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Hyundai Robot

Hi4 Controller Maintenance Manual

HYUNDAI
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Contents

List of Figures

List of Tables

1. Safety

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 HR and HX industrial robots have a responsibility under the safety relavant regulations valid 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 enters 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 and HX Series Manipulator models and Hi4/Hi4a controller.
Valid application and invalid environment of HR and HX 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
- 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.

Invalid 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 ISO10218.Jan. 1992 , safety standards for industrial robots, and furthermore in comply with ANSI/RIA 15.06-1999 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		Descrptions
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 Limiation 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.

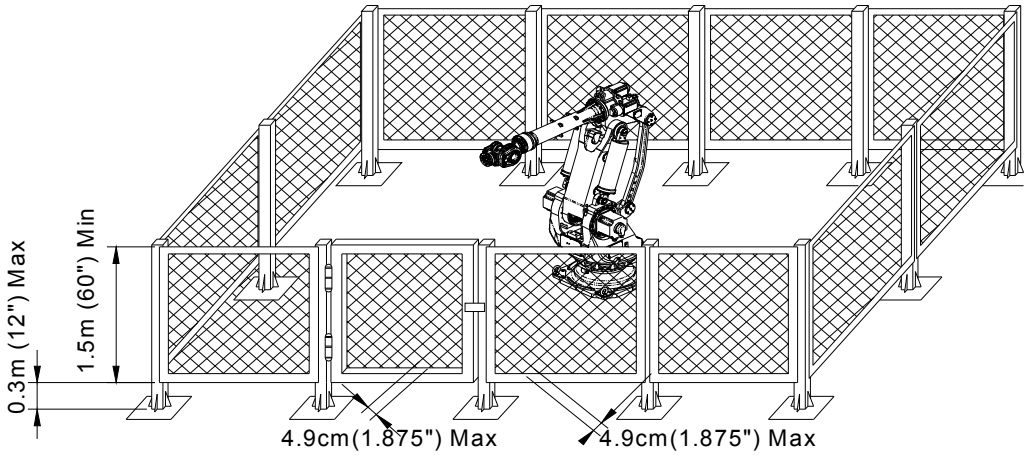


Fig 1.1 Recommended Size for Fence and Gate Hole (Square Gate)

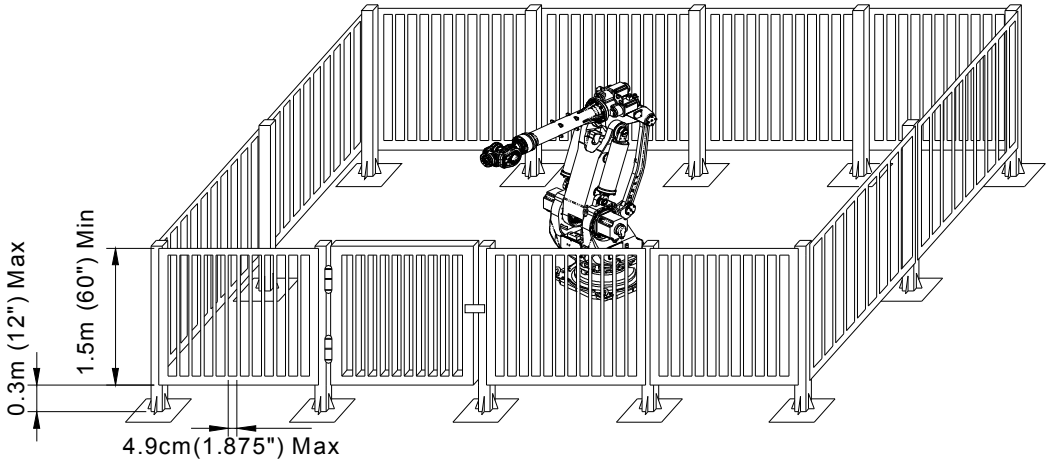


Fig 1.2 Recommended Size for Fence and Gate Hole (Slot Gate)

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 MOTORS OFF when the safety plug is pulled out., or wire the robot to be MOTORS OFF when the safety fence is open. (Refer to “11. Connecting the Other Signals”, Hi4/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”, Hi4/Hi4a Controller Manual)

⑤ For immediate emergency stop, install emergency stop button wihin 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.

