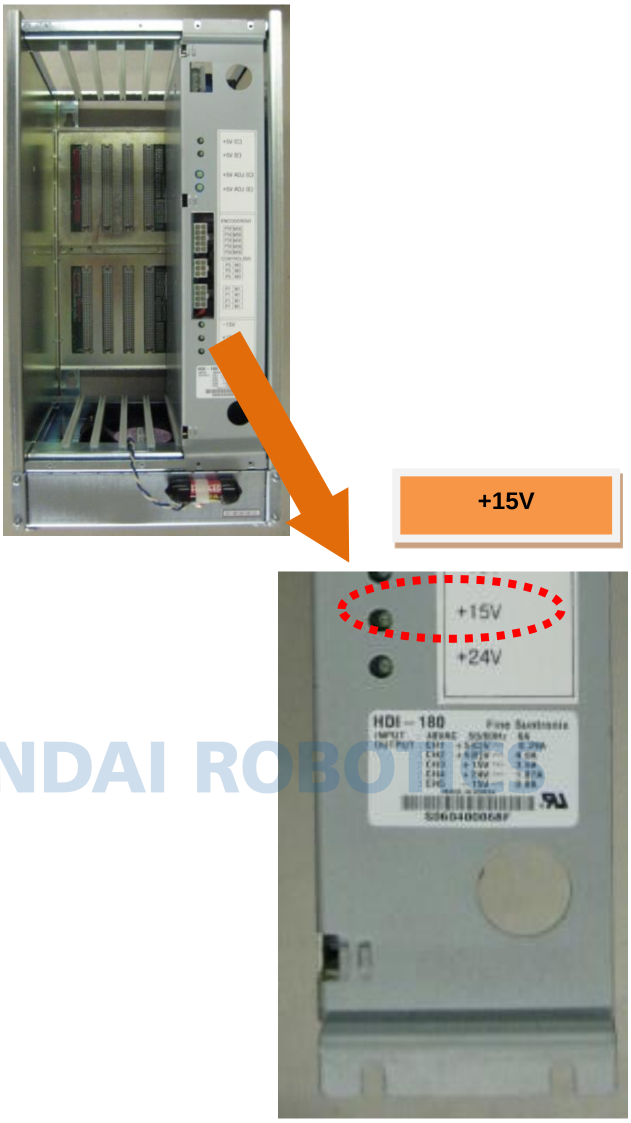


Fig. 5.58 Locations of the “+15 V” LED–related components of SR1

2. Check the output of SR1.

Please remove the wirings and components that are connected to the Servo drive unit, and examine the “+15V” LED to check the output of SR1 itself.

1) Remove the CNBS cable and check the LED.

Please remove CNBS1, 2, and 3 that connect the Servo drive unit and the Servo board. After the removal, please check the LED of SR1. If the “+15V LED” of SR1 turns on after the removal of cables, the Servo drive unit is faulty. Please replace the Servo drive unit with a new one.

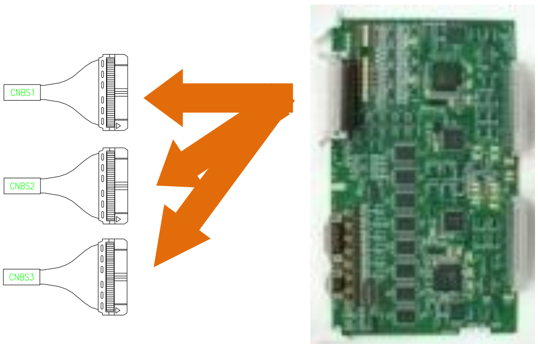


Fig. 5.59 CNBS Removal of the CNBS cable

2) Remove the Servo board (BD540/BD541) and examine the LED.

Please check SR1’s LED after you remove the Servo board from a rack. If the “+15 V LED” of SR1 turns on after the removal of the Servo board, the Servo board is faulty. Please replace the Servo board with a new one.

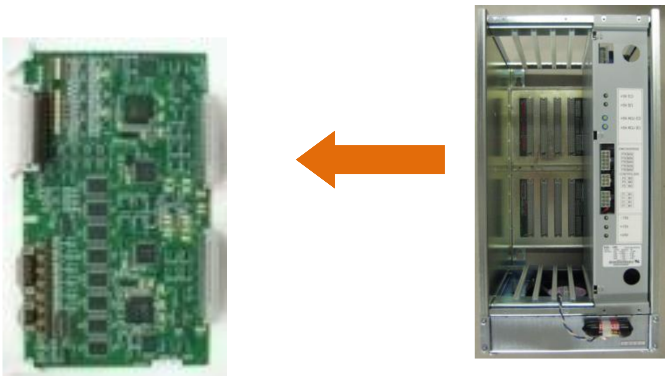


Fig. 5.60 Removal of the Servo board from the rack

3. Examine the SR1 (control power supply unit).

The control power supply unit received AC 48 V (input) and output the necessary control power to each board from the internal circuit.

1) Examine the input voltage of SR1.

If the input voltage to SR1 exceeds the specification, the output of the control power may have an error. If the input voltage exceeds the allowed range, please examine according to the controller's input voltage examination procedures and single-phase internal voltage examination procedures.
SR1 input voltage specification: Single-phase AC 48 V
Allowed range: 44–52 V

2) Replace the SR1 and check the LED.

Please replace the SR1 with a new one, and check the “+15 V” LED. After a new one is installed, if the LED is turned on, the previous SR1 is defective. Please replace and use it.

4. Replace the related components and check the power indicator (LED).

Please replace the Servo drive unit, Servo board, and CNBS cable, and check the “VE” LED of the Servo drive unit.

1) Replace the CNBS cable and check the “VE” LED.

Please replace CNBS1, 2, and 3 that connect the Servo drive unit and the Servo board, and check the “VE” LED. If the “VE” LED is on after the replacement, the cable is faulty. Please replace it with a new one.

2) Replace the Servo board and check the “VE” LED.

Please replace the Servo board and check the “VE” LED. If the “VE” LED is on after the replacement, the Servo board is faulty. Please replace it with a new one.

3) Replace the Servo drive unit and check the “VE” LED.

Please replace the Servo drive unit and check the “VE” LED. If the “VE” LED is on after the replacement, the Servo drive unit is faulty. Please replace it with a new one.

Medium-size robot's Servo drive unit : HSXY6
Small-size robot's Servo drive unit : HDAD6

5.1.19. E0115 (axis ○) Command Error

5.1.19.1. Outline

The main board's command code received by the Servo board does not meet the mutual regulation of the main board and the Servo board. This error may occur due to communication error or version differences between the main board and the Servo board.

5.1.19.2. Causes and checking methods

1. **Examine if the main board and the Servo board are installed properly.**
   1) Examine if the board is installed properly
   2) Examine if the board is faulty.

2. **Examine if the versions of the main board and the Servo board match.**

1. Examine if the main board and the Servo board are installed properly.

This error may be caused by a communication problem if the main board and the Servo board is not installed properly on a rack or the board has an error.

Warning
To protect previous job programs, please back up all the files of the main board to the SRAM card before removing the board from the rack.

1) Examine if the board is installed properly.

Please remove the main board and the Servo board from the rack, and re-install them again.

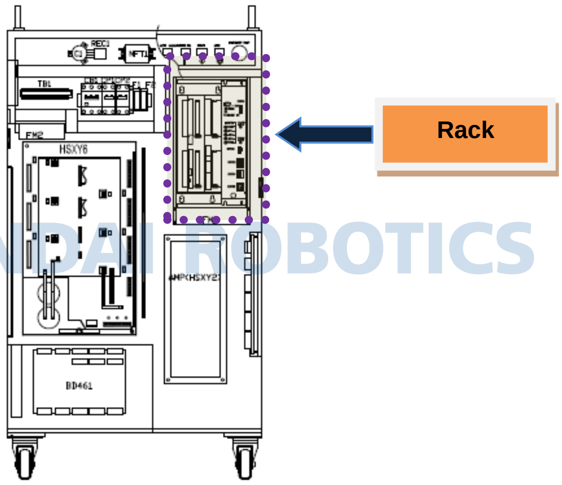


Fig. 5.61 Location of the rack inside the controller

2) Examine if the board is faulty.
To examine if the board is faulty, please replace it with a new one.

2. Examine if the versions of the main board and the Servo board match.

When the controller turns on, it will check the versions of the main board and the Servo board. If the versions do not match, an error “E0178–E181 DSP version mismatch” will be displayed. Please contact our A/S department to update the system with a proper version.

The versions of the main board and the Servo board can be checked from the menu below.
(1) Service
(2) 7. System diagnosis
(3) 1. System version

5.1.20. E0117 (axis ○) Too large position drift

5.1.20.1. Outline

Position (speed) deviation exceeds the set value. If the difference between the location of the moving command and the actual location is too large during the operation of the robot that is controlled by the Servo, the Servo board will detect an error (during Servo operation) and immobilize the robot.

5.1.20.2. Causes and checking methods

1. **Check if the axis with an error has mechanical interference with other equipment.**

   This error may occur if the robot had a mechanical interference or collisions. If the robot is out of the operation area, please move it back into the operation area by using a manual control.

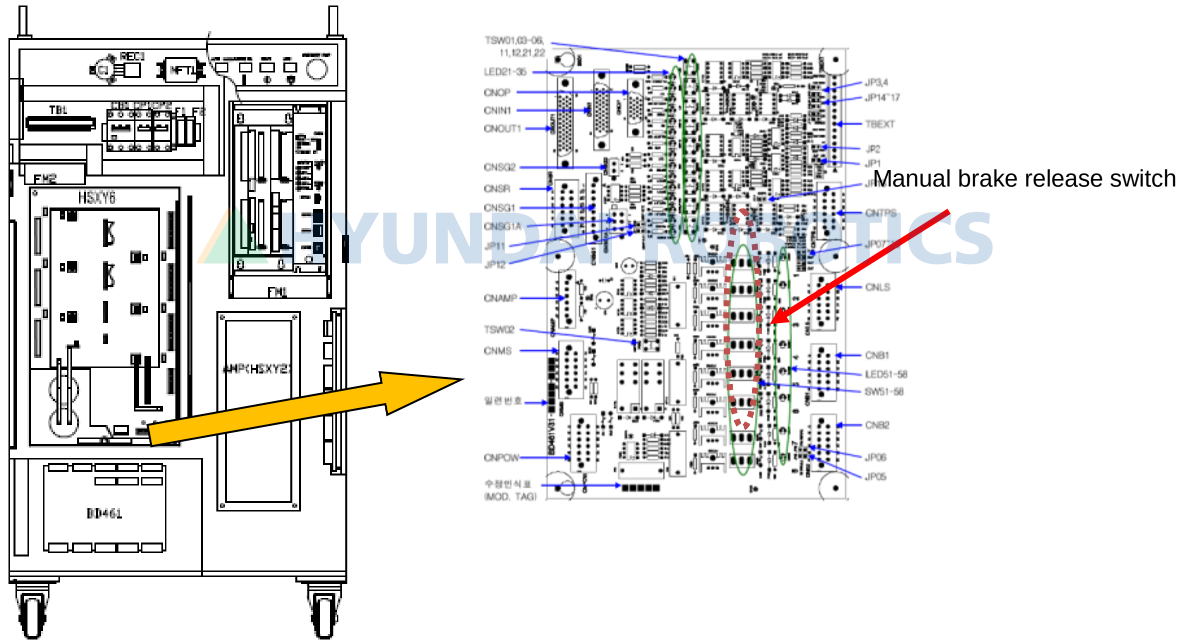
2. Check if the brake release works properly.

The brake release functions of the corresponding axis may have an error or the release voltage of the brake release may have a problem.

1) Examine if the brake release of each axis has an error.

Please remove the motor's power supply (motor off), and check if you can release the brake of the axis with a manual brake switch. You can confirm it with the sound of the brake release from the motor.

> **Warning**
> **Please be cautious. The robot's axis may fall once the brake is released.**



3. Examine the wiring status.

Check if the motor wiring (U, V, and W phases) has been short-circuit from the other wiring or ground lines (FG).

4. Check if the rated load is used.

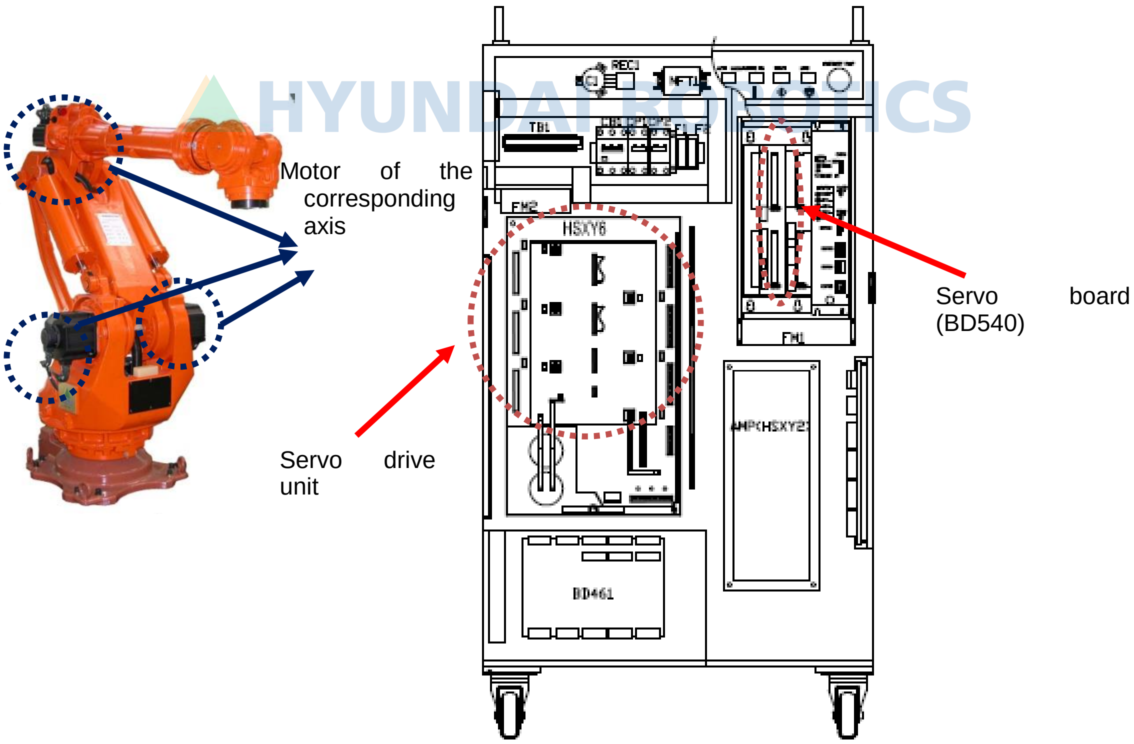
If the total weight exceeds the rated load, please refer to the Robot's specification and adjust the load to within the rated load.

5. Position deviation setting level error

If the position deviation setting value is smaller than the next maximum measured value, please increase the setting value.
The maximum measured value of the position deviation after few cycles of operation is ×1.5.

6. Replace other components.

Replace the component of the Servo board (BD540/1) → Servo drive unit → Motor to confirm the occurrence of an error.



5.1.21. E0119 (axis ○) Overload

5.1.21.1. Outline

The motor or the drive unit is being overloaded. If a motor or drive operation exceeds continuous working conditions, the service life is decreased because of overheating, so the servo board detects the error and stops the robot.

5.1.21.2. Causes and checking methods

1. **Relieve the load condition.**
2. **Please examine if there is a possible collision point during the robot's operation.**
3. **Please check if the axis brake works properly.**
4. **Please replace the Servo board and examine the error.**
5. **Please examine if the drive unit operates normally.**

1. Relieve the load condition.

If the overload error occurs during a normal robot operation, check if it is because of load condition, or the controller or robot body even with a normal load condition. Relieve the working load condition of the robot in the following manner to see if the overload error is solved.
Check the reduced tool load.
Check the robot waiting time inserted or the reduced robot speed.
If the overload error persists even with relieved load condition, check the controller or the robot body for any problem.

Both the tool weight and the inertia size are important for the load of the robot. For the allowed inertia for each robot, check the maintenance manual. Here is an example of an HX165 robot.

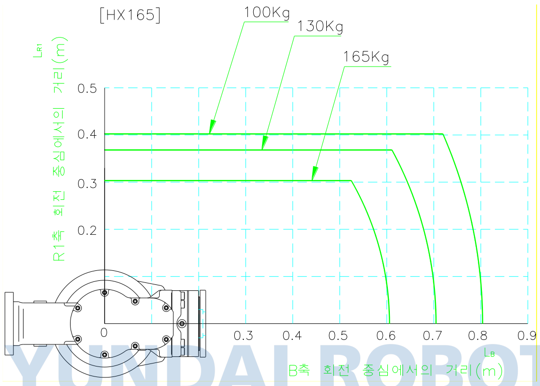


Fig. 5.62 Inertia is allowed for the wrist axis of the HX165 robot.

2. Examine if there is a possible collision point during the robot's operation.

Please check if there is a point where the robot may be interfered or may have a collision in the operation area. This error may occur if the robot is interfered by other equipment. In that case, please modify the job program so that the interference will not occur.

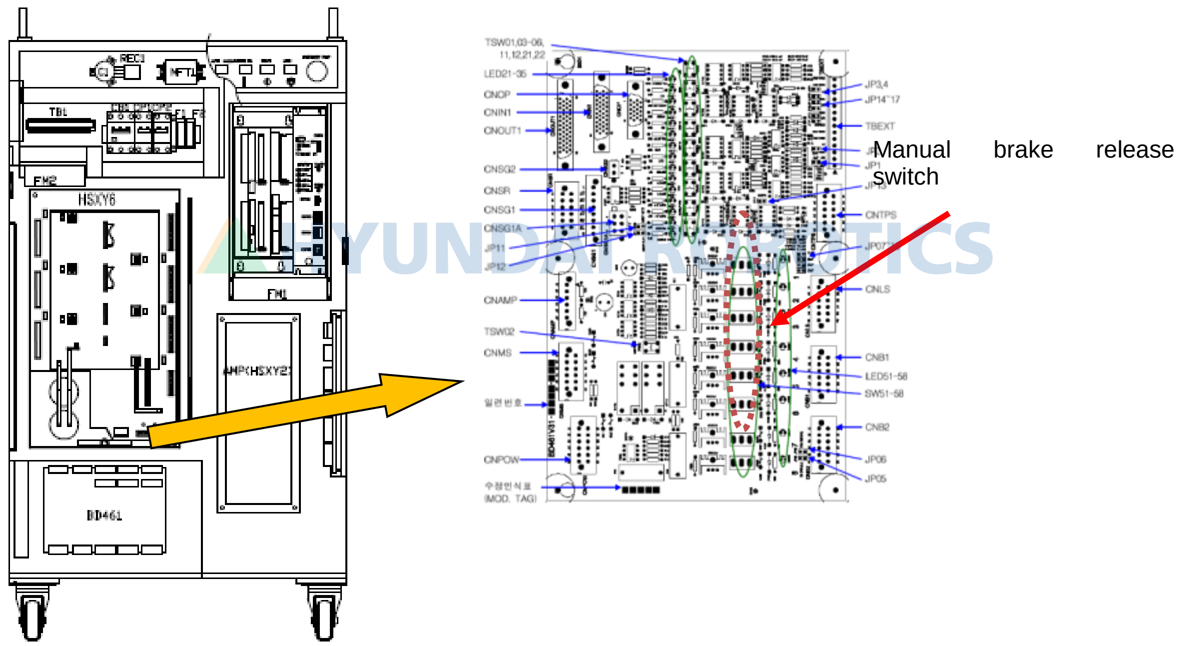
3. Check if the axis brake works properly.

The brake release functions of the corresponding axis may have an error or the release voltage of the brake release may have a problem.

1) Examine if the brake release of each axis has an error.