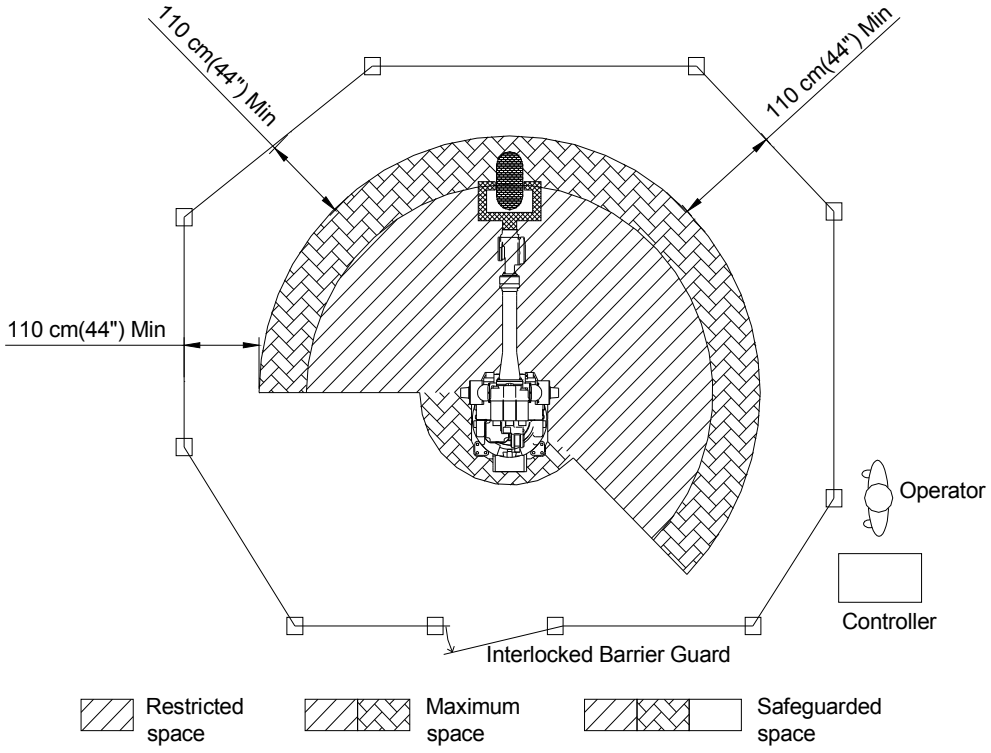


Fig 1.3 Placement of Peripheral Equipment and Operator

(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 valid.

(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 valid 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, Hi4/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 Hi4/Hi4a controller outside of the safety fence in order to monitor the robot manipulator and to operate in a safe way.

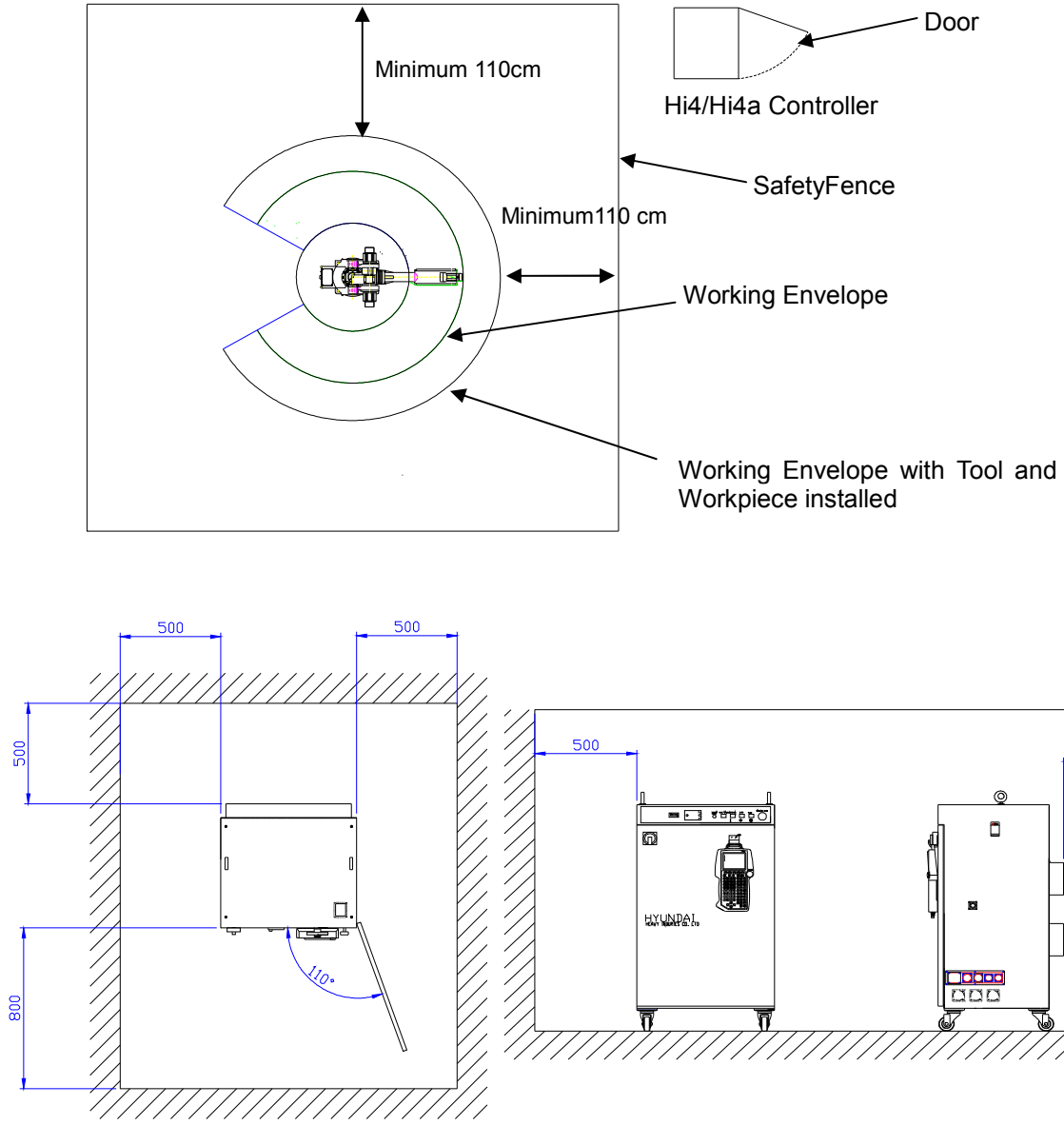


Fig 1.4 Space for robot installation

When installing, be sure to make it easier to perform the maintenance when opening the

Hi4/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) Be sure to set the 'handling setting' on teaching pendant to TEACHING LOCK.

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

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

(5) Do not wear gloves when handling Hi4/Hi4a contoller.

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

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

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

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

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

(11) Follow the predetermined working procedure.

(12) 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 Hi4/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 Hi4/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 Hi4/Hi4a controller.

1.9.2. Safety Precautions for Robot System & Manipulator Maintenanace

(1) Refer to the safety precautions for Hi4/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

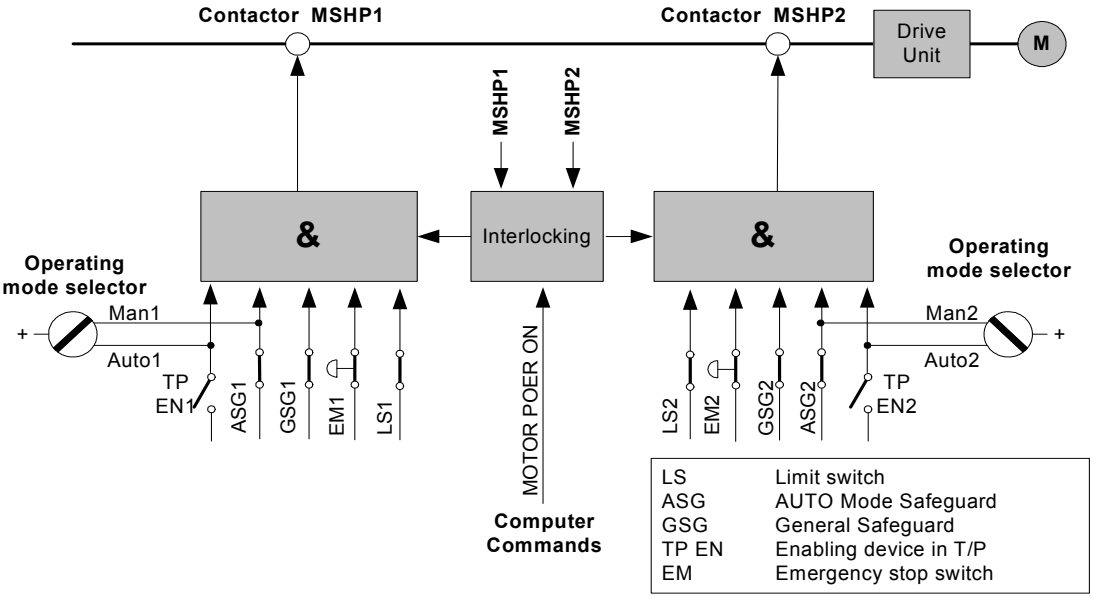


Fig 1.5 Robot's Safety Circuit

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 MOTORS 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 MOTORS ON mode are operated inteactively. In order to be in MOTORS ON mode, the safety circuit consisted of several swtiches must be all connected. MOTORS ON mode indicates that drive power is supplied to the motors. If one of the contactors is disconnected, the robot will always return to MOTORS OFF mode.

MOTORS 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, 『Hi4/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, 『Hi4/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.