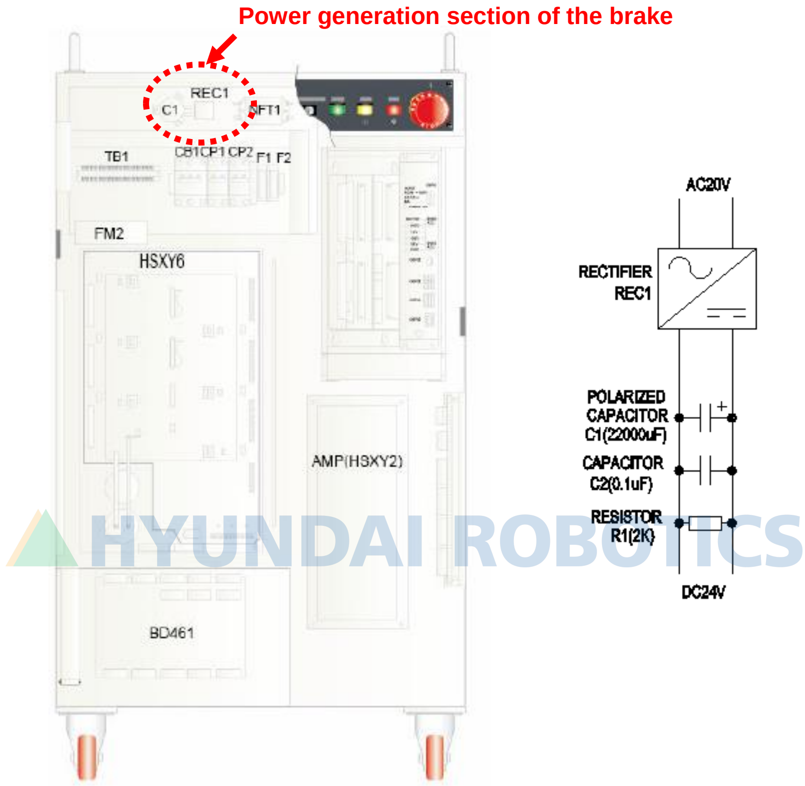
   Please remove the motor's power supply (motor off), and check if you can release the brake of the axis with a manual brake switch. You can confirm it with the sound of the brake release from the motor.

Warning
Please be cautious. The robot's axis may fall once the brake is released.



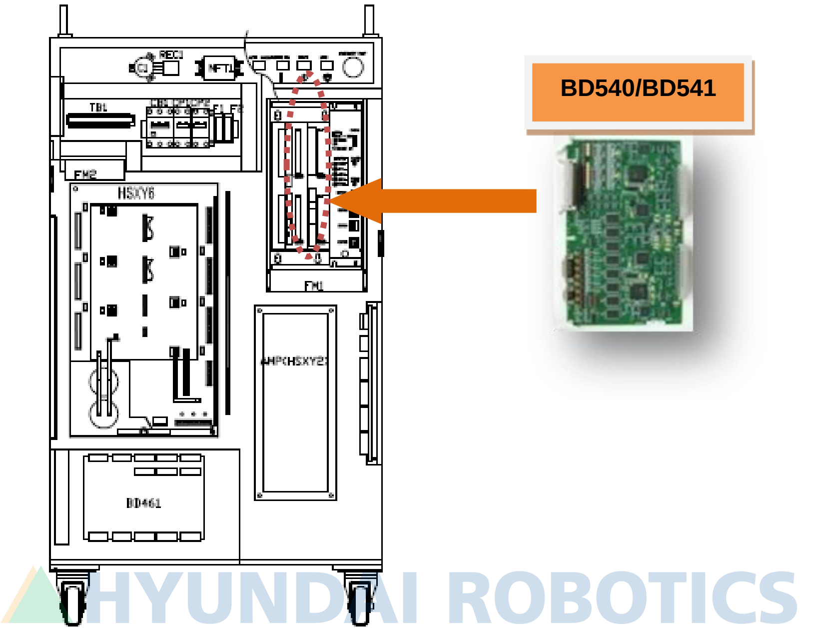
2) Examine the error on the brake's power supply

If the "E0012 brake power error" message is displayed at the same time, there is an error on the brake's power supply unit.
The capacitor and rectifier are installed on top of the controller. A DC24V power is generated from the 20 V one. Check if the DC24V is generated by using a tester.



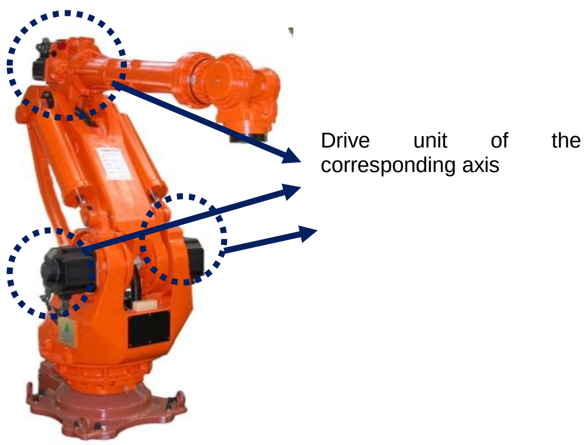
4. Replace the Servo board and examine the error.

After the replacement of the Servo board, if the error does not persist, the Servo board is faulty. Please replace the Servo board with a new one.



5. Examine if the drive unit operates normally.

Please check if the drive unit of the corresponding axis (motor, decelerator) works properly.



5.1.22. E0122 Cannot make servo on

5.1.22.1. Outline

This error occurs if the Servo motor does not turn on when the main board sends out the motor on command to the Servo. The cause might be a communication problem between the main board and the Servo board.
The main board sends the Servo error clear command prior to sending the motor on command, and once the Servo error is cleared, the motor on command will be sent out. If the Servo error is not cleared, the same error persists, and the motor on command will go out. In other words, if the communication between the main board and the Servo board does not have a problem, the motor on command will be received or other Servo errors will occur.

5.1.22.2. Causes and checking methods

1. Examine if the main board and the Servo board are installed properly.
1) Examine if the board is installed properly.
2) Examine if the board is faulty.

1. Examine if the main board and the Servo board are installed properly.

This error may be caused by a communication problem if the main board and the Servo board is not installed properly on a rack or the board has an error.

> **Warning**
> **To protect previous job programs, please back up all the files of the main board to the SRAM card before removing the board from the rack.**

1) Examine if the board is installed properly.
   Please remove the main board and the Servo board from the rack, and re-install them again.

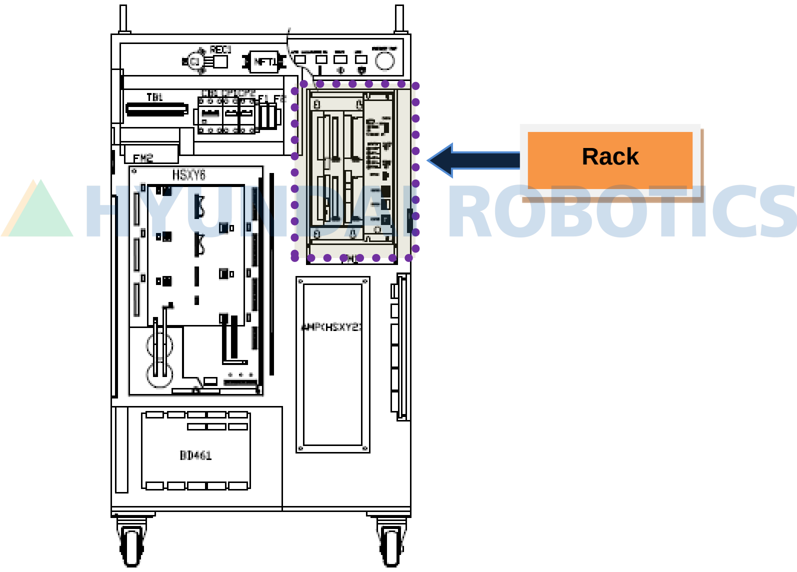


Fig. 5.63 Location of the rack inside the controller

2) Examine if the board is faulty.
   To examine if the board is faulty, please replace it with a new one.

5.1.23. E0125 Accuracy not satisfied

5.1.23.1. Outline

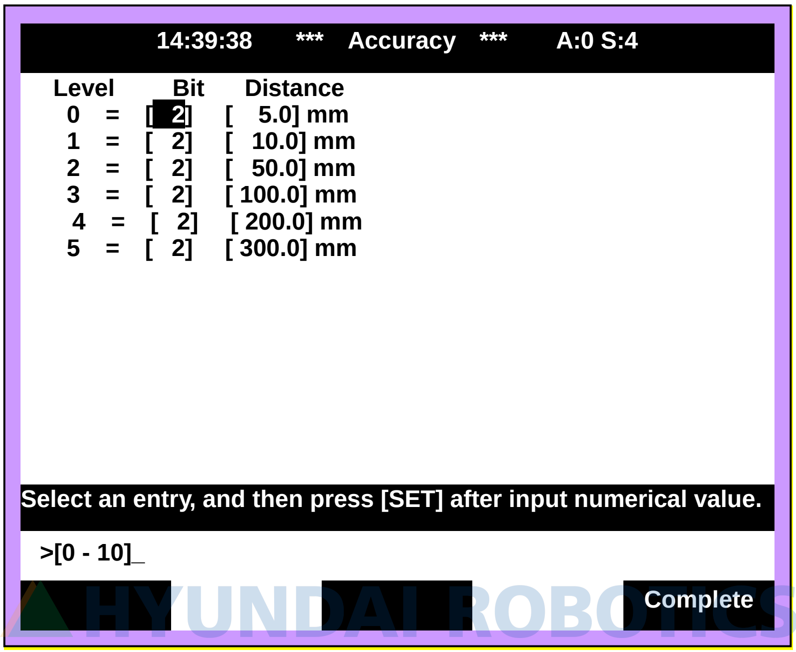
After a certain time has elapsed, with all location commands sent to the servo, the robot is still in an inaccurate level as recorded in the step. This error occurs if the accuracy level is too small or vibration occurs with the robot.

5.1.23.2. Causes and checking methods

1. **Check the accuracy level.**
2. **Adjust the robot to avoid vibration.**
3. **Please replace the Servo board and examine the error.**
4. **Please examine if the drive unit operates normally.**

1. Check the accuracy level.

Check the accuracy level recorded in the step and select System> 3: Robot Parameter > 8: Accuracy in the manual mode.

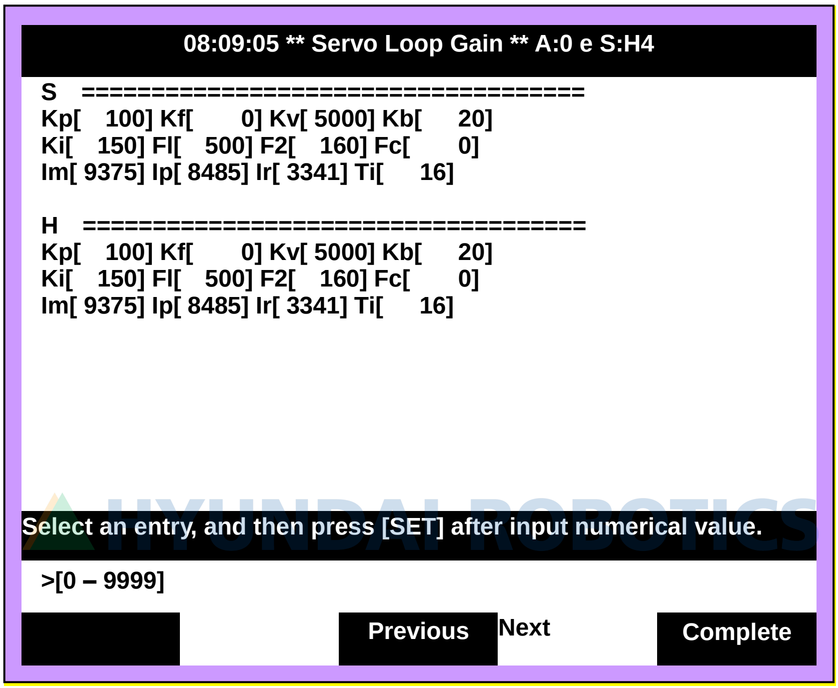


If the accuracy is 0 for the step in which the problem occurred, increase the bit and distance of Level 0 into a level allowed for the operation.

2. Adjust the robot to avoid vibration.

If vibration remains at the tip of the robot tool in the stationary state and Accuracy OK still does not appear, adjust the robot to avoid vibration at the tip.

Enter the engineer code “R314” and select System> 3: Robot Parameter > 12: Servo Parameter Setting>1: Servo Loop Gain in the manual mode.

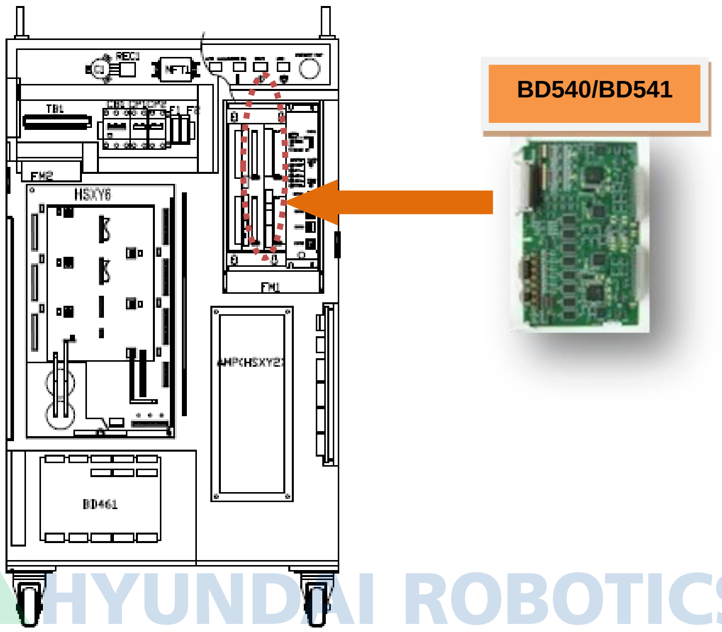


If the vibration occurs at the tip of robot tool, increase F1 and F2 of servo parameters with the same ratio for all axes. For instance, to increase by 20% with F1=500 and F2=160 as above, change them to F1=600 and F2=192 for all axes.

The cycle time will be delayed as F1 and F2 are increased, but controlling the vibration is required. If F1 and F2 aren't set to the same values, the tip of the robot tool may not be in a straight trajectory so pay attention.

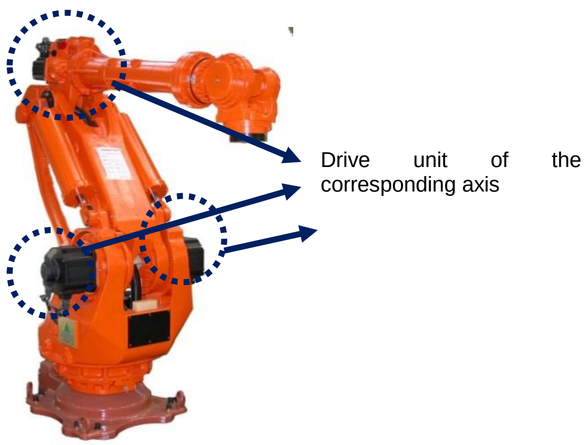
3. Replace the Servo board and examine the error.

After the replacement of the Servo board, if the error does not persist, the Servo board is faulty. Please replace the Servo board with a new one.



4. Examine if the drive unit operates normally.

Please check if the drive unit of the corresponding axis (motor, decelerator) works properly.



5.1.24. E0127 MSHP not work

5.1.24.1. Outline

The motor's power supply is supplied to the AMP according to the open/close status of magnetic contactor MSHP1 and MSHP2.
The status of MSHP1 and MSHP2 are being monitored by the main board's conditions, and E0127 (MSHP operation error) will be generated when an abnormal operation is detected.

For MSHP1 or MSHP2 to turn on, several conditions need to be satisfied, and even if they are turned on, they can be off for some reasons. The main board can identify the causes for the magnetic contactor's operation error if it is a case that provides a monitoring function such as safety signals. However, if the main board cannot identify the magnetic contactor's operation error, a number of examinations are required.

5.1.24.2. Causes and checking methods

1. Replace the sequence board.
2. Replace the IO board.
3. Replace the MSDB1, 2 or MSHP1, 2.

To identify the cause of this error (MSHP operation error), you must understand the motor's power supply insertion system. The basic concept of the motor's power supply to the AMP (drive unit) is as follows. According to the "Motor ON Sequence," the main MSHP operation command is used and the MSHP1 and 2 are operated while monitoring the auxiliary contact. At this stage, if the MSHP1, 2 do not activate within a certain amount of time, E0127 (MSHP operation error) will occur. If magnetic contact MSHP1 and MSHP2 turn on according to the main board's command, AC 220 V R, S, and T three-phase power supply will be supplied to the AMP.

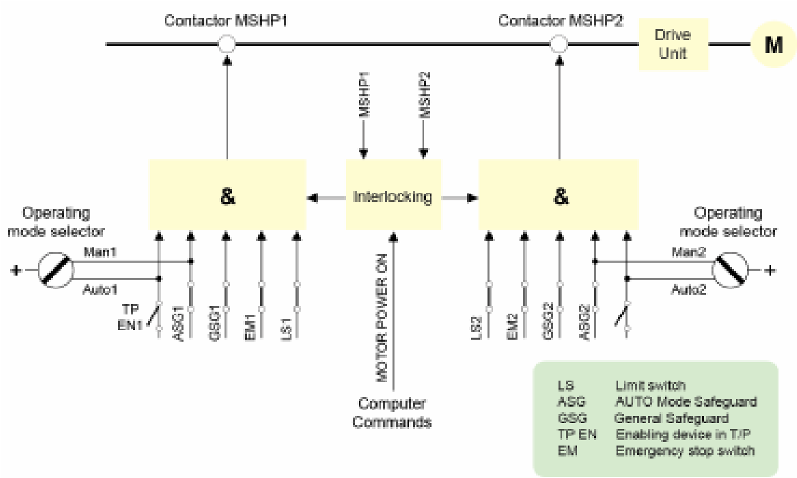
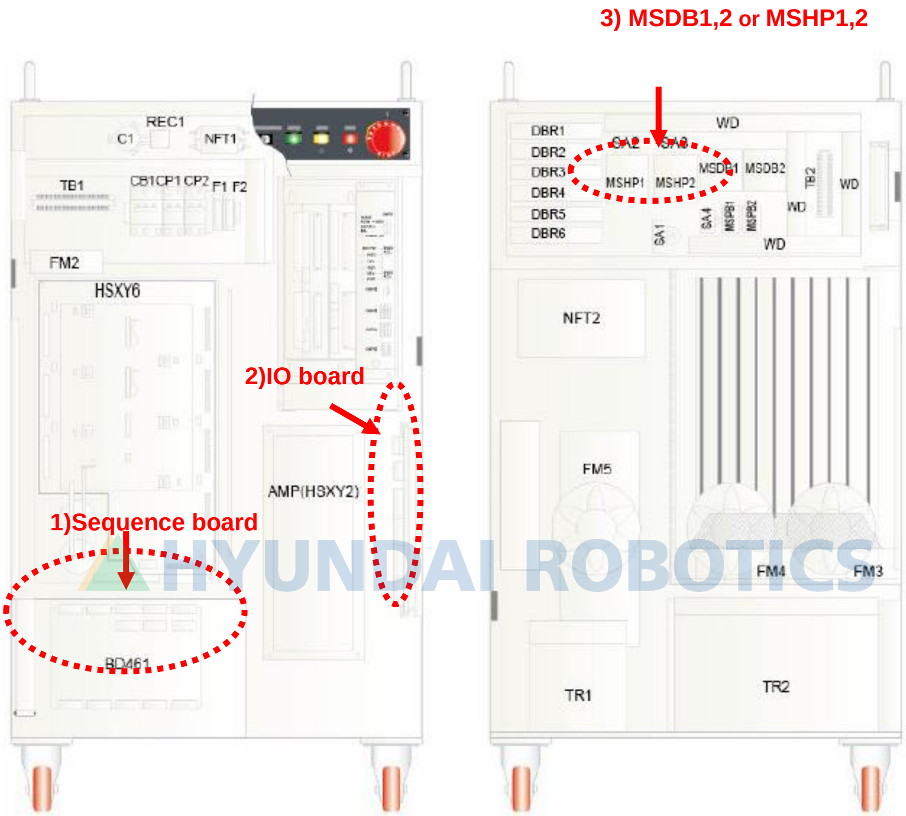


Fig. 5.64 Concept diagram of the safety circuit for the motor's power on/off

1. Board replacement according to command system

   1) Replace the sequence board.
   2) Replace the IO board.
   3) Replace the MSDB1, 2 or MSHP1, 2.