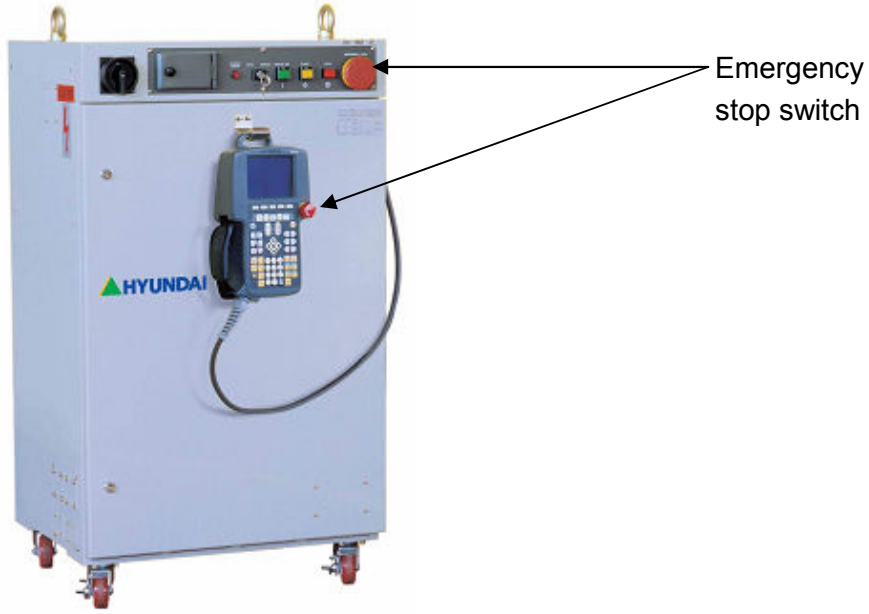


Fig 1.6 Emergency Stop

(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

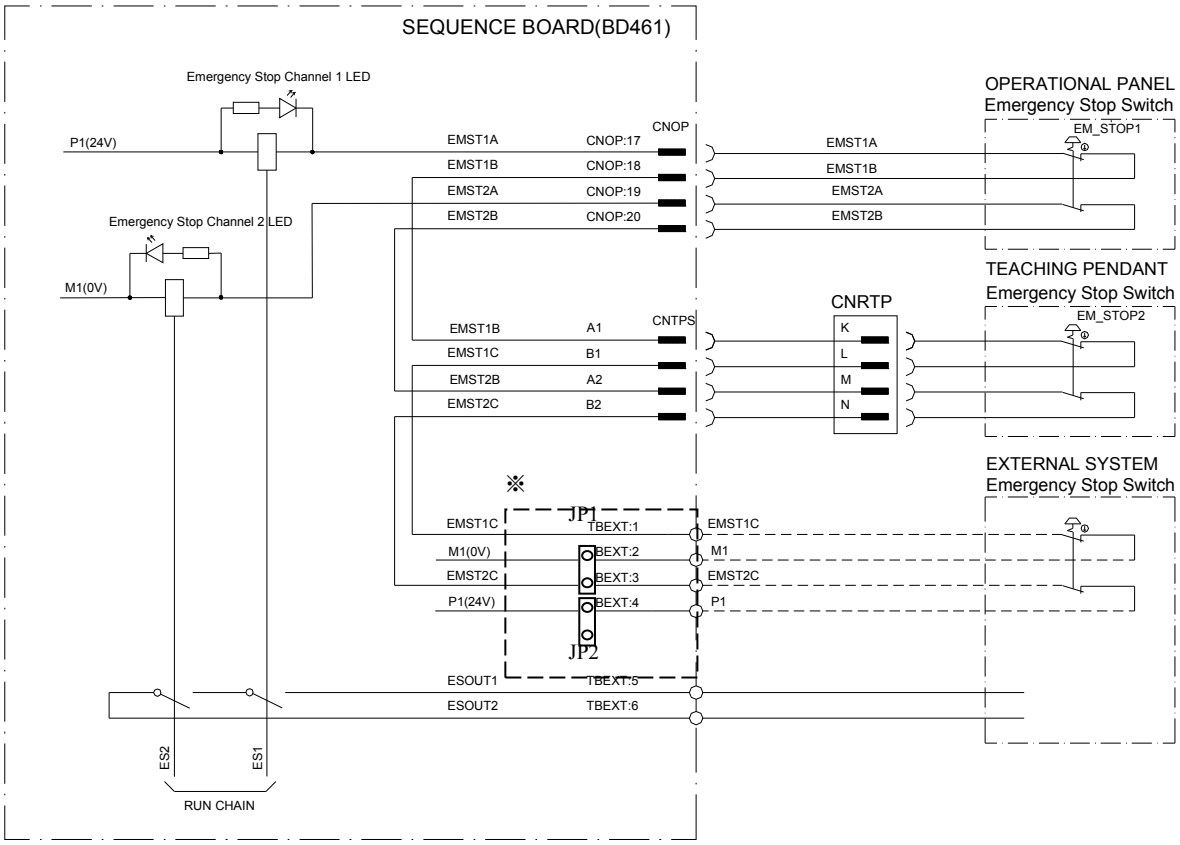


Fig 1.7 Emergency Stop Connection of External System

※ 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 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 safeguared 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 rotbot.

1.10.6. Monitoring Function

(1) Motor monitoring function

Motors are protected against overload by means of onboard sensors.

(2) Volatge 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) Grippers 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 valid 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.

2. Specifications

2.1. Specifications

Table 2-1 Controller Specifications

Model / Specifications	Hi4-0010(Hi4-A010) Hi4-0018(Hi4-A018)	Hi4-0002	Hi4-0000-CP
CPU	32 Beat RISC		
Program Excution Mode	Teaching & Play Back		
Operation Mode	Menu-driven		
Interpolation Type	Linear, Circular Arc		
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 (160Points 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%		

Model / Specifications		Hi4-0010(Hi4-A010) Hi4-0018(Hi4-A018)	Hi4-0002	Hi4-0000-CP
Maximum Voltage Consumption		7KVA	4.5KVA	
Dimension (WxHxD)		675x1158x615(mm)		580x1000x460(mm)
Weight		205Kg(except for transformer)		135Kg(except for transformer)
Protection Grade		IP54		
Operating Temperature		0~45℃		
Noise Level		Maximum 70dB		
Operating Humidity		75%		
Board	**CPU**	BD411		
	DSP(Servo)	BD440		
	Mother Board	BD400		
	Sequence	BD461		
	Input/Output	BD430 or BD431		
	Arc I/F	BD481		
Servo Amp	**Basic Axis**	HSXY6	HDAD6	
	Additional Axis	HSXY2	HDAD2	
Wire Harness		3 pieces	2 pieces	
Teach Pendant		TP300		
Cooling Fan		4 fans		6 fans
Air conditioner		Hi4-A010/A018		

3. Installation of Hi4 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 Hi4 Controller and Robot Manipulator

Basic component of robot manipulator and controller is as follows.

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

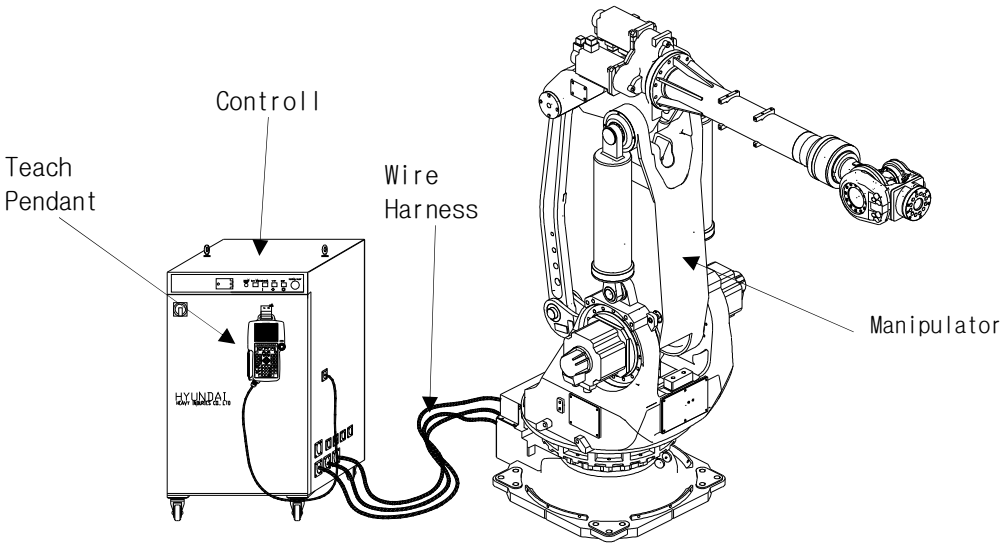


Fig 3.1 Basic Componenets of Manipulator and Controller

3.1.2. Confirmation of Serial Number

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

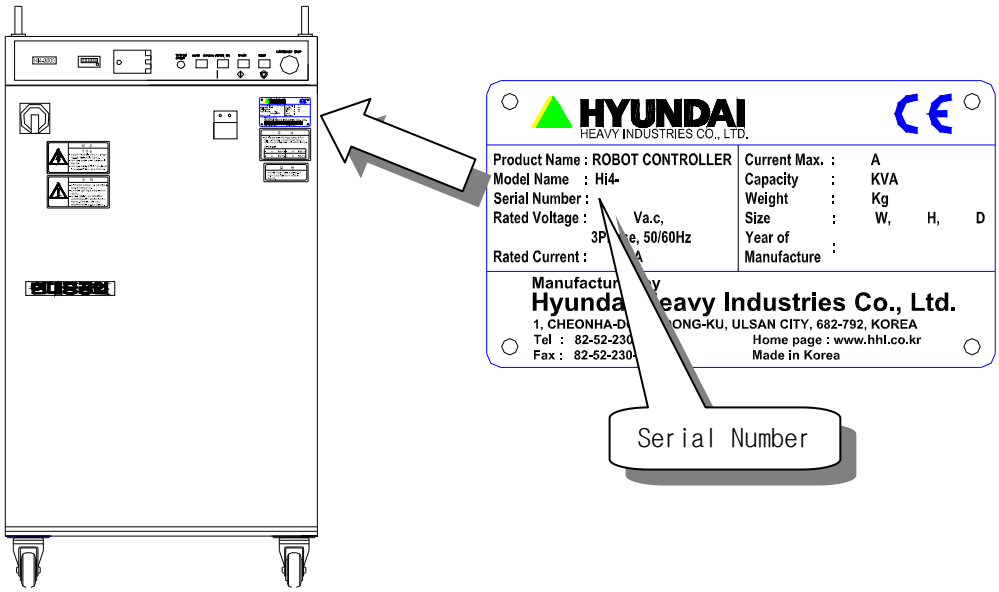