5.1.25. E0133 (axis ○) Command error

5.1.25.1. Outline

This error may occur due to a communication error between the main board and the Servo board, or a rapid change of motion. When a communication error occurs, a valid command cannot be transferred from the main board to the Servo board, so this error will occur and immobilize the robot to prevent the robot's abnormal operation based on an invalid command.
Moreover, this error will occur and immobilize the robot because the drive unit may not follow the rapid changes of the motion command.

5.1.25.2. Causes and checking methods

1. **Examine if the main board and the Servo board are installed properly.**
   1) Examine if the board is installed properly.
   2) Examine if the board is faulty.

2. **Examine if there is a job program that operates the robot rapidly.**

1. Examine if the main board and the Servo board are installed properly.

This error may be caused by a communication problem if the main board and the Servo board is not installed properly on a rack or the board has an error.

Warning
To protect previous job programs, please back up all the files of the main board to the SRAM card before removing the board from the rack.

1) Examine if the board is installed properly.

Please remove the main board and the Servo board from the rack, and re-install them again.

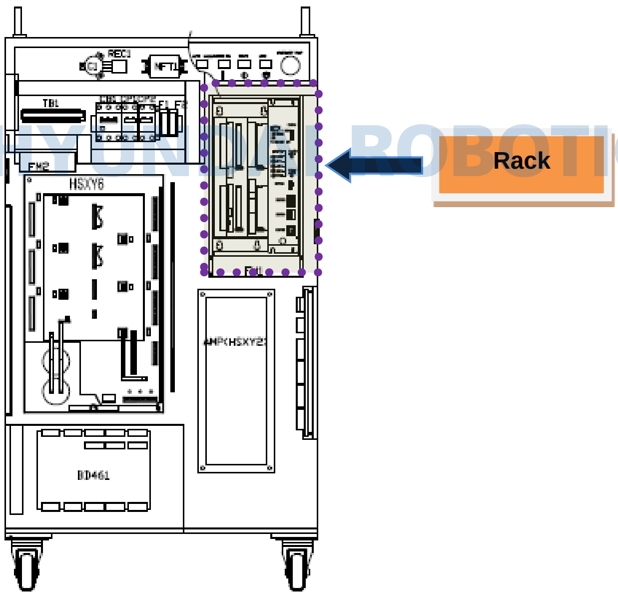


Fig. 5.65 Location of the rack inside the controller

2) Examine if the board is faulty.
To examine if the board is faulty, please replace it with a new one.

2. Examine if there is a job program that operates the robot rapidly.

Please check if the error occurs at the point where the robot's motion changes rapidly. If the error occurs during the rapid motion, modification of the job program is required.
The reason that this error occurs during the rapid motion is as follows. During the execution of the job program, the robot's position may be twisted to move a short distance. At that point, the speed of the robot's axis suddenly increases, and an error may occur if the Servo board follows the movement. To resolve this, please modify the teaching point of the location (where the position changes rapidly) or make changes on the position of the robot.

5.1.26. E0134 (axis ○) Overspeed

5.1.26.1. Outline

The speed of the robot’s axis exceeded the maximum speed limit while in operation. An error will be generated, and the robot will be immobilized because the robot is not being controlled normally.
When the main board sends a command to the Servo board, it will send a limited command so that the robot will not exceed the maximum speed limit. The maximum speed exceeded error may occur if the robot’s speed triggers an overshoot because the robot could not follow the command.

5.1.26.2. Causes and checking methods

1. Please check if the position of the robot is close to the singular point. **2. Please check the setting value of the condensation acceleration/deceleration parameter and the load factor.** **3. Please adjust the job program.**

1. Check if the position of the robot is close to the singular point.

This error may occur if you execute L or C interpolation instead of the PtP interpolation near the position of the singular point.
A singular point occurs when the B axis is close to 0° or the center of the wrist part is close to the spin central axis of the S axis. When passing near the singular point is required, please change the corresponding step to PtP interpolation.

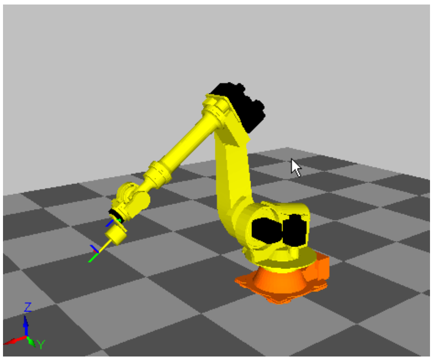


Fig. 5.66 Axis B singular point

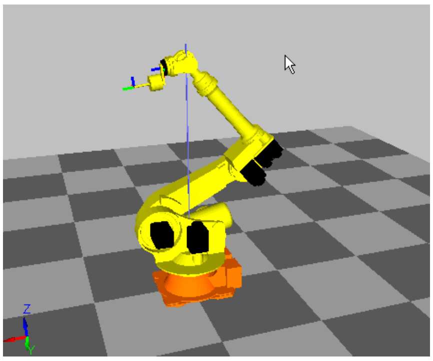


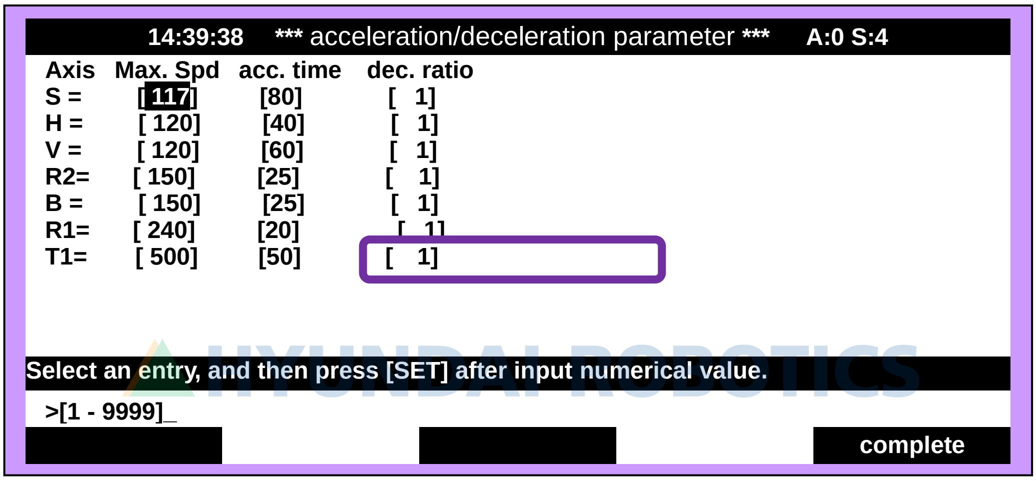
Fig. 5.67 Axis S singular point

2. Check the setting value of the condensation acceleration/deceleration parameter and the load factor.

The motor torque is insufficient because the maximum speed of condensation acceleration/deceleration parameter is too high, or the acceleration time is too short. The I/lp maximum speed had to be reduced with an observation of the load factor (during the robot's operation) or had to increase the acceleration time.

(1) System
(2) 3. Robot parameter
(3) 6. Acceleration/deceleration parameter

The acceleration/deceleration parameter of condensation can be modified from the above.



3. Adjust the job program.

Please make changes of the conditions (from the job program) on a corresponding step, or the previous step. First, try "Acc=0"; second, reduce the step speed; and third, add one more step on a movement routine.

5.1.27. Instructions in examining the controller's input voltage (three-phase)

Please check the voltage on the rating plate and the actual input voltage.

Please check if the voltage of the controller's power supply is within the allowed voltage range as described on the rating plate. The allowed range of input voltage is within 10% of the described value on the rating plate, and it should be over 198 V (AC 220 V standard). The following describes how to measure the input voltage of the controller. If the measured voltage is out of the allowed range, please examine the power supply units.

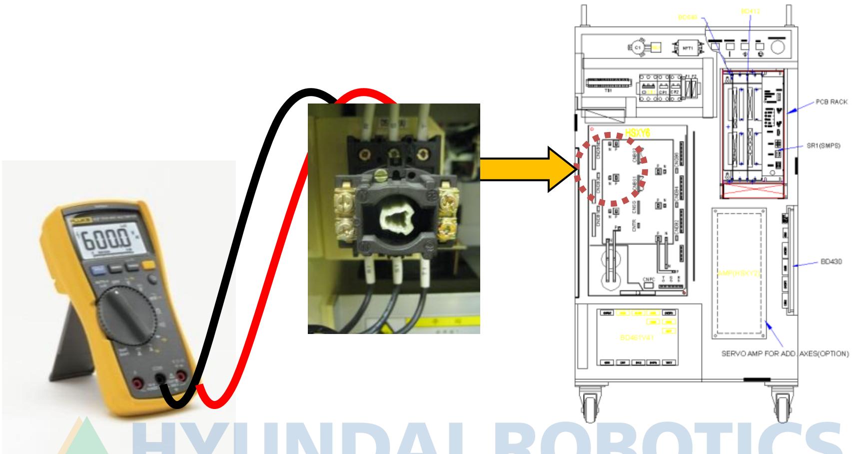


Fig. 5.68 Location of Hi4a-0000 Controller's Power Switch

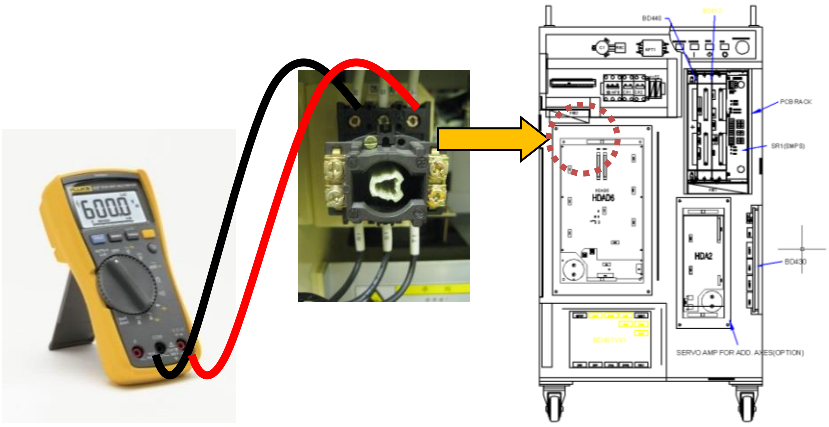


Fig. 5.69 Location of Hi4a-0010/0012 Controller's Power Switch

Warning
Please be cautious. Short-circuit between phases or with surrounding components can occur while measuring high voltage.

5.2. Instructions in Parts Replacement

This instruction shows how to replace the parts and boards during troubleshooting.

5.2.1. Instructions in Substrate Replacement

Pay attention to the followings during boards replacement.

【Cautions】

① Be sure to turn power off before working.

② Keep your hands clean to prevent boards from being stained with oils or water.
If you need to grasp the board, please hold around the board. Be sure not to touch the contacting surface of electric parts or pattern, and especially connector.

③ Align the electric potential between the body(hand) of the user and the controller.

④ Each board has a number of connectors. Be sure to insert completely to prevent false inserting, omission, or looseness when replacing.
Match the printed names on the nameplate of connector and on the one of boards.

Separation of Boards

Please take the followings actions before taking out BD412 board.

If you intend to replace BD510 board, you need to back up the necessary program/constant data by using HR-VIEW S/W or SRAM CARD of (Notebook) PC before replacement.

Since the teaching-program / constant data is stored in SRAM of BD510 board, the previous program / constant data you want is not existed after replacement.

After replacement, load the backup contents to the new board before using.

Program/constant data remains in SRAM by the battery for backup even when power is removed.

Besides, in case that connectors of battery for backup is separated by mistake or by board replacement, capacitor for backup maintains program /constant data up to 1 hour. The battery for backup must be connected to keep the board for long period of time because program/constant data may be deleted afterwards.

Please be aware of the above cautions, and make a replacement of board following the below instructions.

① First, remove input power from power unit.

② Loosen slightly the screw upholding the supporting stand which is above and below of Rack, move the supporting stand to the left, and pull it out.

③ Take all the connectors out of board. Here, for the connector connected by screws, loosen them by using a suitable screwdriver. And be careful of excessive force to connector.

④ Pull out the Ejector mounted on the upper and lower front side of board, and the board will be taken out along the guide rail of Rack.

Insert of Board

① First, turn off the input power of power unit.

② Push inward the Ejector mounted on the upper and lower front side of board along the guide rail of Rack. Here, push it hard until you feel that the connector is inserted into Mother board which is located in the back side of Rack.

③ Connect all the connectors of the board. Here, for the connector connected by screws, tighten it again by using a suitable screwdriver.

④ Move the supporting stand to the right, hooking up to the screw on the upper and lower part of Rack, and then tighten the screw.

Pay attention to the followings after inserting BD412 board.

Make a copy of the program/constant data which is copied prior to the replacement of BD412 in BD510 board memory by using (Notebook) PC or CF CARD. And make sure that the battery connector for backup is connected.

If the battery connector is not connected, it is safe while controller power is ON . However, if power is OFF for more than 1 hour, program/constant data will be all deleted.

5.2.2. Instructions in Servo AMP Replacement

Pay attention to the followings during servo AMP replacement.

[Caution]

Check the nameplate in the front side of panel in case that it would not have compatibility with other types of servo AMP.

Separation of Servo AMP

① First, turn off the input power of power unit.
② Loosen the fixed bolt in servo AMP protection cover to take off.
③ Take off wires tightened to terminal block with screws.
④ Take off all the connected connectors.
⑤ Take off the screws tightening the servo AMP.
⑥ Take out the servo AMP.
Be careful when taking out the servo AMP because it is very heavy. And make sure not to damage wires around it.

Connection of Servo AMP

① First, turn off input power of power unit.
② Lift the servo AMP carefully and push it in.
Be careful when pushing in the servo AMP because it is very heavy. And make sure not to damage wires around it.
③ Screw on the servo AMP.
④ Screw on the wires to terminal block.
⑤ Connect all the connectors.
⑥ Tighten the servo AMP protection cover with bolts.

5.2.3. Instructions in Battery Replacement

This controller is a backup battery for SRAM, and uses 3.6V Lithium battery.
Replace the battery every 2 years on a regular basis.
To prevent a damage of SRAM data, back up SRAM data first by using HRVIEW or SRAM CARD.
When replacing the battery, it can be done with the primary power is ON.

① Prepare a new Lithium battery.

② Disconnect the primary power of controller.

③ Replace Lithium battery with a new one.

④ Supply the primary power to controller.

[Caution]

- Do not litter the spent battery.
- Dispose of the spent battery as an industrial waste under the relevant regulations or rules.
- Do not recharge the used-up battery. It involves a danger of explosion.
- Use the specified battery only.
- Do not make a short circuit of positive and negative poles.
- Do not burn the spent battery, nor leave it in a high temperature.

5.2.4. Instructions in SMPS(SR1) Replacement

[Caution]

This SMPS(SR1) is a complex power unit which is used as a primary control power. Pay close attention to this sophisticated device.

Separation of SMPS(SR1)

① First, turn off input power of power unit.
② Unscrew the terminal stand of SMPS(SR1) to take off the attached wires.
③ Loosen 4 screws tightened to the board Rack.
④ Insert your index finger into the hole in upper and lower side of SMPS(SR1), and pull it out. Then SMPS(SR1) will be taken out of the Rack. Here, if pulling too hard, you may involve an injury, so be careful. And make sure not to damage the wires around it.

Connection of SMPS(SR1)

① First, turn off input power of power unit.
② Grasp the SMPS(SR1) with the right hand and push it into the first guide rail of Rack, while clearing the surrounding wires away. Here, make sure not to damage the wires around it.
③ Screw it to the Rack.
④ Screw on the wires to terminal stand.

5.3. Instructions in Adjustment

This controller does not require extra adjustment because it has been fully adjusted when deleivered from warehouse. However, in case of parts replacement, an adjustment may be needed to some extent. This instructions shows how to adjust and where to adjust. Do not make an adjustment, except that it is needed, unless the cause of trouble is confirmed.

5.3.1. Adjustment of Power System

In case of power system errors or power change, take a measurement of each power voltage, and adjust any voltage below the standard(use a digital voltmeter for measurement).

Table 5-2 Power Standard

Power	Measuring Location	Standard	Adjustment
Primary Power	CB1 input terminal	**AC220V ± 10%**	Define the primary tab of transformer TR1 as AC220V
R6,S6,T6	Servo AMP R, S, T	**AC220V ± 10%**	Check the input voltage of CB1 - AC220V
B2-C2	TB1 B2-C2	**AC220V ± 10%**	Secondary Tab turnover of transformer TR1
P1-M1	SR1 +24V-G2	**DC24V ± 2.0V**	(Note 1)
P5-M0	SR1 +5V-G1	**DC5.1V ± 0.1V**	Volume resistance in SR1
P15-M0	SR1 +15V-G1	**DC15V ± 0.5V**	(Note 1)
N15-M0	SR1 -15V-G1	**DC-15V ± 0.5V**	(Note 1)
P5E-M5E	SR1 +5V-GND	**DC5.4V ± 0.1V**	Volume resistance in SR1 (Note 2)
	Terminal block for Robot external wiring Connectors Pin P5E-M5E	**DC5.1V ± 0.1V**	Volume resistance in SR1 (Note 2)

(Note 1) Replace the SR1 if it is not within the standard.
(Note 2) First, check the standard in the measuring location, and then make a measurement in the nearest terminal stand from robot encoder and between connector Pins. Here, the standard must be DC5.1V±0.1V.

5.3.2. Transformer (TR1)

【Caution】

AC 220V 3-phase must be used for primary power of transformer(TR1).
Do not adjust the secondary terminal because it is connected to power suitable for the internal parts specifications.

AC 220V 3-phase must be used for input power of this controller.
Tab must not be changed without permission of our staff because this controller has been completed in adjusting when delivered from warehouse.

Primary Power (AC 220V specification)

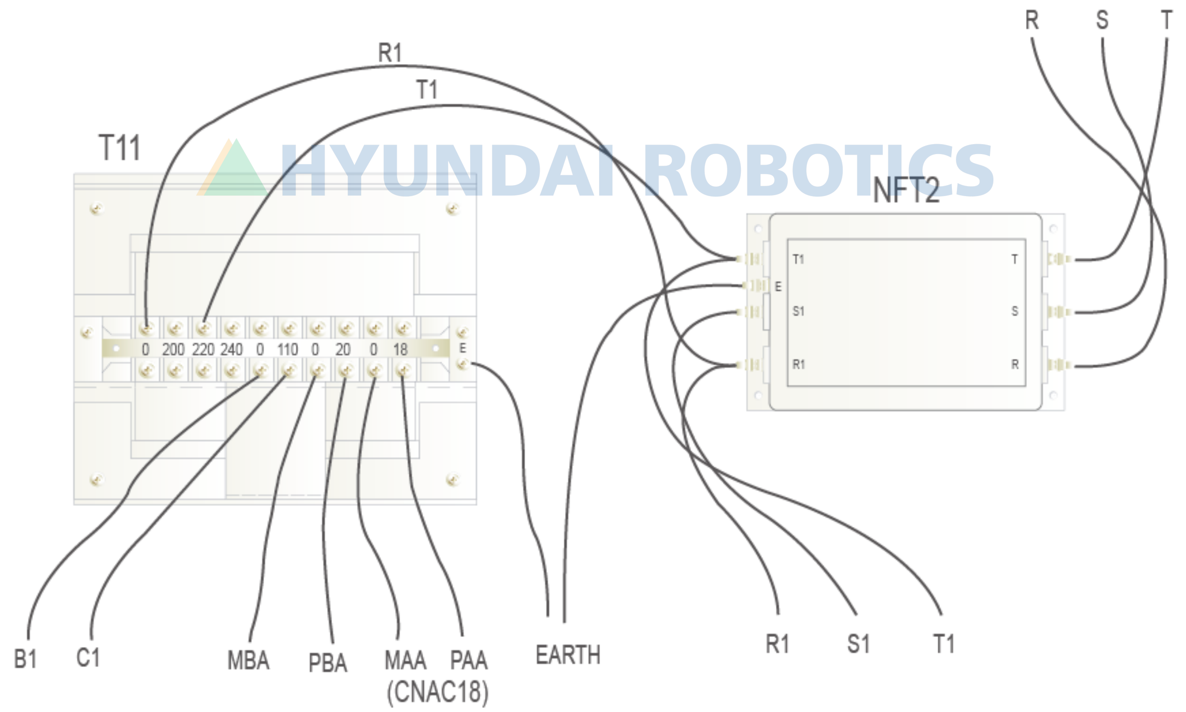


Fig. 5.70 Primary Power(AC220V specification)

5.4. Error Code and Warning

Errors are classified into general errors and handling errors. General errors are to call user's attentions, and handling errors indicates that operator made a mistake or trouble.

Hi4a controller, with its built-in self-diagnostic function, displays the details of errors on LCD screen of Teaching Pendant. Thus, you may check error code, and confirm it in the error code table for troubleshooting.

In case of troubleshooting, read carefully 『5.1 troubleshooting cases』 & 『5.2 Instructions in Parts Replacement』, and be fully understood on your working details before getting down to work. In addition, fully inform us of the followings when contacting with our A/S office.

① Name of type in the robot specification nameplate and name of type in the controller specification nameplate
② Occurrence date month year
③ Symptoms & error code
④ Details conducted by user's company
⑤ Software version of robot controller (Main, I/O, DSP, T/P)
⑥ Environment conditions in the occurrence of errors(power failure, collision with Jig, etc.)

5.4.1. System Error

Code	E0000	Power down detected
Cause	A power was cut after motor ON or CB(Circuit Breaker) was OFF.	
Action	Just to store a power outage to the error list, Any action is not demanded.	

Code	E0002	H/W LMT switch on
Cause	Limit Switch was actuated at the end of work range for each axis.	
Action	Reference the maintenance manual	

Code	E0003	Overload relay or CP tripped
Cause	Overload Relay(OL) or Circuit Protect(CP) on main power line was tripped.	
Action	Reference the maintenance manual	

Code	E0004	Arm interference switch on
Cause	Limit Switch for preventing Arm Interference was actuated.	
Action	Reference the maintenance manual	

Code	E0006	Collision sensor on
Cause	Collision sensor is actuated.	
Action	Check whether tool deformation is occurred. If the cause for collision error is removed, push [Motors-on] button and operate	

Code	E0007	Sticking of weld detected
Cause	Sticking of welds signal is detected in completion of welding sequence.	
Action	1) Check the sticking of welds signal. 2) Remove the cause of weld stick.	

Code	E0008	Motor temperature is risen
Cause	Temperature of Motor has risen high.	
Action	Reference the maintenance manual	

Code	E0010	Discharge resister overheated(AMP)
Cause	In the case that temperature of Discharge resister risen for base value, overheated detect sensor error.	
Action	Reference the maintenance manual	

Code	E0011	Overvoltage in the drive unit
Cause	In the case of excess establish value of the motor voltage(P-N)	
Action	1) Check the AC input voltage in the controller 2) Check the connection of discharge resistor	

Code	E0012	Brake power error
Cause	Brake voltage is lowered.	
Action	Reference the maintenance manual	

Code	E0014	PWM error or E/S switch tripped
Cause	Cause of Emergency switch such as Emergency Stop, Safety Device, Overheated Motor, Limit Switch and so on or a malfunction of servo board, PWM command was not output to the servo amplifier.	
Action	1) Check the Emergency Switch. 2) Check the CNSG cable with HDXY6 and BD440 3) If an error occurs after taking above steps, contact the Robot A/S team.	

Code	E0015	Teaching pendant does not work
Cause	Communication with teach pendant is abnormal or teaching pendant is malfunction.	
Action	Reference the maintenance manual	

Code	E0016	Servo drive unit error
Cause	You pushed [Motors-on] button in the state that Servo Drive Unit is abnormal.	
Action	Take a measure to the error in system initialization and push [Motors on] button.	

Code	E0017	Conveyor pulse line trouble
Cause	Failing in conveyor pulse generating or a break in pulse lines.	
Action	1) Check up the conveyor encoder power and connections of pulse line 2) Change the Arc Board BD48X.	

Code	E0018	BD481 interface error
Cause	Crushed serial data from the BD480 board.	
Action	1) Check the connections between CNSIO (BD411) <-> CNIO (BD481) 2) Dip SW #3 of BD480 board should be ON.	

Code	E0019	CNVY pulse count changed a lot
Cause	Conveyor pulse frequency is than the permitted range in SYSTEM/ APPLICATION PARAMETER/CONVEYOR/ CONVEYOR CONSTANT SETTING	
Action	1) Check the frequence range on SYSTEM/ APPLICATION PARAMETER/ CONVEYOR/ CONVEYOR CONSTANT SETTING 2) Check if noise signal exists in the pulse line	

Code	E0021	Conveyor speed is too high
Cause	CONVEYOR PERMISSION SPEED is high	
Action	Check the CONVEYOR PERMISSION SPEED on SYSTEM/ APPLICATION PARAMETER/ CONVEYOR/APPLICATION PARAMETER/ CONVEYOR/ CONVEYOR CONSTANT SETTING Check if noise signal exists in pulse line.	

Code	E0022	Check up I/O board communi. cable
Cause	Mainboard can not receive expected packet data within 20msec from the I/O board	
Action	Reference the maintenance manual	

Code	E0023	Fieldbus power is not supplied
Cause	The field bus power line is not supplied.	
Action	Check up the field bus power line.	

Code	E0024	Fieldbus network connection error
Cause	The field bus network interface was not good.	
Action	Check up the field bus network cable connections.	

Code	E0025	Fieldbus IDLE state
Cause	The PLC scanner of the field bus master was not running.	
Action	Change the state of PLC to RUN if the PLC is on the program state.	

Code	E0026	Fieldbus adapter response error
Cause	The field bus function on the I/O Board doesn't work well.	
Action	1) Check up the communication cable CNIO from the I/O board to the main board. 2) Check up the communication configuration(75600BPS,DATABit8, STOP bit1, nothing, nothing) on SYSTEM/ CONTROL PARAMETER/ I/O SIGNAL ATTRIBUTE/FIELD BUS SETTING 3) Set up DIP switches referenced I/O BOARD of Maintenance manual 4) Set off USING THE FIELDBUS which is SYSTEM/ CONTROL PARAMETER/ I/O SIGNAL ATTRIBUTE/ FIELD BUS SETTING in case of no using field bus.	

Code	E0027	UCS module is not detected
Cause	No interface to UCS module	
Action	1) Check up the UCS module installation on I/O board. 2) Set off USING THE FIELDBUS which is SYSTEM/ CONTROL PARAMETER/ I/O SIGNAL ATTRIBUTE/ FIELD BUS SETTING in case of no using field bus.	

Code	E0028	In Jog-ON mode, Be changed to auto
Cause	Turn off motors for operator’s safety in the fence when the turnover from manual mode to automatic mode in JOG ON occurs this error.	
Action	1) Turnoff the Jog-ON LED certainly in turnover from manual mode to automatic mode 2) Turn off the Jog-ON LED to turn on motors	

Code	E0029	Fieldbus setting error
Cause	If you use CC-Link module(Bd471), the dip s/w for baudrate and station number may be faultly set	
Action	Confirm the baudrate and station number is in valid range, and make it coincident to master setting.	

Code	E0030	Mismatched AMP type & robot type!
Cause	Mismatched between amp and selected robot.	
Action	(1) Check AMP type private signal. (2) Check selected robot type. (3) Check PDLY of current loop gain.	

Code	E0031	The mode switch is failure
Cause	The mode switch or connected status(connector, line) is abnormal.	
Action	Check the mode switch or connected line status.	

Code	E0101	Need more DSP boards
Cause	The number of motors to control is larger then the number of controllable motors on servo board(BD440)	
Action	1) Check up the number to control motors on the menu SERVICE/ SYSTEM DIAGNOSTIC/ SYSTEM VERSION 2) Add the servo board	

Code	E0102	Different arm type!
Cause	No supported robot type was set	
Action	Check up setup robot type on the menu SERVICE/ SYSTEM DIAGNOSTIC/ SYSTEM VERSION	

Code	E0103	Enc Err:Process time over
Cause	The encoder data is not received within the setting time.	
Action	Reference the maintenance manual	

Code	E0104	Enc Err:Imperfect data frame
Cause	The data is received, but it is not in the set format.	
Action	Reference the maintenance manual	

Code	E0105	Enc Err:Cable not connected
Cause	The communication was not possible on account of broken encoder wires.	
Action	Reference the maintenance manual	

Code	E0106	Enc Err:Bad input data
Cause	The data is received, but it is not in the set format.	
Action	Reference the maintenance manual	

Code	E0107	Enc Err:Bad bit sequence
Cause	The data is received, but it is not in the set format.	
Action	Reference the maintenance manual	

Code	E0108	Enc Err:Encoder reset needed
Cause	Encoder data gets out of the range to apply the offset function.	
Action	Reference the maintenance manual	

Code	E0112	Fuse blown or IPM fault(6Amp)
Cause	The fuse in the amplifier was blown or IPM fault happened.	
Action	Reference the maintenance manual	

Code	E0113	Overcurrent
Cause	Overcurrent flows through the Motor or amplifier.	
Action	Reference the maintenance manual	

Code	E0114	Control voltage drop(AMP)
Cause	Control power +15V was dropped, SMPS for discharge control in drive unit was wrong.	
Action	Reference the maintenance manual	

Code	E0115	Command Error
Cause	Received packet data from main board was wrong.	
Action	Reference the maintenance manual	

Code	E0117	Too large position drift
Cause	Position Error exceeded the set value.	
Action	1) If the robot works normally, the setting value for the position error is too small, tune it. 2) Reference the maintenance manual	

Code	E0118	Too large speed drift
Cause	Speed Error exceeded the set value.	
Action	Reference the maintenance manual	

Code	E0119	Overload
Cause	Motors were operated overly.	
Action	Reference the maintenance manual	

Code	E0121	Divided by zero
Cause	Dividing by zero was occurred in calculations.	
Action	Contact with out service department.	

Code	E0122	Cannot make servo on
Cause	When executing Servo On or releasing power saving mode, Servo On was not executed within the set time.	
Action	Reference the maintenance manual	

Code	E0123	Cannot make servo off
Cause	When executing Servo Off or releasing power saving mode, Servo Off was not executed within the set time.	
Action	1) Replace the servo board. 2) If the same error occurs, contact with our service department.	

Code	E0124	Cannot clear servo error
Cause	Motor ON was not abilable because of servo error	
Action	Clear the servo error	

Code	E0125	Accuracy not satisfied
Cause	Despite that 10 sec passed after command was output, real position was not accorded with the command	
Action	1) Check servo gain. 2) Check encoder power. 3) Check encoder wiring. 4) Reference the maintenance manual	

Code	E0126	Trial to go out of workspace
Cause	You tried to move the robot to the position where tool-end can not arrive.	
Action	Check whether the workpiece and the robot was located properly.	

Code	E0127	MSHP not work
Cause	MSHP doesn't work.	
Action	Reference the maintenance manual	

Code	E0131	Bit jump error (high level)
Cause	In High Speed Mode(playback), the speed exceeds HighSpeed Detecting Level(Bit Jump High Level -BJH).)	
Action	1) Check the connection of CNEC for BD440 2) Check the connection of CNR4 and CNR5. 3) Check whether BJH is set to 1.5 times of the maximum speed.	

Code	E0132	Bit jump error (low level)
Cause	In Low Speed Mode(Jog, Step forward/ backward, Allocation input signals, Teach mode), The speed exceeds Low Speed Detecting Level(Bit Jump Low Level-BJL).	
Action	1) Check the connection of CNEC for BD440. 2) Check the connection of CNR4. 3) Check whether BJL is set to 1.5 times of the minimum speed.	

Code	E0133	Command error
Cause	The position command to the servo board BD440 is abnormal.	
Action	Reference the maintenance manual	

Code	E0134	Overspeed
Cause	The position command on the packet data to the servo board exceeds the maximum speed.	
Action	Reference the maintenance manual	

Code	E0137	Encoder pulse setting error
Cause	In the servo parameters, Encoder Pulse Setting Value ('PUL') is unusable.	
Action	Check 'PULS' of servo parameters.	

Code	E0138	Can't return to previous position
Cause	The distance for returning to the previous position exceeded the set value.	
Action	1) Check servo gain. 2) Check encoder power. 3) Check encoder wiring.	

Code	E0139	Can't clean up DSP Filters
Cause	Communication from the main board to servo board was unable.	
Action	1) Check the insertion of main board and servo board. 2) Replace the main board or servo board.	

Code	E0140	MSPR does not work
Cause	The MSPR relay for precharging the capacitor did not work.	
Action	Check up the MSPR relay and the CNPC cable on drive unit.	

Code	E0151	Improper step command
Cause	Robot can't work because of unprofitable step information	
Action	Contact with out service department.	

Code	E0154	Tip consumption exceeded maximum.
Cause	Total tip consumption detected by gun search excess maximum tip consumption setted servo gun parameter.	
Action	1) Check maximum tip consumption at 2) Replace electrodes.	

Code	E0155	Move-tip consumption exceeded max
Cause	Maximum abrasion of the moving electrode which was set in servo gun parameter setting was excessed by gun search.	
Action	1) Check up maximum abrasion of the moving electrode which was set in servo gun parameter setting 2) Replace electrodes.	

Code	E0156	Fix-tip consumption exceeded max
Cause	Maximum abrasion of the fixed electrode which was set in servo gun parameter setting was excessed by gun search.	
Action	1) Check up maximum abrasion of the fixed electrode which was set in servo gun parameter setting 2) Replace electrodes.	

Code	E0157	Too large skew error
Cause	1) This error occurs in the synchronizing 2 axes function of gantry robots. 2) Torsion angle to travelling axis was larger then set parameter of the synchronizing 2 axes function	
Action	Adjust torsion parameter of the synchronizing 2 axes function of servo parameter.	

Code	E0158	Skew error compensation Timeout
Cause	1) This error occurs in the synchronizing 2 axes function of gantry robots. 2) Returning torsion angle to travelling axis exceeded set 5 seconds after motor on.	
Action	1) Put out obstacles of the moving way 2) Check up encoder powers and lines 3) Replace motors	

Code	E0159	Joint speed cmd over the limit
Cause	Angular velocity of an axis is high on interpolation operation of this position	
Action	1) Decrease the speed on this step. 2) Adjust the position made this error	

Code	E0160	collision detect
Cause	Disturbance torque is over excessed collision detection level	
Action	1) If collision is occurred, remove the problems 2) Adjust collision detection level	

Code	E0161	shock detect
Cause	Disturbance torque ratio is over excessed collision detection level	
Action	1) If collision is occured, remove the problems 2) Adjust collision detection level	

Code	E0162	current sensor error
Cause	In the drive unit, large current feedback offset is detected	
Action	1) Check +/-15V voltage in the SMPS 2) Change the BD440 board 3) Replace the AMP	

Code	E0163	Axis drifted during power saving
Cause	In power saving mode it happens that the brake is slipped.	
Action	Change the Brake(BD461) board	

Code	E0170	MotStopWait(5Sec) TimeOut
Cause	To decrease speed and stop on working exceed 5 seconds after stop signal input	
Action	1) Decrease sum of times within 5 seconds after converting acceleration time and reduction ratio of acceleration and deceleration parameter into time 2) Refer to acceleration and deceleration parameter of operation manual	

Code	E0171	Gun open time is over
Cause	Opening time was exceeded 5 seconds after pressurization of spot welding or gun-search function.	
Action	Check the Gun was welded to the object or interference to the gun occured.	

Code	E0172	Improper Endless rotation
Cause	Difference the encoder value of endless axis which was backuped from the encoder value of initializing read out exceeds 0X20000 in hex decimal	
Action	1) Compensate the encoder offset value of endless axis again. 2) Reset the encoder offset value of endless axis and compensate it.	

Code	E0173	Endless rotation overflow
Cause	The encoder value of endless axis to record exceeded max. encoder value	
Action	Execute R350 code to reset the recorded endless position manually, adjust the position.	

Code	E0174	1st servo CPU initialize error
Cause	Initialization response of DSP1 in first board was not received	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0175	2nd servo CPU initialize error
Cause	Initialization response of DSP2 in first board was not received	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0176	3rd servo CPU initialize error
Cause	Initialization response of DSP1 in second board was not received	
Action	1) Check up insertion the servo board. 2) Replace the servo board.	

Code	E0177	4th servo CPU initialize error
Cause	Initialization response of DSP2 in second board was not received	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0178	Incorrect 1st servo CPU version
Cause	The ROM version of DSP1 in first board is so low that set robot can't use.	
Action	Contact with out service department.	

Code	E0179	Incorrect 2nd servo CPU version
Cause	The ROM version of DSP2 in first board is so low that set robot can't use.	
Action	Contact with out service department.	

Code	E0180	Incorrect 3rd servo CPU version
Cause	The ROM version of DSP1 in second servo board is so low that set robot can't use.	
Action	Contact with out service department.	

Code	E0181	Incorrect 4th servo CPU version
Cause	The ROM version of DSP2 in second servo board is so low that set robot can't use.	
Action	Contact with out service department.	

Code	E0182	1st servo CPU communication error
Cause	Communication between main CPU board and the DSP1 of the first servo board was not work.	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0183	2nd servo CPU communication error
Cause	Communication between main CPU board and the DSP2 of the first servo board was not work.	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0184	3rd servo CPU communication error
Cause	Communication between main CPU board and the DSP1 of the second servo board was not work.	
Action	1) Check up insertion the servo board. 2) Replace the servo board	

Code	E0185	4th servo CPU communication error
Cause	Communication between main CPU board and the DSP2 of the second servo board was not work.	
Action	1) Check up insertion the servo 2) Replace the servo board	

Code	E0186	1st servo CPU found main CPU error
Cause	Watch dog error of main board was detected in the DSP1 of the first servo board.	
Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board	

Code	E0187	2nd servo CPU found main CPU error
Cause	Watch dog error of main board was detected in the DSP2 of the first servo board.	
Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board	

Code	E0188	3rd servo CPU found main CPU error
Cause	Watch dog error of main board was detected in the DSP2 of the second servo board.	
Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board	

Code	E0189	4th servo CPU found main CPU error
Cause	Watch dog error of main board was detected in the DSP2 of the second servo board.	

Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board

Code	E0190	Improper encoder reception
Cause	Unexpected error was occupied from the servo board in receiving initial values of the absolute encoder.	
Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board.	

Code	E0191	Not defined servo error found
Cause	Unexpected error was occulted from the servo board on working.	
Action	1) Please check and decrease PLC execution time. Contact with our service department. 2) Check up insertion the main or servo board. 3) Replace the main board or servo board.	

Code	E0192	AUX amp number error
Cause	The drive number of auxiliary axis has assigned as same number	
Action	Check up the number of BD, DSP, AXIS of auxiliary parameter set up assigned as same number	

Code	E0193	Improper Encoder for Endless
Cause	The number of pulses a rotation from the endless encoder was wrong.	
Action	Check up the number of pulses on the menu, SERVO PARAMETER/ MOTORS, ENCODERS as 1024,2048,4096 or 8192	

Code	E0194	Load weight is too heavy
Cause	Load weight is over 120% of normal capacitance	
Action	1) Check the weight value in the tool data 2) Reduce tool load weight	

Code	E0195	Sync Axes must use only 1 DSP
Cause	In order to control the sync axes you should configure the system as only 1 DSP controls both of sync axes	
Action	Change the system configuration so that only 1 DSP controls both of sync axes. If under 5 axes robot is used, 1 DSP in BD440 servo board can handle 2auxiliay axes. but over 6 axes robot is used, 1 DSP in BD440 servo board can't handle them, so you should use extra BD440 servo board.	

Code	E0200	(Ax0) Speed over while cooperating
Cause	Command exceeds own axis speed while cooperative following.	
Action	Change Orientation of the Slave at a reference position of COWORK or modify recorded speed slowly	

Code	E0201	Cooperative Start time mismatch
Cause	Read of Sync. communication signal is wrong among cooperative robots, or running mode is not same each other.	
Action	Check communication status. check the running mode. adjust the mode status of robots in same, and run.	