Fig 3.2 Location of Serial Number

3.1.3. Confirmation of Nameplates

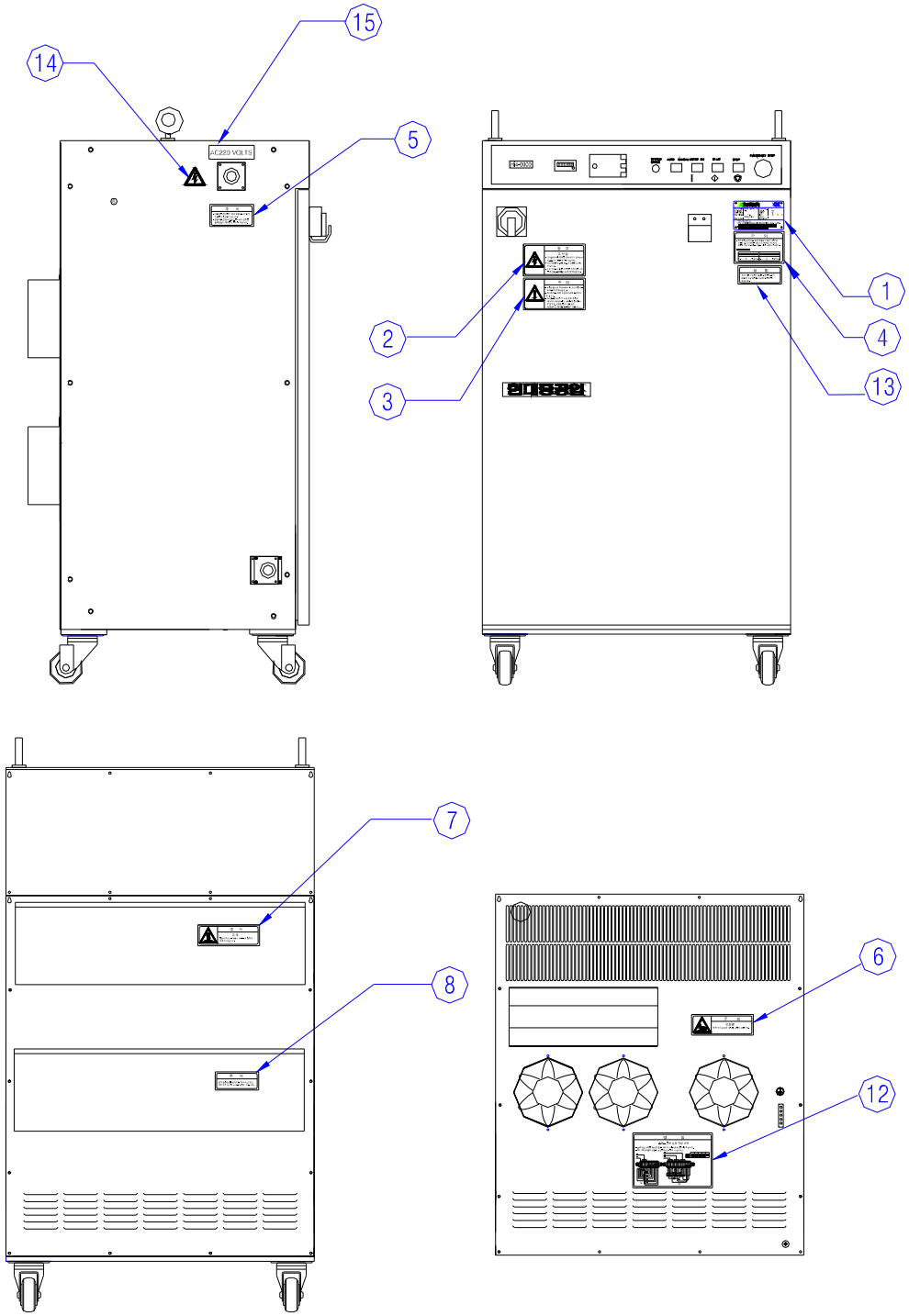


Fig 3.3 Location of Controller Nameplate 1

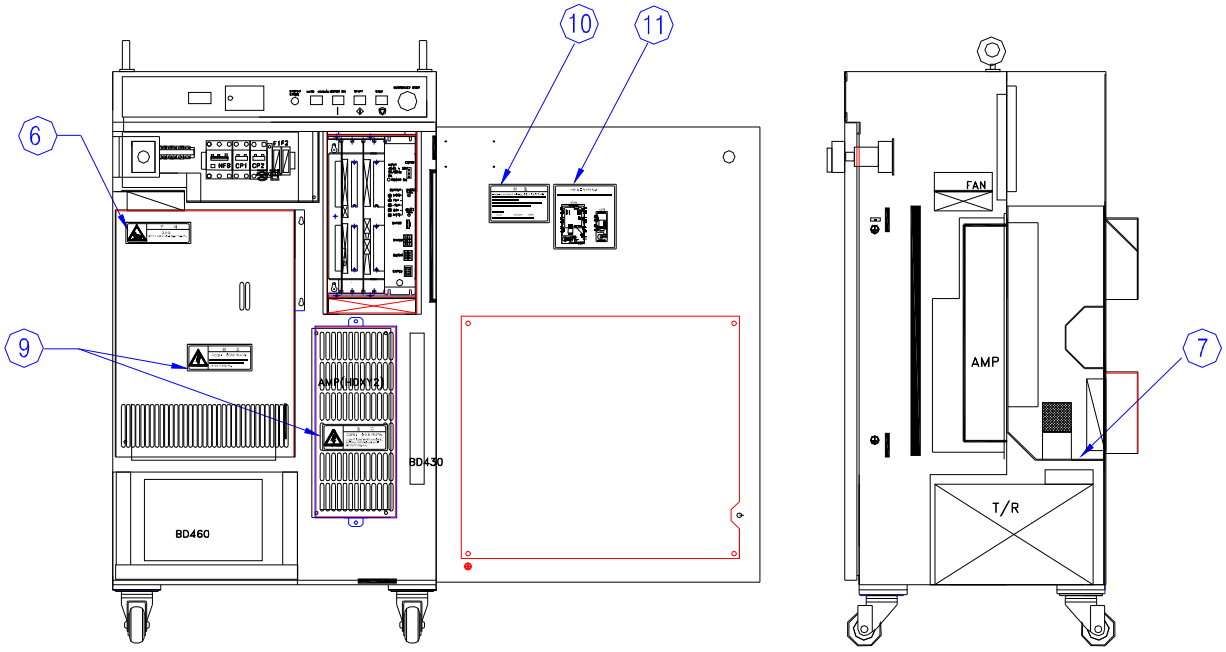
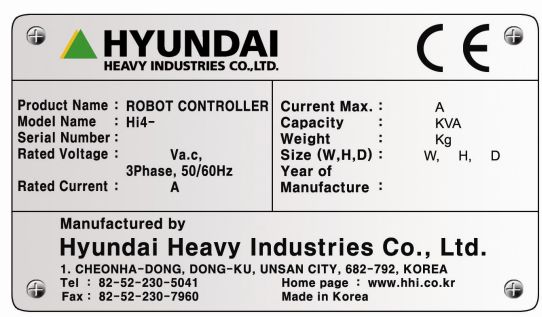
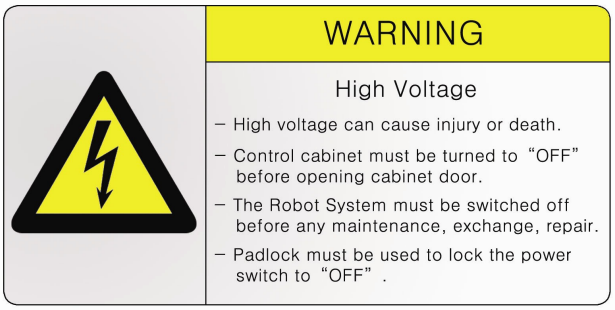