Code	E0202	Partner robot is in abnormal stop
Cause	Partner robots aren't ready to cooperate. one of them is stop status.	
Action	Check the running status mode. if you want to rerun after stopping playback of cooperation, you will run Master ahead after running Slave.	

Code	E0203	Partner robot is in emergency
Cause	Partner robots is stopped by motors off. My robot also is stopped by motors off	
Action	Check the status of partner robot. and fix the cause of error.	

Code	E0204	Rbt#0 Communication is not working
Cause	Communication connection is lost with corresponding robot.	
Action	Check connection of line and LAN card. HiNet check can find the unusual part of HiNet.	

Code	E0205	HiNet is not working
Cause	Hinet for cooperative control is not working.	
Action	Check connection of line and LAN card. you can find the unusual part of HiNet as using HiNet Check	

Code	E0206	Jog Prohibited - Master overlapped
Cause	You try to jog with setting Master over two robots.	
Action	Choose only one robot which do a role of Master. and the other robots are set in the status of Slave or Indiv.	

Code	E0207	Jog Prohibited - No slave selected
Cause	You try to jog with no selecting Slave, or with Slave not ready to cooperation.	
Action	Choose the Slave robots to manual cooperation. and check motors ON, MANUAL mode, JOG OFF status. and then you can jog Master.	

Code	E0208	Duplicated robot number is set
Cause	Cooperation control is impossible because duplicated robot number can't be identified the robot	
Action	Inspect robot number of robot connected in HiNet, and change overlapped robot number.	

	After this action, you must repower the controller.

Code	E0209	Slave jog status are changed-Stop
Cause	The Setting of Slave jog status have been changed while cooperative jog	
Action	Slave robot requiring jog should be cooperative jog available. Don't change the status of slave jog when cooperative jog is go on.	

Code	E0210	Fail of Init. of SVG Connection
Cause	Fail of SVG connecting initialization is occurred.	
Action	Check the DSP version over 4.13 Check ATC connecting status and encoder power is inputed	

Code	E0211	SVG Servo On fail in time limit
Cause	The servo of servo gun has not been turned on within the time limit.	
Action	The encoder signal is not correctly processing because of the poor connection of the ATC. Remove any foreign matter from the ATC, and try again.	

Code	E0212	SVG's Servo filter clear is failed
Cause	Clear of SVG Filter is failed while trying to connect SVG axis	
Action	Communication between Main board and Servo board is bad. Check the connecting status, or another try after changing board(servo, main)	

Code	E0213	SVG Servo Off fail in time limit
Cause	Servo off is failed within limit time, while SVG disconnecting process	
Action	Check if ATC is connect well. Or another try after changing servo board.	

Code	E0214	SVG Encoder power is not connected
Cause	Failure of encoder power on is occurred as SVG connecting.	
Action	Check if encoder power control unit such as a really operating SVG encoder power and BD481. If trouble is observed, exchange the trouble part.	

Code	E0215	SVG Encoder power off is failed
Cause	Failure of encoder power off is occurred as SVG disconnecting.	
Action	Check if encoder power control unit such as a really operating SVG encoder power and BD481. If trouble is observed, exchange the trouble part.	

Code	E0216	SVG Encoder data error
Cause	Encoder receiving result of the SVG axis is abnormal while trying to connect.	
Action	Check if battery is useless, and do another try after encoder try after encoder reset. and then encoder offset should be re-adjusted.	

Code	E0217	Sync axis acceleration/deceleration parameter error
Cause	Top speeds, acceleration times, and deceleration ratios of two sync axes must be the same for sync control but they are set differently.	
Action	Check the acceleration/deceleration parameter of the robot parameter to set the same acceleration/deceleration parameter for the sync axes.	

Code	E0218	0 Axis) Overload is detected.
Cause	Overload of the Axis is detected. Current has lasted over rated current to harm the motor of axis.	
Action	Check if rated current is set correctly, and check servo gun mechanism. Don't take a pressurization over rated current for a long time.	

Code	E0219	Couldn't execute SMOV W/O SELSTN
Cause	You could not execute positioner sync. command(SMOV) without selec ting station in a SELSTN command	
Action	Chose the station # you want to sync. Correctly or Change the number of station of SMOV command to the same # in a SELSTN command.	

Code	E0220	0Ax) Encoder noise
Cause	Robot current position is not the same as encoder data. There is noise in encoder pulse.	
Action	Check encoder voltage, connection of lines and frame grounds at controller and robot.	

Code	E0221	0Ax) failed to receive encoder data
Cause	It is failed to receive absolute encoder data to check if there is encoder noise.	
Action	Check encoder voltage, connection of lines and frame grounds at controller and robot.	

Code	E0222	Coincident entrance to same cube
Cause	Robot's TCP enter the cube area on which other robot is working. You can't playback in status of deadlock.	
Action	Turn to manual mode, and jog the robot to cube outside. And you can modify the robot program which can be run without deadlock status.	

Code	E0223	encoder line cut or comm. err
Cause	It is failed to receive absolute encoder data from serial encoder.	
Action	Check encoder voltage, connection of lines and frame grounds at controller and robot.	

Code	E0224	encoder status error occurred
Cause	Error status is received from encoder such as overflow, overspeed, inner capacitor voltage drop, LED fail.	
Action	Reset the encoder in encoder reset menu. If it is still in error state, the encoder(motor) should be changed.	

Code	E0225	Softlimit exceed encoder limit
Cause	The current softlimit range of the axis exceeds the range which can be used by encoder.	
Action	If you downloaded new ROBOT.C01 file to controller, and then this error is occurred, you had better to initialize the encoder from encoder resetting. Otherwise, you should check the softlimit. And modify the limit properly.	

Code	E0226	exceed encoder limit
Cause	Robot axis can't reach the position which exceed the limit of encoder usable range.	
Action	Turn to the manual mode, and jog the axis to internal direction with system setting mode. If the limit is short abnormally, you should initialize the encoder.	

Code	E0227	Seq. error of Cooperative control
Cause	Commands sequence between the master and the slave make a difference while cooperative robot control.	
Action	Check the network connection for cooperative robot control. And check whether the slave is doing power saving. The function should be disabled at the slave side.	

5.4.2. Operation Error

Code	E1001	Program not found
Cause	The program to execute was not exist.	
Action	Check if the program exists.	

Code	E1002	Step not found
Cause	You selected the step number was bigger than the total number of all steps.	
Action	Check the step number and select	

Code	E1003	Too many files(It's more than 255)
Cause	Total file number is limited by 255	
Action	Delete unnecessary files and make it.	

Code	E1004	The number of axis not match
Cause	Number of axes of the selected program was different with the number of the robot.	
Action	You select the program of other robot. Check it.	

Code	E1005	Conveyor sync state mismatch
Cause	The conveyor sync program is selected when the machine integer file is not supported by the conveyor sync or vice versa.	
Action	Select another program or write a new one.	

Code	E1006	Memory full
Cause	You tried to make a program in the deficient memory.	
Action	Delete unnecessary files and make it.	

Code	E1007	Brake slipped!(Excess of 50mm)
Cause	It happens when the slippage of a brake by pressing during stud welding is over 50mm.	
Action	1) Check up the pressure. 2) Check up the slippage of the motor of every axis and change the motor with which slippage is bigger than any others'	

Code	E1008	Excessive brake slip count!
Cause	When the slippage excess of a brake by pressing during stud welding happens over times by which you limited the count in the Constant Setting Mode Group 1	
Action	1) Check up the pressure. 2) Check up the slippage of the motor of every axis and change the motor with which slippage is bigger than any others'	

Code	E1009	Simultaneous file access confined
Cause	You can not copy same file, external -> internal and internal -> external, simultaneously. (RS-232C, Ethernet, SRAM card)	
Action	Wait a while until other people's copying is completed. And try again.	

Code	E1010	More teach points required
Cause	Insufficient recoded steps to tune conveyer angle automatically or to define user coordinate.	
Action	1) To tune linear conveyer angle automatically need 2 steps 2) To tune circular conveyer angle automatically need 3 steps 3) To define user coordinate need 3 steps	

Code	E1011	Points too close to one another
Cause	Recoded position is so close that calculation is impossible to tune conveyer angle automatically	
Action	Try to record positions as possible as wide	

Code	E1012	Recorded points are linear
Cause	3 steps to define user coordinate are in a line so calculation is impossible.	
Action	Refer to operation manual, locate 3 steps in a plane except 3 steps in a line	

Code	E1013	Function not found
Cause	The selected function was not exist	
Action	Check the function number of the step.	

Code	E1014	Failed in allocating file handle
Cause	More than 4 copying operating is tried via several channel. (RS-232C, Ethernet, SRAM card)	
Action	Wait a while until other people's copying is completed. And try again	

Code	E1015	Protected program
Cause	Editing the protected program by step is prohibited.	
Action	Try to edit after release the protect of the file in Service/ file management/ protection	

Code	E1016	Can't modify (No parameters)
Cause	You tried to edit the function of no modifiable parameter.	
Action	Check the function to edit.	

Code	E1017	No contents
Cause	You tried to delete or edit unmade program.	
Action	Check the selected program.	

Code	E1018	Program has no step data
Cause	Selected step is not exist.	
Action	Check the step number.	

Code	E1021	Unassigned weld condition signal
Cause	Number of welding condition output was bigger than the assigned number	
Action	Check assigned welding condition signals in System/ Control parameter/ I/O signal	

Code	E1023	Checksum error at the step
Cause	Check Sum of the taught step was changed.	
Action	Delete the selected step and add it.	

Code	E1024	Palletizing program changed
Cause	You changed the program in palletizing and tried to operate again	
Action	Initialize the palletizing counter and set again.	

Code	E1026	More steps than 4 are needed
Cause	Min.4 recoded steps need to estimate auto setup constants	
Action	Make 6 steps at least to estimate auto setup constants and try to make variety position	

Code	E1027	Program damaged.
Cause	Recoded auto step constants are broken because of failure of the back up battery.	
Action	Initialize the memory by assistant of A/S member in HHI.	

Code	E1028	It is not the same tool
Cause	The number of tool to estimate auto setup constants is different from the number of estimated tool	
Action	Consist tool number.	

Code	E1029	Robot type not applicable
Cause	Estimation of auto set up constants is do on only 6 axes manipulator.	
Action	1) Check up robot type on SERVICE / SYSTEM CHECKING/ SYSTEM VERSION/ ROBOT TYPE 2) Input measured constants.	

Code	E1030	Additional axes not applicable
Cause	Auxiliary axes should not move to estimate auto set up constants	
Action	Record positions only to move main 6 axes.	

Code	E1031	Pose data not good
Cause	Processing auto set up constants is not possible because steps are similar to each other.	
Action	Let robot pose different, teach hand axes to pose as differently as possible above all.	

Code	E1032	Axis Const out of soft limit
Cause	Compensation values of processing auto set up constants is so big that operating robot make a danger.	
Action	1) Check selected robot be correct. 2) Move to reference position to calibrate encoders, initialize axes parameters, try to process auto setup constants. 3) Make steps again to minimize position error between steps and try it again.	

Code	E1034	Collision sensor on
Cause	Collision happened.	
Action	1) Check if the shape of the tool is ok. 2) Get the robot started again if there is no cause of the error more. 3) If collision was happed, check up collision signal logic in System/users.	

Code	E1035	Works over permitted No. entered
Cause	If conveyer parameter in SYSTEM/ APPLICATION PARAMETER/ CONVEYER is set to APPROACH OBJECTS = PERMISSION, robot approach objects is permitted in conveyer synchronized operation. sum of approached objects is more then 10	
Action	Stop the system, clear process, run again.	

Code	E1036	Welding wait time is over
Cause	Welding completion signal is not inputted within waiting time of WI in SYSTEM/ APPLICATION PARAMETER/ SPOT&STUD/ DATA FOR SERVO GUN WELDDING (CONDITION, SEQUENCE) / WELDING SEQUENCE in welding by servogun	
Action	1) Check up circuit diagram in FLOW SIGNAL/ WELDING CONDITION SIGNAL/ COMPLETION SIGNAL OF WELDING and surrounding equipments. 2) Refer to SYSTEM/ APPLICATION PARAMETER/ SPOT&STUD/ DATA FOR SERVO GUN WELDDING (CONDITION,SEQUENCE)/ COMMON DATA wether wait for welding completion signal(WI) or stop the robot when error occurs	

Code	E1038	Can't record tip consump. position
Cause	Robot position was not posed to compensate the length of abraded electrode to record the position to compensate the length of abraded electrode.	
Action	Arrange robot position of length compensating of abraded electrode not to break away operation region.	

Code	E1039	Tolerance of sync. exceeded range
Cause	In operation of synchronized 2axes torsion angle to traveling two axes was larger then set parameter of the synchronizing 2 axes function	
Action	1) Set the same gain to each axis. 2) Increase Kp gain of deleied axis.	

Code	E1040	In this robot type can't provide
Cause	Robot of synchronized traveling 2 axes can not use interpolation(linear, circular).	
Action	Edit interpolation off on the step, run the robot.	

Code	E1041	Axes over at this positioner Group
Cause	Number of axes in positioner group exceeds 2	
Action	Set the value equal or less then 2 on the group in SYSTEM/ INITIALIZATION/ POSITIONER GROUP	

Code	E1042	Not support REFP step for calibr.
Cause	Reference point(REFP) was not recorded in the calibration program for the positioner	
Action	Record reference point(REFP) in the step for calibration program	

Code	E1043	Cannot calculated : Modify Steps
Cause	Floating point calculation error occurs in calibration processing.	
Action	1) Edit recorded steps for calibration program. 2) Tilt the direction between points by more then 30 degree to calibrate exactly.	

Code	E1044	Can't motor ON without Enc. Compen
Cause	No calibrate encoder offsets after selection of the robot type in SYSTEM/ INITIALIZE ,not to try MOTOR ON.	
Action	Calibrate encoder offsets after selection of the robot type in SYSTEM/ INITIALIZE and try to operate MOTOR ON.	

Code	E1045	Not input freq/palletize count
Cause	When setting frequency or palletize count to external signal after selected register doesn't input setting count before 800ms.	
Action	Input count number to external signal after selected register before 800ms.	

Code	E1046	Gun is opening by external signal
Cause	During the servo gun moving by external signal, the auto-run signal was inputted.	
Action	After the servo gun moving is over, operate the auto-run.	

Code	E1047	FIFO Registers number is over 20
Cause	Program tries to register over 20EA from the state of FIFO function's (1)application at system/ user parameter menu.	
Action	Check reserved program count at service/ register/ FIFO register.	

Code	E1048	Gun connection number signal error
Cause	When spot gun manual/ auto connect for external input signal, the value of gun no has an error.	
Action	Check external input signal for Gun connection no.	

Code	E1049	Spot gun was already connected
Cause	When spot gun was connected at system, reconnection(GUNCHNG ON or manual connection etc) was an attempt. so cannot achieve it.	
Action	Check spot gun connection stats.	

Code	E1050	Spot gun was already separated
Cause	When gun was disconnected at system, GUNCHNG OFF commend or manual disconnection was achieved.	
Action	Check gun connection status.	

Code	E1051	Improper environment to gun change
Cause	GUNCHNG command or manual gun connection on/off was executed. when gun change wasn't environment.	
Action	Resetting the controller to gun change environment.	

Code	E1052	Gun change time by manual is over
Cause	After gun connection on/off was manually execute, within 5 second this function doesn't complete.	
Action	Contact the Robot A/S team.	

Code	E1101	Soft limit
Cause	Encoder value of any axis arrived at the Soft Limit in SYSTEM/ ROBOT PARAMETER on teaching or running the robot	
Action	Move the robot within the Soft Limit in SYSTEM / ROBOT PARAMETER	

Code	E1102	Motor on under axis operation!
Cause	MOTOR can't be turned on under axis operation	
Action	Don't hold the key of AXIS OPERATION in the operation of MOTOR ON	

Code	E1105	Step for jump not found
Cause	Number of steps to run Is bigger than the total number of all steps	
Action	Check the final step number of the program.	

Code	E1106	Function for jump not found
Cause	Number of functions to run is bigger than the total number of all functions.	
Action	Check the final function number of the program.	

Code	E1107	Shelter step not found
Cause	Step to shelter in timer condition function, etc. doesn't exist.	
Action	Check the number of the step to shelter.	

Code	E1108	Jumping to shelter step occurred
Cause	Condition is improper in conditional function execution.	
Action	Check the received data status of the program.	

Code	E1109	Interpolation impossible
Cause	Interpolation was tried in pose where the interpolation was impossible.	
Action	Change the pose by single axis movement and operate.	

Code	E1110	Out of workspace!

Cause	You tried to move tool-end to the position where it can't reach.
Action	Check whether the work piece and the robot was located properly.

Code	E1111	Too large angle between arms
Cause	The 1st Arm and 2nd Arm got into interference state.	
Action	Operate the robot to avoid interference.	

Code	E1112	Too small angle between arms
Cause	The 1st Arm and 2nd Arm got into interference state.	
Action	Operate the robot to avoid interference.	

Code	E1113	Step for jump not found
Cause	There is no target step for step-jump function at playback.	
Action	Check the parameter of the made program.	

Code	E1114	Step for call not found
Cause	There is no target step for step-call function at playback.	
Action	Check the parameter of the made program.	

Code	E1115	Too many step-calls without return
Cause	Step-call was executed than 9 times without return.	
Action	Don't execute step-call than 9 times without return.	

Code	E1116	Can't return without step-call
Cause	Return exists without step call.	
Action	Use step-return and step-return together.	

Code	E1117	Can't return to another program!
Cause	The number of the program to step-return is different from the number of the program in executing.	
Action	Check whether step-call exists before step-return in the	

Code	E1118	Step for return not found
Cause	There is no target step of step-return function at playback.	
Action	Check the parameter of the made program.	

Code	E1119	Program for jump not found
Cause	There is no target program of program-jump function at playback	
Action	Check whether the program exists and the parameter of the made program.	

Code	E1120	The number of axes mismatch: Jump
Cause	The axes number of the program in program-jump function is different from the axes number of the robot.	
Action	Check the program to jump for.	

Code	E1121	Program for call not found
Cause	There is no target program of program-call function at playback	
Action	Check whether the program exists and the parameter of the made program.	

Code	E1122	The number of axes mismatch: Call
Cause	The axes number of the program in program-call function is different from the axes number of the robot.	
Action	Check the program to call.	

Code	E1123	Too many Prog-calls without return
Cause	Program-call is executed than 9 times without return.	
Action	Don't execute step-call than 9 times without return.	

Code	E1124	Program for return not found
Cause	There is no target program of program-return function when playback.	
Action	Check whether the program exists and the parameter of the made program.	

Code	E1125	The number of axes mismatch:Return
Cause	Axes number of the target program in program-return function was different from the axes number of the robot.	
Action	Check whether the program exists and the parameter of the made program.	

Code	E1126	A pose unable to take Cir-Interpol
Cause	Steps are too close or linear to make a Cir-Interpolation	
Action	Modify the recorded position of step.	

Code	E1128	Unusable output(DO) signal
Cause	You specified Signal which can't be output in playback, this error occurs.	
Action	Check the number for the output signal.	

Code	E1129	Undefined speed unit
Cause	You tried to playback with other unit except for [%] and mm/sec.	
Action	Check the condition of the present step.	

Code	E1130	END step not found
Cause	You tried to playback the program of no END step.	
Action	Check the parameter of the made program.	

Code	E1135	End relay output error
Cause	END Relay Time exceeds 15 sec. Usually, because the END Relay Time is less than 10 sec in Constant Setting Mode, this error doesn't occur.	
Action	Constant Parameter is abnormal. Check the constant file.	

Code	E1136	Playback-protected program!
Cause	1) It is impossible to playback from step 0. 2) It is impossible to execute step go/back.	
Action	Release Playback Protection in SERVICE/ FILE MANEGEMENT and execute.	

Code	E1138	Shelter step not found
Cause	There is no step to shelter in Timer Conditional Function, etc.,	
Action	Check the parameter of the made program and change it.	

Code	E1139	Improper GI signal No
Cause	Number of Timer Conditional IB signal is wrong.	
Action	Check the parameter of the made program and change it.	

Code	E1140	Improper port number
Cause	A port for T/P was set in Shift Data Request Function.	
Action	Set port designation as general in Shift Data Request Function.	

Code	E1141	Improper use of serial port #1
Cause	Use of serial port(RS232C) was wrong.	
Action	Check the use for port in SYSTEM/ CONTROL PARAMETER in Condition Setting.	

Code	E1142	Repeated requests for shift data
Cause	Shift Data Request Function was executed again, before Shift Data was input, in executing the function.	
Action	1) Check whether Shift Data Function is used delicately. 2) Check the connection for the external sensor.	

Code	E1143	Function M88 needed
Cause	You executed function-jump function without completion function in playing back.	
Action	Check the parameter of the made program.	

Code	E1144	Function M86 or M87 needed
Cause	You executed completion function without function-jump function in playing back.	
Action	Check the parameter of the function jump.	

Code	E1145	Out of range for function jump
Cause	Jumping range exceeds the calculated value.	
Action	Check the parameter of the made program and change it.	

Code	E1146	Use function M78 only 4 times
Cause	There are palletizing functions more than 5 in the program to be executed.	
Action	Reduce the number of palletizing function used.	

Code	E1147	Palletize start was not executed
Cause	There is END only without palletize start.	
Action	Check the contents of the made program.	

Code	E1148	Palletizing already executed
Cause	There is palletize start in executing palletizing functions.	
Action	Check the contents of the made program.	

Code	E1149	Start after palletizing stopped
Cause	You selected other program in executing palletizing functions and start from step 0.	
Action	Reset the palletizing function and start.	

Code	E1150	Can't use during palletizing
Cause	P reset was executed in executing palletizing functions.	
Action	End the palletizing function and execute.	

Code	E1151	Function for jump not found
Cause	There is no function number to jump in executing palletizing functions.	
Action	Check the parameter of the made program and change it.	

Code	E1152	Check search function M59(on/off)
Cause	Search On and Off are not accorded.	
Action	Check the parameter of the made program and change it.	

Code	E1153	Set search reference Pt. record on
Cause	When executed search function without setting standard position for search.	
Action	Set search reference position data record to 'on' in condition setting, and record in 1-Cycle Playback, execute.	

Code	E1154	Only in the 1 cycle at AUTO mode
Cause	You can record standard position data for search in 1 Cycle at AUTO Mode. Excepting for this case, error occurs.	
Action	Set AUTO Mode to 1-Cycle, and execute.	

Code	E1155	Out of the search range
Cause	Robot Interrupt doesn't occur despite search range exceeds setting value.	
Action	Check the searching object and search range setting of condition setting.	

Code	E1156	3 points are on the same line
Cause	Transformation calculation can't be made because 3 taught points are on the same line in the coordinate transfer function.	
Action	Check the teaching points.	

Code	E1157	No data in the shift register
Cause	In On-line Shift or On-line Coordinate Transformation Function, if the function is executed even when data are not input through RS232C port, this error occurs.	
Action	Modify the program to input data through RS232C before On-line Shift or On-line Coordinate Transformation.	

Code	E1158	Transfer reference step not found
Cause	There is no standard step number in Coordinate Transformation Function.	
Action	Check the parameter for the Coordinates Transformation in the program.	

Code	E1159	Can't take transferred pose
Cause	Transferred pose is out of Robot's Reach.	
Action	Modify the recorded position of step.	

Code	E1160	Improper welding condition
Cause	You designated welding condition output data exceeding its range.	
Action	Check welding condition output format and welding condition parameter in SYSTEM/APPLICATION PARAMETER/SPOT &STUD	

Code	E1161	Interpolation impossible
Cause	Interpolation was executed in pose that interpolation is impossible.	
Action	Change the pose of robot and teach.	

Code	E1162	Three points too close
Cause	Transformation calculation can't be made because 3 taught points are too close each other in the coordinate transfer function.	
Action	Check the teaching points.	

Code	E1163	Shift makes robot leave workspace
Cause	Shift position is out of work range.	
Action	Check the shift amount and working procedure.	

Code	E1164	Improper coordinate frame:XYZshift
Cause	Setting of the standard coordinate system was not corrective in XYX shift function.	
Action	Check the parameter for the XYZ shift function in the program.	

Code	E1165	Improper coordinate frame :Search
Cause	Setting of the standard coordinate system was not corrective in search function.	
Action	Check the parameter for the search function in the program.	

Code	E1166	Improper coordinate frame :Pallet
Cause	Setting of the standard coordinate system is not corrective in palletizing function.	
Action	Check the parameter for the palletize function in the program.	

Code	E1167	Search target is out of workspace
Cause	Search range got out of work range.	
Action	Reduce search range in condition setting.	

Code	E1168	Search available in linear INPLTN
Cause	Step where search function is to be executed is not in 'Interpolation On'.	
Action	Modify the step as Interpolation On.	

Code	E1169	Playback errors in fetching steps
Cause	Error in step data which were fetched to execute a program.	
Action	Delete the step and make the step again.	

Code	E1171	Transfer makes robot leave WRKSPC
Cause	In transformation of the coordinate between on-line and off-line transfomated data was out of robot operation space.	
Action	Change the robot pose, robot installation or location of the work piece and try it again.	

Code	E1189	Not inputs WCR at arc start
Cause	Fail to generate arc at start point.(The number of retrial was exceeded)	
Action	Check the power supply to the welder system.	

Code	E1192	Arc sensing error([A] range over)
Cause	The welding current is out of the abnormal margin for the abnormal time.	
Action	1.Check the feedback circuit of welding current. 2.If the work end, set the abnormal processisng methid=<END>. 3.Other case, adjust the margin/t	

Code	E1193	Arc sens'g error(Too unstable [A])
Cause	While the arc sensing function with the curve fitting algorithm, this is out of the Allowed error weav'g cycle because of unstable welding current.	
Action	1.Check the feedback circuit of welding current. 2.Adjust the coef. curve to small 3.If you want to detect the start of bead, set bead detection=EN.	

Code	E1194	Arc sens'g error(Side range over)
Cause	The side tracking range over.	
Action	Adjust the side coef. of Ampere or/and the max. Distance limit.	

Code	E1195	Arc sens'g error(Height range ov.)
Cause	The height tracking range over.	
Action	Adjust the height coef. of ampere or/and the max. distance limit.	

Code	E1196	Shift limit over
Cause	Shift amount exceeds the shift limit set in SYSTEM/SHIFT LIMIT	
Action	Decrease shift length or reassign shift limit.	

Code	E1197	Invalid step for Cir-Interpolation
Cause	2 steps at least are required for completing circular interpolation	
Action	Add step(s) for circular move.	

Code	E1198	Not exist approach step
Cause	Cannot execute a weaving motion without approach step or 'REFP 2'	
Action	Add approach step or 'REFP 2'.	

Code	E1199	Read error of current step
Cause	Fails in motion planning during the retry or restart function.	
Action	Add step(s) after the step including 'ARCOFF' function.	

Code	E1200	Read error of preview step
Cause	Fails in motion planning during the retry or restart function.	
Action	Add step(s) before the step including 'ARCON' function.	

Code	E1202	Syntax error
Cause	It is general syntax error.	
Action	Check the syntax.	

Code	E1203	Length of identifier exceeded
Cause	An identifier's length is longer then 8 characters.	
Action	Decrease the identifier's length to be equal or fewer then 8 characters.	

Code	E1204	The number of element fault
Cause	The number of elements in pose constant or shift constant is not matched with setting.	
Action	1) Check the number of elements of pose constants or shift constants. 2) In case of pose, it should include the additive axes. 3) Shift constant is the sum of basic axes number and additional axes number. 4) Pose constant is the sum of basic axes number, additional axes number and one(config).	

Code	E1205	Misusage of Parenthesis
Cause	In arithmetic expression, function, or pose/shift constant, there is no parenthesis at its required position.	
Action	Check whether the parenthesis is used properly.	

Code	E1206	Misusage of type postposition
Cause	An postposition of V variable has been used badly.	
Action	Use '%', '!', or '$' as postposition.	

Code	E1207	'[' missed
Cause	In variable, there is no index or '['.	
Action	Check whether the index is missed, or '[' and ']' is paired properly in variable.	

Code	E1208	']' missed
Cause	In variable, there is no index or '['.	
Action	Check whether the index is missed, or '[' and ']' is paired properly in variable.	

Code	E1209	Index exceeded its range
Cause	An index value exceeds its limit.	
Action	Make the index doesn't exceeds the variable type's index limit.	

Code	E1210	Misusage of index
Cause	The syntax of a constant or expression used as variable index is wrong.	
Action	Check the syntax of variable index.	

Code	E1211	Must be separated by space
Cause	Commend and parameter was sticked	
Action	Separate coleman and parameter with a space.	

Code	E1212	Shift operating fault
Cause	Syntax of shift calculation was wrong or shift parameter was not described properly.	
Action	Check syntax of shift calculation or shift parameter.	

Code	E1214	',' missed
Cause	',' was missed in command statement or function statement.	
Action	Check the separation with ',' properly.	

Code	E1215	Pose expression fault
Cause	In MOVE statement, the pose expression is not proper.	
Action	Check the pose statement syntax. In case of hidden-pose MOVE, check the syntax of speed.	

Code	E1216	Speed parameter fault
Cause	In MOVE statement, speed is not proper.	
Action	Check the syntax of speed. S={Speed}	

Code	E1217	'=' missed
Cause	There is no '=' at its required position.	
Action	Check whether a '=' is used properly in assignment or statements.	

Code	E1218	Unit fault
Cause	In MOVE statement, the syntax of speed unit is wrong.	
Action	Use 'cm/min', 'mm/sec', 'sec', or '%' as speed unit. It must be small letters.	

Code	E1219	Accuracy parameter fault
Cause	In MOVE statement, the syntax of accuracy is wrong.	
Action	Check the syntax of accuracy. A={0-3}	

Code	E1220	Tool no. parameter fault
Cause	In MOVE statement, the syntax of tool is wrong.	
Action	Check the syntax of tool. T={0-3}	

Code	E1221	Too many output options
Cause	In MOVE statement, there is more than 5 output options(MX,MX2,G1,G2,BM).	
Action	Make output options don't be duplicated.	

Code	E1222	Value exceeded its range
Cause	In certain statement, some parameter values exceed their limit.	
Action	Make parameter values don't exceed their limit.	

Code	E1223	Input/Output direction fault
Cause	Output direction of PRINT, or input direction of INPUT is wrong	
Action	Use '#0', '#1' or '#2' as input/output direction.	

Code	E1224	Step number exceeded its range
Cause	Step no. value exceeds its limit.	
Action	Use the value of 0 - 999 as step no.	

Code	E1225	Line number exceeded its range
Cause	Line no. value exceeds its limit.	
Action	Use the value of 1-9999 as line no.	

Code	E1226	Address parameter fault
Cause	The syntax of address is wrong, or it's attempted to branch to an address not existed.	
Action	Check the syntax of address, and whether the address actually exist.	

Code	E1227	Failed in getting hidden pose
Cause	Because of broken working file, it was failed to get hidden pose of the step.	
Action	Delete the step, record new step	

Code	E1228	Incorrect element
Cause	An incorrect pose element or shift element is used.	
Action	Check the syntax of pose element or shift element. (refer to the operational manual.)	

Code	E1229	String fault
Cause	The syntax of string constant is wrong.	
Action	Check the syntax of string constant.	

Code	E1230	Program number parameter fault
Cause	The syntax of program no. is wrong.	
Action	Check the syntax of program no. Program no. must be a constant, not variable or arithmetic expression.	

Code	E1231	Voltage parameter fault
Cause	The syntax of voltage parameter value is wrong, or the value exceeds its limit.	
Action	Check the syntax of voltage parameter value, and the value is within its limit.	

Code	E1232	Current parameter fault
Cause	The syntax of current parameter value is wrong, or the value exceeds its limit.	
Action	Check the syntax of current parameter value, and the value is within its limit.	

Code	E1233	Time parameter fault
Cause	The syntax of time parameter value is wrong, or the value exceeds its limit.	
Action	Check the syntax of time parameter value, and the value is within its limit.	

Code	E1234	File parameter fault
Cause	The syntax of file no. parameter value is wrong, or the value exceeds its limit.	
Action	Check the syntax of file no. parameter value, and the value is within its limit.	

Code	E1235	Divided by zero
Cause	Divided by zero in arithmetic expression.	
Action	Make the result of expression used as divisor don't be zero in any case.	

Code	E1236	Mathematical Error
Cause	Fault occurred in arithmetic calculation.	
Action	Check whether the expression is valid form. Infinity value shouldn't occurred.	

Code	E1237	Checksum Error
Cause	Checksum of the encoder value of the step was wrong.	
Action	Deleted the step and record a step.	

Code	E1238	Job header fault
Cause	The string syntax of working header was wrong.	
Action	Refer to other working file, edit the string syntax of working header.	

Code	E1239	Job format version is different
Cause	Because of upper version file, loading would not execute.	
Action	Increase the version of the controller, revise the working file as present version.	

Code	E1240	Too many addresses
Cause	On GOTO statement, there are too many addresses.	
Action	Use address parameters not more 10ea.	

Code	E1241	Code number fault
Cause	In M code or I code statement, the code no. not existed is used.	
Action	Use valid code no.(refer to the operation manual.)	

Code	E1242	Assign. fault(Read only variable
Cause	Because the left side of substitute is read only variable, substitution was not possible.	
Action	Check the error in working file, use substitutional variables.	

Code	E1243	Fault of Jig number to sync
Cause	In SMOV statement. the syntax or the extend of the parameter of the jig number was wrong.	
Action	Use the parameter of jig number in 0 to 3 by SMOV statement syntax	

Code	E1244	There is no registered jig
Cause	Jig number was inputted without a registration of jig.	
Action	Execute jig registration first.	

Code	E1245	Block stack overflow
Cause	GOSUB - RETURN, IF - ENDIF, FOR - NEXT of robot language have too many blocks. or because of mismatched flow control GOSUB, IF, FOR executed repeatedly without RETURN, ENDIF, NEXT.	
Action	Reduce inner block number about GOSUB, IF and FOR. or repair the mismatched flow control.	

Code	E1246	Coordinate no. fault
Cause	In pose or shift constant, coordinate setting syntax was wrong.	
Action	Search for wrong syntax and fix it.	

Code	E1247	Already assigned signal.
Cause	When edit connection confirm sig. at GUNCHNG command signal no is already assigned private signal.	
Action	Resetting input signal no to not assigned signal.	

Code	E1260	Invalid position move conditions
Cause	Fails in motion planning during the retry or restart function.	
Action	Welding segment and approach step must be interpolated, PTP move is not allowed.	

Code	E1261	Incorrect number of REFP
Cause	REFP number can get its value of 1 to 4.	
Action	Correct the REFP number.(Refer to the operational manual.)	

Code	E1262	Detected wire stick
Cause	Wire is sticked to the workpiece. or 'Auto Stick Recovery' has failed in repetition.	
Action	1) Check the welder power source. 2) Remove wire stick to the workpiece.	

Code	E1263	Cannot read WEAV CONDITIONS
Cause	Cannot find the weaving condition file(ROBOT.WV2).	
Action	Move the cursor to the WEAVON statement, press [QuickOpen] to create the file.	

Code	E1264	Cannot read ARC START CONDITIONS
Cause	Cannot find the arc start condition file(ROBOT.AS2).	
Action	Move the cursor to the ARCON statement, press [QuickOpen] to create the file.	

Code	E1265	Cannot read ARC END CONDITIONS
Cause	Cannot find the arc end condition file(ROBOT.AE2).	
Action	Move the cursor to the ARCOF statement, press [QuickOpen] to create the file.	

Code	E1266	Cannot read ARC AUX CONDITIONS
Cause	Cannot find the arc end condition file(ROBOT.AX2)	
Action	Move the cursor to the ARCON or ARCOF statement, press [Quick- Open] to create the file.	

Code	E1267	Cannot read ARC START CONDITIONS
Cause	Cannot find the arc end condition file(ROBOT.WL2).	
Action	Move the cursor to the ARCON or ARCOF statement, press [Quick-Open]. Then press [PF2] 'Welder' to create the file.	

Code	E1268	Incorrect reference pose(REFP 3)
Cause	In steady weaving reference point(REFP3) was not exist or in normal weaving it was occurred to coincide direction to reference point with the direction to the object point.	
Action	1) In case of steady weaving (1) Record REFP3 point. (2) There was not agreed between start step and object step(try to copy the step) 2) In case of normal weaving (1) Adjust the REFP3 position.	

Code	E1269	Incorrect reference pose(REFP 1)
Cause	Distance between welding path and REFP 1 is smaller than 0.1mm.	
Action	Change the position of REFP 1 to the proper one.	

Code	E1270	Wall and target pose are linear
Cause	Forward direction and wall point are linear. if wall point does not exist, z-axis is assumed.	
Action	Add REFP 1 or reposition it.	

Code	E1271	Incorrect reference pose(REFP 2)
Cause	Forward direction and approach step(or REFP 2) are linear.	
Action	Add REFP 2 or reposition the approach step.	

Code	E1272	Too small weaving width
Cause	Weaving pattern length is smaller than 0.1mm.	
Action	Enlarge the pattern length	

Code	E1273	Too small number of weaving seq.
Cause	Number of sequence is equal to or less than 1 in user-defined pattern.	
Action	Enter weaving sequence more than 2.	

Code	E1274	Out of restart number on weld line
Cause	Restart repeats more than given value.	
Action	1) Check the welder power source 2) Adjust the 'ARC OFF DETECT TIME' in welder conditions	

Code	E1275	An insufficiency of shield gas
Cause	Shield gas pressure is low.	
Action	1) Charge the shield gas 2) Set gas-off signal 0 to ignore the low pressure.	

Code	E1276	A shortage of weld wire
Cause	Welding wire is run short of.	
Action	1) Replace wire roll. 2) Set wire-off signal 0 to ignore the wire shortage.	

Code	E1277	Cannot overlap pose of cir-interp
Cause	Unable to plan an overlap motion on the circular welding path.	
Action	Increase overlap length or use the overlap prohibition option.	

Code	E1278	Cannot retry pose of cir-interp.
Cause	Unable to plan an retry motion on the circular welding path.	
Action	Do it again. if error occurs, increase retry distance or change operation mode in the welding time & condition file.	

Code	E1280	Check VOL CONFIRM of conditions
Cause	If 'Power Supply' in welder condition has changed, 'Voltage Confirm' altered to 'NOT DONE'.	
Action	Confirm the output voltage in ASF or AEf. And then set 'Vol Confirm' 'DONE'.	

Code	E1281	Detected welder error signal
Cause	Welder error signal is detected.	
Action	1) Check welding power device. 2) To ignore the signal reset the signal in 'arc application'.	

Code	E1283	No BD48x board for arc welding
Cause	Option board was not installed. So, the arc welding does not support.	
Action	Check the installation of BD48X, If it was installed, check DIP3 = ON on BD430.	

Code	E1285	Improper use of serial port #2
Cause	the object of serial port in 'SYSTEM/CONTROL PARAMETER/SERIAL PORT' was not 'SENS'	
Action	Set the object of serial port in 'SYSTEM/CONTROL PARAMETER/SERIAL PORT'as'SENS' to use the serial port as sense.	

Code	E1286	Different from Power Control Mode
Cause	Voltage output mode was not correspond to voltage control mode in welder character file.	
Action	In individual power control mode voltage out was selected as 'voltage', in one source or pulse voltage output was selected as '%'	

Code	E1287	Undefined Station(PositionerGroup)
Cause	In execution of 'SMOV' no defined station was appointed.	
Action	Adjust selected station in 'SYSTEM/INITIALIZATION/POSITIONER GROUP CONFIGURATION'	

Code	E1288	Not executed Calibration of S(?)
Cause	In execution of 'SMOV' it was selected that the station was not calibrated.	
Action	Do the calibration of the station in 'SYSTEM/ AUTO CONSTANT SETUP/ POSITIONER CALIBRATION'	

Code	E1289	Detected Arc Off in arc welding.
Cause	When WCR signal was not inputted in set time, arc off signal was detected in arc welding. Arc off detection time was adjusted in welding character file.	
Action	1) Adjust time of WCR signal and arc off detection. 2) To ignore the signal, select the ignore in 'Aux. welding config. file/restart condition'	

Code	E1290	Don't detect the start point.
Cause	Don't detect the start point within the search range.	
Action	Adjust the search range in the tracking conditions, or modify the step's pose.	