Fig 3.4 Location of Controller Nameplate 2

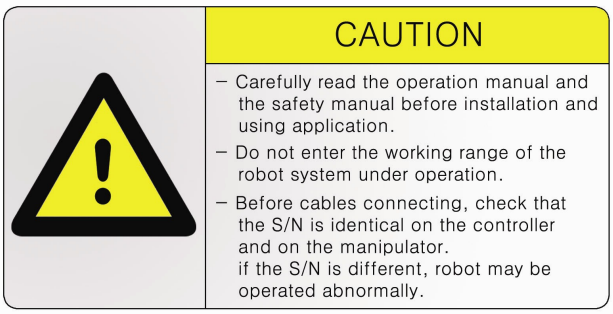
(1) Main Nameplate



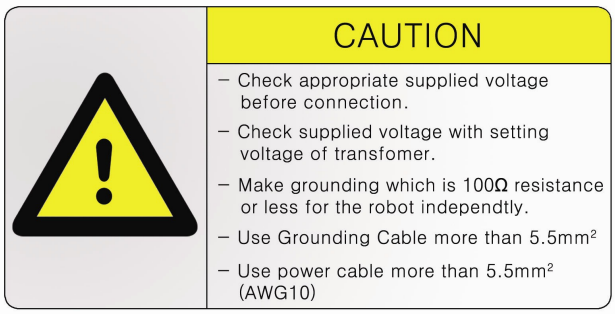
(2) High Voltage



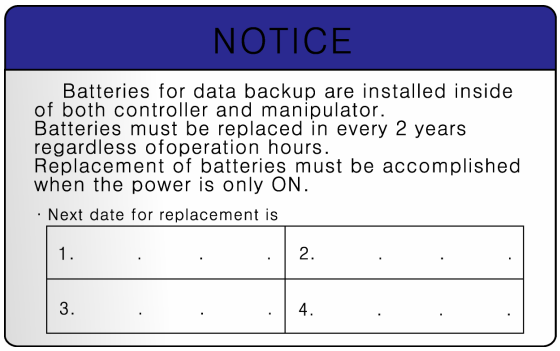
(3) Cautions for installation



(4) Power Supply

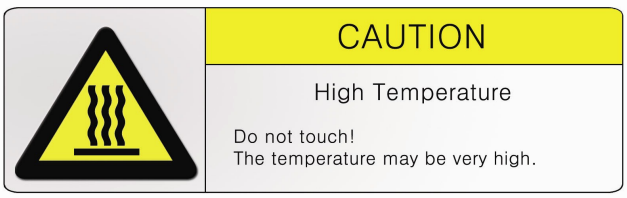


(5) Battery Replacement



(6) Caution for fan

(7) Caution for High Temperature



(8) Exhaust Pipe

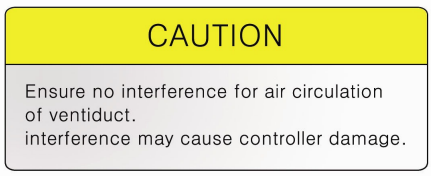
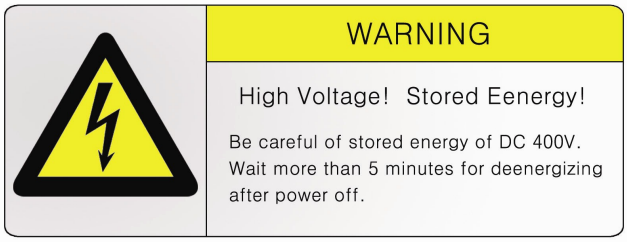
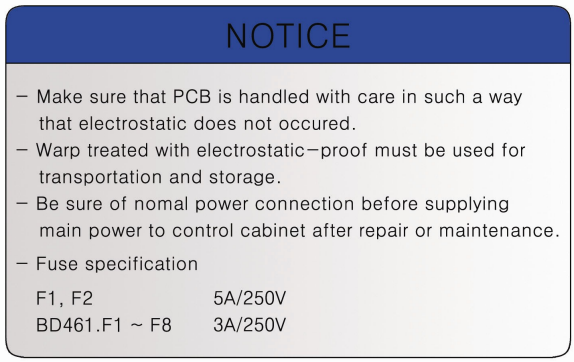


Fig 3.5 Contents of Controller Nameplate 1

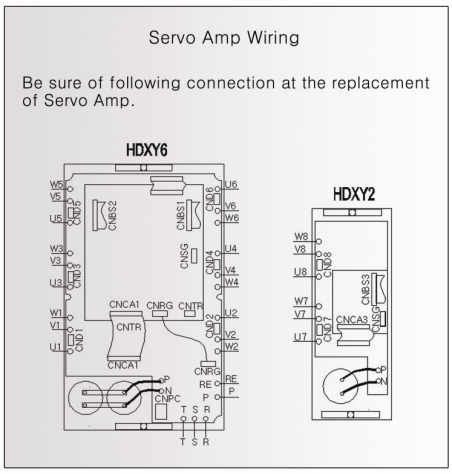
(9) Charged Energy



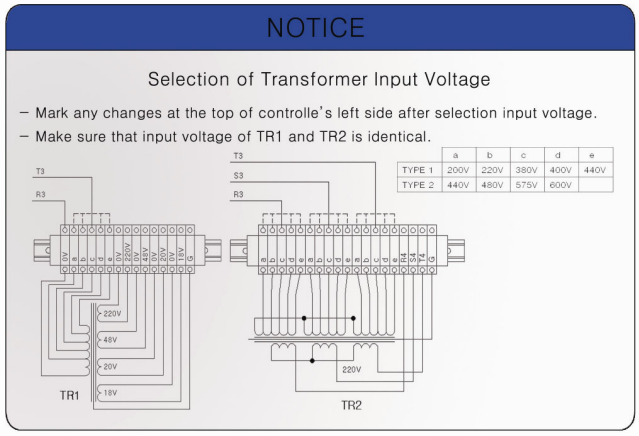
(10) Cautions for Board



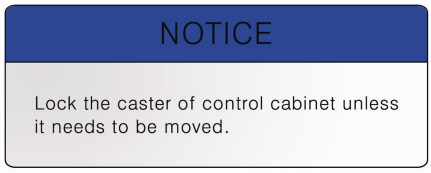
(11) Cautions for Servo Amp Wiring



(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 exposured connectors with dusk 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 paking
④ Attach the list of waterproof packing to the outer box.