Code	E1291	No responding of LVS.
Cause	The laser vision sensor does not reply.	
Action	1. Check the serial port usage. 2. Check the laser vision sensor. 3. Check the communication cable.	

Code	E1292	Do modify search start length.
Cause	When search a start pose with the laser vision sensor, at start pose correct with conditions even if the robot doesn't move.	
Action	1. Modify the search range in condition. 2. Modify the step pose.	

Code	E1293	Error detect at Laser sensor.
Cause	The laser vision sensor sends a error number, refer to HISTORY frame.	
Action	Refer to the error number in HISTORY frame, and the sensor manuals. 1 : PC setup comms error - serial connection fault to PC 2 : Sensor camera fault - no video from the sensor head 3 : Sensor link fault - no comms to sensor head. Camera cable faulty? 4 : No sensor connection - no video or comms. Sensor not plugged in? 5 : Sensor at wrong temp - too hot or too cold 6 : Sensor power failing - 24v supply to sensor head out of range. Camera cable faulty? 7 : Lasers disabled - check the laser enable keyswitch, and the laser warning lamps 8 : No sensor calibration - sensor calibration data faulty. Try a different sensor head 9 : Seam out of range - no stripe in picture	

	10: Analysis could not see the seam. Hit data ok, but analysis failed, only in search 11: Not used in this interface 12: Seam has not been setup. Incorrect seam number? 13: No seam in image in tracking 14: Esc pressed in tools program while robot communicating with the sensor 15: Control unit memory corrupt, reformat and reload memory from backup. 16: Reading system data fail 17: Error reading seam from FLASH memory - corrupted? 18: Error reading seam from FLASH memory - corrupted? 19: Fault in the analogue I/O circuitry(POST) 20: Error in video acquisition hardware 21: Error in the on blord timer hardwar 22: FLASH memory dead - needs replacing 23: Data FLASH memory full 24: FLASH memory bad sector - warning only 25: Error in the error log 26: Power to the I/O on the SAPEII board missing 27: ESTOP active - check the ESTOP link or connections 28: Within 5 degrees of the temperature limits

Code	E1294	Cannot read LVS CONDITIONS.
Cause	Cannot read the laser vision sensor condition file, ROBOT.LVS.	
Action	Move cursor on the LVSON/ CHGLVS command and, press [QuickOpen]. If not be solved, backup all file and execute the system format	

Code	E1295	Set Weav'g mode=single for Track'g
Cause	When the mode of weaving condition is not the single, it's detect	
Action	Set the mode of weaving condition to the single.	

Code	E1296	Assign InPORT of weld [A] for TRK.
Cause	When unassigned the analog input port for tracking, it's detect.	
Action	Assign a number of port to the analog input port for tracking at {system>4:>2:>11:}.	

Code	E1297	아크센싱 승인 코드가 없습니다. Not correct the license key.
Cause	아크센싱 기능은 옵션기능입니다. This function requires the license key.	
Action	당사 영업부에 요청하십시오.	

Code	E1298	A seam data doesn't exist with LVS
Cause	Laser vision sensor doesn't detect a seam pose.	
Action	If a joint type is no problem, please adjust the allowed value in LVS condition, or adjust the extend length for search target.	

Code	E1299	The Search Start supports only LIN
Cause	The step's interpolation method is not linear for the moving search start function.	
Action	Please change next and next step interpolation method to linear.	

Code	E1300	Reference position doesn't record
Cause	Reference length between the limit switch to the object on conveyer was needed in conveyer synchronization.	
Action	Before conveyer synchronization(M55 [1]) was used, record the function of inputting conveyer register variable (M37), input CR variable on monster in teaching.	

Code	E1301	Not available under CNVY Syncro.
Cause	Cannot execute stud gun during conveyor tracking.	
Action	1) Change gun type except stud gun in 'SYSTEM/ INITIALIZATION/ PURPOSE CONFIG.' 2) Delete the stud gun which was record as a step condition data	

Code	E1302	Conveyor interpolation error
Cause	During conveyor tracking, interpolation off step was executed.	
Action	Change interpolation of step.	

Code	E1303	Available only during CNVY Synchro
Cause	'I50 Conveyor interlock' is available only under conveyor synchronization.	
Action	Make a program so that the function 'M55[1]' is executed before the function 'I50' or 'I51'.	

Code	E1304	Conveyor running signal is given
Cause	Conveyor running signal is input. in case of conveyor operation mode was set Test or Simulat. in synchronization on.	
Action	Either turn conveyor running signal off or set conveyor operation mode to Normal.	

Code	E1305	Create Robot.CO1 file for conveyor
Cause	In case of conveyor synchronization was set to disable, CNVYPOS, CNVYSYNC, WAITCNVY instruction was executed.	
Action	Delete the instruction.	

Code	E1306	Base position data is not recorded
Cause	After configuring mechanical constant file, playing gun search", function or spot welding function was executed without record gun search reference position.	
Action	Record gun search reference position with new electrodes	

Code	E1307	Gun search program is abnormal
Cause	Playing of spot welding function was occurred without termination of gun search normally or gun search 2 was executed without execution of gun search 1.	
Action	Do the work after detection of tip consumption with execution gun search 1 and 2.	

Code	E1308	Tool No. of selected step is wrong
Cause	The tool number to servo gun number was not selected correctly when the step was executed with spot welding function and gun search function.	
Action	Correspond tool number(G1->T0, G2->T1) in the step with spot welding function and gun search function.	

Code	E1310	Squeeze force exceeded current LMT
Cause	Current limit(IP) of the servo amp was exceed to current limit of calculation by commanding pressure.	
Action	Lower configured pressure or increase capacity of the servo motor.	

Code	E1311	Squeeze force exceeded overload
Cause	Command pressure was exceeded over load detection level.	
Action	Lower command pressure not to make over load error.	

Code	E1312	Squeeze target is out of workspace
Cause	Out of robot work space was occurred when pressure position(Object position) of servo gun calculation.	
Action	Change the pose of robot, record the position.	

Code	E1313	Squeeze data out of range in table
Cause	The pressure in the welding condition data of spot welding parameter(M72) was exceeded configured pressure extend of pressure table of servo gun parameter.	
Action	Lower configured pressure.	

Code	E1314	Squeeze force delay time is over
Cause	Electrode abrasion detected was exceeded max. electrode abrasion of servo parameter.	
Action	Change electrodes, adjust max. electrode abrasion value of servo parameter as preferable value.	

Code	E1315	Gun number for servo gun is wrong
Cause	To work with gun is not servo gun	
Action	Check the work is with whether servo gun in addition axis configuration	

Code	E1316	A robot search or C/V is operating
Cause	When gun search function was executed, the function of robot searching or conveyer was running	
Action	Do not use robot search function or conveyer function in gun search operation.	

Code	E1317	HRview is going to load program
Cause	When a program was downloaded by HRview, Run command was executed.	
Action	After downloading the program, do the program.	

Code	E1318	The result value was overfloor
Cause	The result of addition or subtraction with count register was exceed 255.	
Action	Max value of count register is 255, check the program.	

Code	E1319	The result value was underfloor
Cause	The result of addition or subtraction with count register was exceed 255.	
Action	Check the program	

Code	E1320	Sensor doesn't search operation
Cause	This error occurs when the sensor does not work though the robot approach the object in searching of fixed electrode abration by servo gun search function or robot equalize function	
Action	1) When electrodes approach sensor check the sensor work 2) Check connection of connectors. 3) check the kind of sensor contact	

Code	E1321	The pallet entry number is wrong
Cause	Use same palette number on a palette such as PAL and PALEND command or make this error.	
Action	1) Check palette number on a palette with command of TIERST, PALPU, PAL, PALEND and PALRST 2) Input same pallet number on the pallet	

Code	E1322	Check the pattern register!
Cause	1) Palletizing pattern registers were inputted to palletize. 2) If invalid pattern register in 16 pattern registers was used, this error was occurred	
Action	1) Check pattern register number that was set up. 2) Check used/unused items of palletize pattern register.	

Code	E1323	Equalizerless environment is wrong
Cause	The condition to be execute robot equalizer function was not enough	
Action	Select 'SERVICE' as 'SPOT' in 'SYSTEM/ INITIALIZATION/ SERVICE SELECTION' after selection of air gun1, air gun2, etc as EQ'less	

Code	E1324	Palletizing environment is wrong
Cause	There was not selected 'SERVICE' as 'SPOT' in 'SYSTEM/ INITIALIZATION/ SERVICE SELECTION' after selection of air gun1, air gun2, etc as EQ'less	
Action	Set GUN2 as 'palletize' in 'SYSTEM/ INITIALIZATION/ SERVICE SELECTION'	

Code	E1325	Palletize pick'g up function fault
Cause	Shift quantity of 'PAL'was needed to use shift quantity of PALPU. PALPU is to be on between PAL and PALEND or make this error.	
Action	PALPU put on between PAL and PALEND in the program.	

Code	E1326	Invalid environment of GUN search2
Cause	Controller is configured to compensate consumption of gun by gun search method 1 only.	
Action	Change the compensate method to use gun search method 1,2 either by set the value 0 to 'Move tip consumption rate(%)'	

Code	E1327	Servo hand opening limit over
Cause	Open position of servo hand open step excess maximum open position of system/ application parameter/ palletizing/ servo hand parameter setting.	
Action	reduce length of the offset of servo hand open step or increase maximum open position of servo hand parameter menu.	

Code	E1328	Servo hand squeezing limit over
Cause	Squeeze position of servo hand squeeze step is smaller then Maximum squeeze position of system/ application parameter/ palletizing/ servo hand parameter menu.	
Action	Increase the length of servo hand squeeze step's offset or decrease maximum squeeze position of servo hand parameter menu.	

Code	E1329	Servo hand squeezing time over
Cause	While squeezing at servo hand squeezing step, squeeze force doesn't come in setting range in spite of passing system/ application parameter/ palletizing / servo hand parameter menu's Squeeze fault check Tm.	
Action	1) Settle servo hand squeeze position. 2) Setting the Squeeze-Current Table of system/ application parameter/ palletizing/ servo hand parameter 3) Settle squeeze force. 4) Settle squeeze fault check Tm.	

Code	E1330	Can't load .LD? file while PLC RUN
Cause	You tried to load ladder file(.LAD) while embedded PLS RUN or Remote-RUN mode	
Action	Turn the embedded PLC to STOP or Remote-STOP mode, and try again.	

Code	E1331	Confirm external program select
Cause	You tried to start in case of system/ user parameter menu's FIFO function (2)Program is <Ext-Sel> & (1)Application No. is <20EA> or <1EA> & external program select <DSBL>.	
Action	Confirm the setting of external program select at system/ user parameter menu.	

Code	E1332	Confirm program strobe signal use
Cause	You tried to start in case of system/ user parameter menu's FIFO function (2)Program is <Ext-Sel> & (1)Application No. is <20EA> or <1EA> & program strobe signal use <DSBL>.	
Action	Confirm the setting of program strobe signal use at system/ user parameter menu.	

Code	E1333	Cannot found selected program
Cause	Reserved program is not exist on the internal memory when execute FIFO register's reserved program	
Action	Confirm selected program on the internal memory.	

Code	E1334	Free-fall! start after step SETg
Cause	When motor off for return to previous posi is enable, fall length excess limit for error detect. if error isn't occur in the case of robot restart because of stopped step is out of normal trace this error inform to user warning.	
Action	1) In spite of restart at current position interference isn't occur start after set again current step. 2) If interference expects when step execute at current posi, exchange robot posi at manual mode. 3) If error detect length is unsuitable, adjust limit for error detect at system/ 2:control parameter/return to the previous posi menu.	

Code	E1335	Cannot use continue play at FIFO
Cause	When execute program at FIFO application, in case of cycle type of the cond set menu is continu input start.	
Action	When apply FIFO Function, please use after select 1cycle cycle type of the cond set menu	

Code	E1336	Undefined User-coordinate number.
Cause	When execute/input User-coordinate without setting User-coordinate	
Action	The first select a program and record 3 steps, the origin, the X-direction, and pose on XY-plan for User-coordinate. Sets System>2:>12:>1:User-coord. If you want it in program, refer to the MKUCRD command.	

Code	E1337	SOFT Instruction execute fail
Cause	When execute SOFT instruction While setting time(5sec) command and current encoder's difference is over 384Bit	
Action	Please set to 0 Accuracy for step before SOFT instruction.	

Code	E1338	Soft floating error distance over
Cause	When SOFT instruction executed, position difference is over error detection level.	
Action	Adjust error detection level.	

Code	E1340	Invalid condition for co-work run
Cause	Invalid condition of controller to do COWORK function	
Action	Verify communication status, common coordinate was set, same between manual cooperation role and COWORK's role of robot.	

Code	E1341	Cooperation wait time is over
Cause	All of cooperative robot are not ready to cooperate by COWORK wait time.	
Action	Considerate wait time of COWORK must be set, considering the other robots. or you can set the time as 0, waiting until agreement	

Code	E1342	Invailded COWORK or common coordi.
Cause	COWORK can not be executed as in validity of cooperative control, or as no common coordinate.	
Action	Cooperate control is set as enable at System setting/ Cooperation control parameter and common coordinate must be set.	

Code	E1343	COWORK execution mismatch
Cause	Duplicated COWORK is used, or program encounter END without COWORK END	
Action	COWORK function is programmed with pairing COWORK and COWORK END. It is prohibited from repetition of running COWORK caused by step change.	

Code	E1344	COWORK Para.(M/S, robot No.) error
Cause	COWORK's partner robot number is wrong set as my robot number.	
Action	Change robot number used in COWORK M(S),S(M)=robot number, my robot number can not be set as partner robot number.	

Code	E1345	The slave already executed COWORK.
Cause	Cursor position of Slave is at COWORK END.	
Action	Don't go to the trouble to change step to operate Master and Slave normally.	

Code	E1346	Excess of P* repeat limit (10x)
Cause	You can't repeat steps including P* over 10 times. (for limit of calculation load)	
Action	Insert a hidden pose step within preceding 10 steps.	

Code	E1347	Coord. system not supporting shift
Cause	You can only add <base/robot/tool/user coord. system shift> to <base/robot/ encoder/user coord. system pose>. The shift operation of other coord. system is not permitted.	
Action	Check the pose or shift variable/ constant and convert it to permitted coord.system.[Quick Open]	

Code	E1348	Time out of connection complete.
Cause	For marked time gun connection doesn't complete.	
Action	If connection complete at ATC, send spot gun connection complete signal to controller. GUNCHNG ON, commend execute after connection between gun and ATC.(automatic tool changer)	

Code	E1349	SVG Disconnect error in limit time
Cause	After GUNCHNG OFF instruction execute, within 5sec spot gun doesn't disconnect.	
Action	Contact the Robot A/S team.	

Code	E1350	Don't set an user-coord. number.
Cause	Don't set user-coordinate number in the [Condi Set].	
Action	Please input user-coordi. Number with T/P, or execute SELUCRD command with teaching program	

Code	E1351	Interrupt defined duplicated.
Cause	For pre-defined interrupt number redefine without delete.	
Action	Define not used interrupt number or after execution interrupt delete.	

Code	E1352	Pre-execute interrupt definition.
Cause	Private interrupt enable instruction executes without defined number interrupt execution.	
Action	After pre-execution for interrupt define instruction executes private interrupt enable instruction.	

Code	E1353	Over allowed max. dist. deviation.
Cause	The distance deviation by the seam tracking is over.	
Action	Modify step's pose or the allowed max. deviation in TRK condi.	

Code	E1354	Over allowed max. angle deviation.
Cause	The angle deviation by the seam tracking is over.	
Action	Modify step's pose or the allowed max. deviation in LVS cond.	

Code	E1355	Partner robot is in abnormal stop
Cause	Partner robots aren't ready to cooperate. one of them is stop status.	
Action	Check the running status mode. If you want to rerun after stopping playback of cooperation, you will run Master ahead after running Slave.	

Code	E1356	Duplicated robot number is set
Cause	Cooperation control is impossible because duplicated robot number can't be identified the robot	
Action	Inspect robot number of robot connected in HiNet, and change overlapped robot number. After this action, you must repower the controller.	

Code	E1357	Detected coolant error signal
Cause	Coolant circulation error signal is detected.	
Action	Check the cooling system. If there is no error, check the setting of input signal port in controller. And restart welding step after removing error state.	

Code	E1358	Interrupt enable at continue path.
Cause	When Interrupt Define or Enable instruction executes, continuous path function has been executed.	
Action	Cannot use interrupt & continuous path function at the same time	

Code	E1359	Set continuous path at Int enable.
Cause	When continuous path set, Interrupt function already executes.	
Action	Cannot use interrupt & continuous path function at the same time	

Code	E1360	ROBOT.C00 file is damaged.
Cause	ROBOT.C00 structure is broken.	
Action	Initialize the memory by assistant of A/S member in Hyundai Robotics.	

Code	E1361	ROBOT.C01 file is damaged.
Cause	ROBOT.C01 structure is broken.	
Action	Initialize the memory by assistant of A/S member in Hyundai Robotics.	

Code	E1362	ROBOT.C00 file is read only.
Cause	Can't write data to ROBOT.C00.	
Action	Clear the attribute of ROBOT.C00	

Code	E1363	ROBOT.C01 file is read only.
Cause	Can't write data to ROBOT.C01.	
Action	Clear the protect of ROBOT.C01.	

Code	E1364	Duplicated setting of master.
Cause	The number of controllers which are set as masters of manual mode is more than 2EA.	
Action	Use R351 or F key for turning the roles such as master/slave. Only one should be selected as a master.	

Code	E1365	A cooperative status is not ready.
Cause	A master of manual mode is not selected.	
Action	Select a master for cooperative robots of manual mode.	

Code	E1366	Master number of slave is wrong.
Cause	The master number selected by the slave is not coincident with the master number.	
Action	This message will be ready.	

Code	E1367	Can't be Shifted in CMOV
Cause	Shift function is applied, but the shift coordinate is not supported	
Action	You should apply the robot coordinate for CMOV shift.	

Code	E1368	Not select Master for Crd. trans.
Cause	The coordinate of step data is the master end effector Crd.<M>, but the master robot is not selected.	
Action	Select the master coincident with the master of current CMOV step	

Code	E1369	Invalided master number, ID in CMOV
Cause	The master number from COWORK S, M=#1,ID=#2 is not coincident with the master number from CMOV R#1#2	
Action	You should record the CMOV position, after the same master of COWORK is selected.	

5.4.3. Warning

Code	W0001	Backup memory damaged
Cause	It occurs when damage is found in all kinds of files.	
Action	Initialize the internal memory, and load all kinds of files backed up in a diskette.	

Code	W0002	Controller temperature risen
Cause	It occurs when the controller temperature is above 65.	
Action	Refer to Troubleshooting Manual.	

Code	W0003	Damaged program. Delete it
Cause	Program to execute is damaged.	
Action	Delete the program, and reload a backup program.	

Code	W0004	Emergency stop on
Cause	It occurs when [Motor ON] in an emergency.	
Action	Cancel the emergency stop key, and start an execution.	

Code	W0005	Backup battery voltage dropped
Cause	Backup battery voltage connected to Main board BATCN connector is below the standard.	
Action	Replace the backup battery.	

Code	W0006	Step for jump or call
Cause	It occurs when the steps for step jump and step call are deleted.	
Action	It may be dangerous to start without checking the program, Thus, check the program before starting.	

Code	W0007	Interlocking not good
Cause	Input signal is not input while controller is waiting for the signal.	
Action	- Check if the signal is input to service monitor function. - Check the interface connection of interlock. - Check all the connections of interlock machine.	

Code	W0008	Welding machine does not work well
Cause	It occurs when welding completion signal is not input within re-welding standby time during spot welding.	
Action	Input the welding completion signal.	

Code	W0009	Brake slip!(Excess of set value)
Cause	It occurs when the brake slip by force during stud welding is in excess of the set value in the system/applied parameter/spot & stud/welding parameters.	
Action	Check out the slip that has the largest slip in brake slip count of service/monitoring. Replace the motor where axis has the largest slip.	

Code	W0010	Fieldbus power is not supplied
Cause	Field bus power is not supplied.	
Action	In case of DeviceNet, check if +24V of power supply line is correctly connected, and measure the voltage with multimeter. Take necessary actions to correctly supply +24V power to DeviceNet cable.	

Code	W0011	Fieldbus network connection error
Cause	Field bus network connection is not normal.	
Action	Check if field bus connector is taken off. Check if field bus network cables are all in comply with each field bus regulation.	

Code	W0012	Fieldbus IDLE state
Cause	Master stops I/O operating.	
Action	If PLC is in a program mode, change it to RUN mode.	

Code	W0013	UCS module is not detected
Cause	UCS module is not sensed.	
Action	Check if UCS module is correctly mounted on I/O board. If you don't intend to use field bus, turn off the "field bus adaptor use or not" in "PF2: system/controller parameter/input & output signal setting/field bus setting"	

Code	W0014	Fieldbus setting error
Cause	Parameter setting for field bus master is not identical with that of slave.	
Action	Check if parameter setting is correctly done for filed bus master and slave. If any errors, then correct them	

Code	W0015	Fieldbus general error
Cause	BD420 board field bus has an error.	
Action	Check if there is any error in BD420 field bus setting and field bus master setting, and cabling.	

Code	W0016	Improper use of GE or DE signal No
Cause	The specified values for GE or DE variable are incorrect. The values are out of range.	
Action	- It is different from coworking robot number. - GE: Min.=(robot #-1)*4+1, Max.=(robot #-1)*4+4 - DE: Min.=(robot #-1)*32+1, Max.=(robot #-1)*32+32	

Code	W0101	Step data checksum error
Cause	It occurs when Checksum values of step position data have an error.	
Action	Delete the step, and teach a new step.	

Code	W0103	Something wrong with interlocking
Cause	While controller is waiting for input signal, the input signal is not input within the time set.	
Action	- Check if the signal is input to service/monitoring. - Check the interface connection of Interlock. - Check all the connection of Interlock machine. - Adjust the Interlock error detection time.	

Code	W0104	Encoder battery voltage drop
Cause	Battery voltage is too low in axis (○) encoder.	
Action	Follow the controller MANUAL to check the encoder battery in corresponding axis. Check the Battery connection of corresponding axis encoder.	

Code	W0105	Tip consumption exceeded limit!
Cause	It occurs when total tip consumption detected with gun search is in excess of tip exchange wear set in servo gun parameter.	
Action	Inspect the unfixed tip and fixed tip consumption, and replace the tip.	

Code	W0106	Move-tip consumption exceeded LMT.
Cause	It occurs when total tip consumption detected with gun search is in excess of tip exchange wear set in servo gun parameter.	
Action	Inspect the unfixed tip and fixed tip consumption, and replace the tip.	

Code	W0107	Fixed-tip consumption exceeded LMT
Cause	It occurs when fixed tip consumption detected with gun search is in excess of unfixed tip exchange wear set in servo gun parameter.	
Action	Inspect the fixed tip, and replace the tip.	

Code	W0108	In jog moving, Pressure exceeded!
Cause	It occurs when actual value of pressure is in excess of set value in manual pressurizing. Here operate the servo gun axis in the opposite direction.	
Action	Check if force is sufficiently set for the axis you intend to operate. Make contact with servo gun manufacturer because mechanical problem is anticipated in servo gun.	

Code	W0109	Change gun No. to jog this SVG
Cause	The servo gun you intend to operate is different from the selected servo gun number.	
Action	Servo gun should be operated by manual jog after being selected. Select the servo gun you intend to operate with R210 code before operating.	

Code	W0111	Previous position return detection
Cause	This warning occurs when the returning distance simultaneously with motor ON input is larger than the set value of error detecting distance in case of enable returning function in [Motor ON].	
Action	Extend the error detecting distance of system/control parameter/returning to precious position. Disableate the returning function to previous position in system/control parameter/returning to previous position Make contact with our A/S.	

Code	W0112	Previous position return distance
Cause	This occurs when the returning distance simultaneously with motor ON input is larger than the set value in case of enable returning function in [Motor ON].	
Action	Set the returning distance setting to be larger than the existing set value.	

Code	W0117	Jog will make overspeed CMMD.
Cause	Robot is in a posture of high speed while manually operated in rectangular coordinate system or tool coordinate system.	
Action	Change the robot’s posture by manipulating with articulation coordinate before operating it manually.	

Code	W0118	1st servo CPU version is Old
Cause	The robot may be used, but it has problems in the use of some functions due to the old version of 1st servo board CPU.	
Action	You may use the existing functions as they are, but for the use of new functions, please make contact with our A/S to update the version.	

Code	W0119	2nd servo CPU version is Old
Cause	The robot may be used, but it has problems in the use of some functions due to the old version of 1st servo board CPU.	
Action	You may use the existing functions as they are, but for the use of new functions, please make contact with our A/S to update the version.	

Code	W0120	3rd servo CPU version is Old
Cause	The robot may be used, but it has problems in the use of some functions due to the old CPU version of 1st servo in the 2nd servo board.	
Action	You may use the existing functions as they are, but for the use of new functions, please make contact with our A/S to update the version.	

Code	W0121	4th servo CPU version is Old
Cause	The robot may be used, but it has problems in the use of some functions due to the old CPU version of 2nd servo in the 2nd servo board.	
Action	You may use the existing functions as they are, but for the use of new functions, please make contact with our A/S to update the version.	

Code	W0123	Stop input from partner robot
Cause	Stop instruction is received from the partner robot during cowork control operation. In this case, the above message is output, and the robot stops.	
Action	Start running a master to resume a program after starting the robot on the part of slave.	

Code	W0124	Slave is Impossible to jog
Cause	It is set as salve in the condition of manual cowork control. The robot set as slave is impossible to operate separately.	
Action	To operate each robot individually in a manual mode, change the condition of manual cowork. To change the condition of manual cowork, users need to use F key or R351 code.	

Code	W0125	Invalid position of connected SVG
Cause	The position of servo gun attached by GUNCHNG ON instruction or instruction for manual gun connection is different from the one remained in its memory when separating.	
Action	It is normal if it occurs when servo gun is initially connected. If it occurs other than the initial connection, check the followings. It may occur if an incorrect servo gun is selected. Thus, check this out. And check if encoder battery of servo gun is sufficient.	

Code	W0131	Jog Prohibited - Master overlapped
Cause	Among robots connected to HiNet are more than two robots set as Master in their manual cowork.	
Action	Only one Master for manual cowork is possible to set. Change the setting.	

Code	W0132	Jog Prohibited - No slave selected
Cause	Jog operation is attempted for Master robot without setting the Slave robot to be available to cowork.	
Action	Check if Slave robot is selected, and get it ready to be available to cowork before operating(Jog Off/Enabling Switch On).	

Code	W0133	Slave jog status are changed-Stop
Cause	A robot chaged its manual cowork is detected among the coworking Slave robots Master during cowork jog operation with robot.	
Action	Doublecheck the cowork condition of Slave before operating.	

Code	W0134	Master Tool Coord. isn't selected
Cause	It occurs when attempting to operate jog for Slave robot in a CMOV recording mode(R351,3). Master robot is not specified. Or it may occur when using forwarding function of CMOV step. The currently set number of Master is different from the recorded Master number in CMOV.	
Action	Set a correct master robot for manual cowork Master.	

6
Regular Inspection

Regular inspection of controller is to minimize robot failures, and to maintain its efficiency. Instructions and working details for regular inspection are explained here.

6.1. Inspection Schedule

Inspection should be done in accordance with the schedule of (Figure 6.1). Regular inspection is to prevent robot failures, and to secure and maintain its stability even for a long employment of robot and controller. Regular inspection is a requisite for the use of robot, and even for a normal condition.

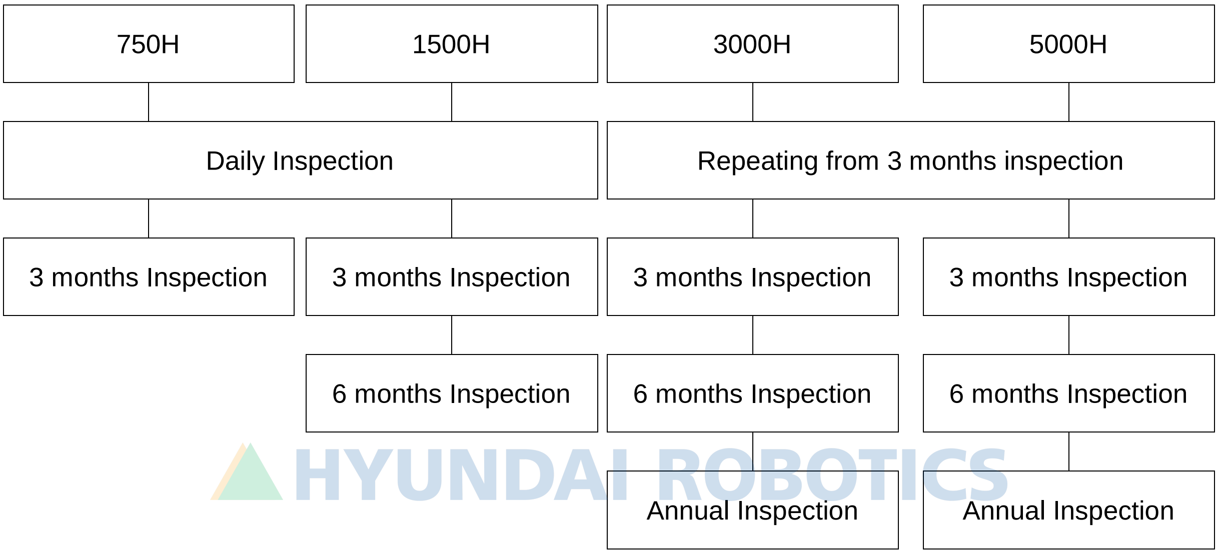


Fig. 6.1 Inspection Schedule

6.2. General Instructions for Regular Inspection

☞ **Instructions**

(1) Inspection working should be performed by a personnel who completed our training course in robot school.

(2) Check the necessary parts & tools, and drawings before inspection work.

(3) Be sure to use special replacement parts specified by our company.

(4) Be sure to turn power OFF when inspecting robot manipulator.

(5) Turn primary power OFF when working with controller door open. Prevent dust or other things from entering the working area.

(6) Pay close attention to IC breaking by static electricity if you need to touch the parts of controller. (Beware of it when touching a connector)

(7) Be sure to forbid anyone to enter robot’s working envelope when performing an inspection with robot manipulator operated.

(8) Perform a voltage measurement in a specified place, and be careful of electric shock and short circuit.

(9) Do not inspect robot and controller at the same time.

(10) Be sure to perform a test operation after inspection to check robot’s movement before normal operation.

6.3. Daily Inspection

Table 6-1 Daily Inspection

No.	Inspection Part	Inspection Details	Remarks
1	Controller	Is display lamp working(normal)?	Check with the naked eye
2	Robot Manipulator	Is door completely closed?	Check with the naked eye
		Are there any errors in Teach Pendant screen?	Check with the naked eye
		Is there a noise during operation?	Listen out
		Is a tip joint unscrewed?	Fasten
		Are there any scratch, stain, and damage in a wiring and Wire harness of manipulator?	Check with the naked eye
		Are there any other impediments such as dust soil causing a damage to manipulator?	Check with the naked eye & clean
3	Others	Are there any obstacles around controller and robot manipulator?	Check with the naked eye

6.4. First Inspection (750 hours inspection)

Table 6-2 3 First Inspection

No.	Inspection Part	Inspection Details	Remarks
1	External, major screws	Unscrewed	Fasten
2	Manipulator wiring connector & Wire harness	Loose connector	Fasten
3	Dog & limit switch screws	Unscrewed	Fasten

6.5. Daily Inspection

Table 6-4 Daily Inspection

No.	Cycle(months)			Inspection Part	Inspection Details	Remarks
	3	6	12			
1		◎	◎	Packing of door	· Transformed & torn part	
2	◎	◎	◎	Back side	· Dust & rotation in cooling fan wings of heat exchanger	
					· Damage & dust in regenerative discharge resistance	
					· Check a heating of Transformer Room by touch, and clean the room.	
					·Terminal Block(TB1) : Loose & damaged terminal	
3	◎	◎	◎	Wire harness	· Loose & damaged connector	
4		◎	◎	Drive Unit	· Loose & damaged connector	
5		◎	◎	Connectors of each board	· Check a loose connector by touch	
6	◎	◎	◎	Operating panel	· Check Button switch & LED	
7		◎	◎	Overall Controller	· Dust cleaning	
8	◎	◎	◎	Nameplate	· Inspect all kinds of nameplates	
9		◎	◎	Voltage measurement	· Primary power voltage	Refer to "5.3.1 Adjustment of Power System"
					·R1, S1, T1	
					·C2, B2	
					·SR1	
10		◎	◎	Grounding	· Check a loose & removed terminal	
11		◎	◎	Battery	· Voltage inspection & regular replacement	BD412 LED
12	◎	◎	◎	Teach Pendant	· Exterior inspection, and damage & joint part of connector checking	
					· Check LCD Display	
					· Check LED Display	
13	◎	◎	◎	Safety related parts	· Check emergency stop switching (operating panel, teach pendant)	
	◎	◎	◎		· Check primary power disconnecting switch(DS1)	
	◎	◎	◎		· Check enabling device of teach pendant	
	◎	◎	◎		· Check circuit protector (CP1,CP2)	
	◎	◎	◎		· Check magnet connector (MSHP,MSPB,MSDB)	
14	◎	◎	◎	Safety related PCB	· Inspect BD461(connector, exterior relay of board)	

6.6. Inspection for Long-Term Idleness

In case of long-term idleness, inspect the followings before turning off power.

(1) Check if LED for battery discharge detection is normal in BD412 board. If there is an error in battery, LED is turned OFF. In this case, replace it with a rated battery. If turning off a primary power with errors in battery, all program/constant data in a board will be deleted after about 1 hour. Thus be sure to back up the program data by using HRView, etc.

(2) Check if controller door is completely closed.

6.7. Parts List for Maintenance

It explains the characteristics of parts.

Maintenance Parts A

☞ **Major maintenance parts to prepare in daily inspection**

Table 6-5 Maintenance Parts Inspection A

Type	Details	Remarks (reference)
Maintenance Parts A-1	Standard accessory parts to prepare	Table 6.1
Maintenance Parts A-2	Major backup parts	Table 6.2
Maintenance Parts A-3	Regular replacement parts	Table 6.3

◆ To maintain a normal operation, parts A-2 and A-3 is a minimum of essential parts, and prepare more than 1 set of these parts.

Maintenance Parts B

☞ **To many maintain a normal operation parts**

Table 6-6 Maintenance Parts Inspection B

Type	Details	Remarks (reference)
Maintenance Parts B-1	Parts to purchase from HHI, Ltd.	Table 6.4
Maintenance Parts B-2	Purchasable Parts from Maker	Table 6.5

☞ **Caution**

Pay attention to the followings for maintenance because high-performance parts are mounted on board.

Storage Temperature 0℃ ~ +45℃

To store for a long period of time and maintain high-reliability, keep temperature ranged 25±10℃ and avoid sudden change of temperature(±10℃/time).

Storage Humidity 20% ~ 80%

To store for a long period of time and maintain high-reliability, keep humidity ranged 45%~65% , and in particular , be careful of dew condensation.

Electric Shock Prevention

If extremes are kept dry, static electricity is likely to be charged. Here, semiconductor is likely to be ruined when the charged static electricity is discharged. Thus, when keeping the board separately, use an antistatic treated packing materials.

Others

- ◆ No poisonous gas
- ◆ No dust
- ◆ Store without excessive loading

Table 6-7 Maintenance Parts A-1 (Standard accessory parts to prepare)

No.	Product Name	Type	Maker	Quantity (EA)	Remarks
1	Connector-plug (CNIN2)	10140-3000VE	3M (USA)	1	CNIN2(BD430)
2	Connector -hood (CNIN2)	10340-45F0-008	3M (USA)	1	CNIN2(BD430)
3	Connector -plug (CNOUT2)	10150-3000VE	3M (USA)	1	CNOUT2(BD430)
4	Connector -hood (CNOUT2)	10350-52F0-008	3M (USA)	1	CNOUT2(BD430)
5	Fuse (F1,F2)	GLASS CATRIDGE FUSE 5X20mm		2	250V, 5A
6	Fuse (BD461)	GLASS CATRIDGE FUSE 5X20mm		6	250V, 8A
7	Fuse (HDAD6)	600CF30	HINODE (JAPAN)	2	660V, 30A

Table 6-8 Maintenance Parts A-2 (Major Backup Parts)

No.	Product Name	Type	Maker	Quantity (EA)	Remarks
1	Servo AMP	HSXY6	HHI	1	Hi4a-0000, Hi4a-0010
		HSXY6-111222	HHI	1	Hi4a-0008
		HDAD6	HHI	1	Hi4a-0002, Hi4a-0012
		HSLXY6-000222	HHI	1	Hi4a-P000
2	Complex Power Unit	HD-180	HHI	1	SMPS
3	Teach Pendant	TP300	HHI	1	
4	Board	BD400	HHI	1	Mother Board
		BD412	HHI	1	Main CPU Board
		BD430V50	HHI	1	I/O Board
		BD540	HHI	2	Servo CPU Board (Hi4a-0000, Hi4a-0008, Hi4a-0002, Hi4a-P000)
		BD541	HHI	2	Servo CPU Board (Hi4a-0010, Hi4a-0012)
		BD461V31	HHI	1	Sequence/Brake board (Hi4a-0000,Hi4a-008, Hi4a-0002,Hi4a-P000)
		BD461V41	HHI	1	Sequence/Brake board (Hi4a-0012,Hi4a-0010)
		BD461V50	HHI	1	Sequence/Brake board (Hi4a-0000,Hi4a-008, Hi4a-0002,Hi4a-P000)
		BD461V60	HHI	1	Sequence/Brake board (Hi4a-0012,Hi4a-0010)
		BD463	HHI	1	Brake board (Hi4a-0012,Hi4a-0010)

Table 6-9 Maintenance Parts A-3 (Regular Replacement Parts)

No.	Product Name	Type	Maker	Quantity(EA)	Remarks
1	Battery (3.6V AA Size)	ER6C	Hitachi Maxwell(JAPAN)	1	Replacement required every 2 years

Table 6-10 Maintenance Parts B-1 (Parts to purchase from HHI (Co.,Ltd.))

No.	Product Name	Type	Maker	Quantity(EA)	Remarks
1	Wire harness	CNR1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4a-0000, Hi4a-0008
		CNR2	HHI (Co.,Ltd.)	1	
		CNR4	HHI (Co.,Ltd.)	1	
2	Wire harness	CNR1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4a-0002
		CNR4	HHI (Co.,Ltd.)	1	
3	Wire harness	CMC1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4a-0010
		CMC2	HHI (Co.,Ltd.)	1	
		CEC1	HHI (Co.,Ltd.)	1	
4	Wire harness	CMC1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4a-0012
		CEC1	HHI (Co.,Ltd.)	1	

Table 6-11 Maintenance Parts B-2 (Purchasable Parts from Maker)

No.	Product Name	Type	Maker	Quantity(EA)	Remarks
1	Circuit Breaker for wiring(CB1)	GV2-RS32 GV2-AN11	Schneider (France)	1	
2	Magnetic Contactor (MSDB)	HMX22 + HAC22	HHI (Co.,Ltd.)	2	For Hi4a-0000, Hi4a-0010, Hi4a-0008
3	Magnetic Contactor (MSHP)	HiMC-40W22	HHI (Co.,Ltd.)	2	For Hi4a-0000, Hi4a-0010, Hi4a-0008
		GMC-50	LGIS	2	For Hi4a-P000
		HiMC-2211B + HAL11	HHI (Co.,Ltd.)	2	For Hi4a-0002, Hi4a-0012
4	Magnetic Contactor (MSPB)	G7L-2A-BUB	Omron(JAPAN)	2	
5	Circuit Protector(CP1)	BKM2-16A	LS Industrial System Co.,Ltd.	1	
6	Circuit Protector(CP2)	BKM3-6A	LS Industrial System Co.,Ltd.	1	