3.3. Transportation of Hi4 Controller

Since Hi4 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 260Kgf. If using a crane, prevent wires from damaging objects on controller.
⑥ If using a forklift truck, secure the contoller to prevent shaking.
⑦ If using a vehicle, secure the manipulator and controller with a skid and so on.

3.4. Unpacking

Caution

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

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. Hi4 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 Hi4 Controller

Table 3-1 Weight of Hi4 Controller

Model	TR2(optional)	Weight	
		Kg	lb
Hi4-0000(Hi4-A010) **Hi4-0018(Hi4-A008)**	×	184	406
	○	252	556
Hi4-0002	×	184	406
	○	230	508
Hi4-0000-CP	×	119	263
	○	165	364

TR2 : Primary Power Transformer

Table 3-2 Weight of Hi4 Controller by Models

Model	Weight	
	Kg	lb
Hi4 Controller except for TR2 (Hi4-0000, Hi4-A010, Hi4-0008, Hi4-A0018, Hi4-0002)	184	406
Hi4 Controller except for TR2 (Hi4-0000-CP)	119	263
TR2 for Hi4 Controller (Hi4-0010, Hi4-A0010, Hi4-0018, Hi4-A010)	68	149

Model	Weight	
	Kg	lb
TR2 for Hi4 Controller (Hi4-0002, Hi4-0000-CP)	46	102
Teach Pendant(TP300), Cable (10m)	4	8
Wire harness for Hi4 Controller (5m, Hi4-0010, Hi4-A010, Hi4-0010, Hi4-0018, Hi4-A018)	15	32
Wire harness for Hi4 Controller (5m, Hi4-0002, Hi4-0000-CP)	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 Hi4 controller, crane wire with Eye Bolt should be used.
② Check if the wire is strong enough to hold Hi4 Controller.
③ Check if the eye bolt is securely fastened.

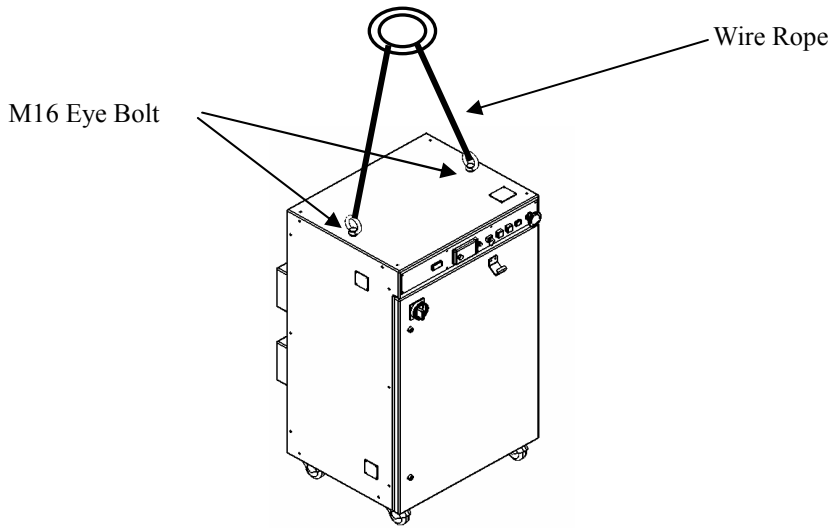


Fig 3.7 Transporation of Controller Using Crane

3.5.3. Transporation 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 Hi4 controller.
② Check if the eye bolt is securely fastened.
③ Transport the controller as low as possible.

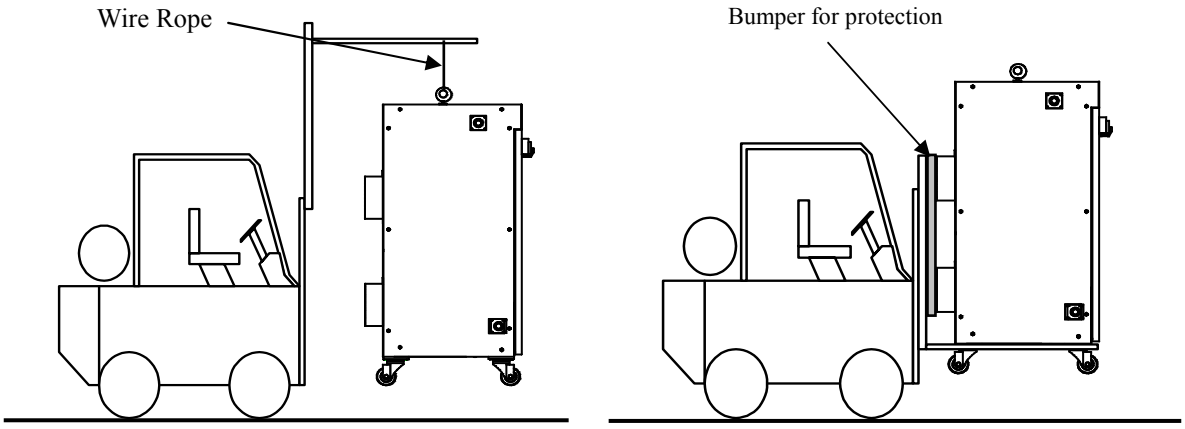


Fig 3.8 Transportation of Controller Using Forklift Truck

3.6. Space for Installation

Check the following instructions before installation.

① Secure the robot working envelope.

② Secure the space for mainetenance of robot manipulator and controller.

③ Check if the installing place has such environment as follows.

- Ambient Temperature ; 0°C ~ 45°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 Hi4 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.

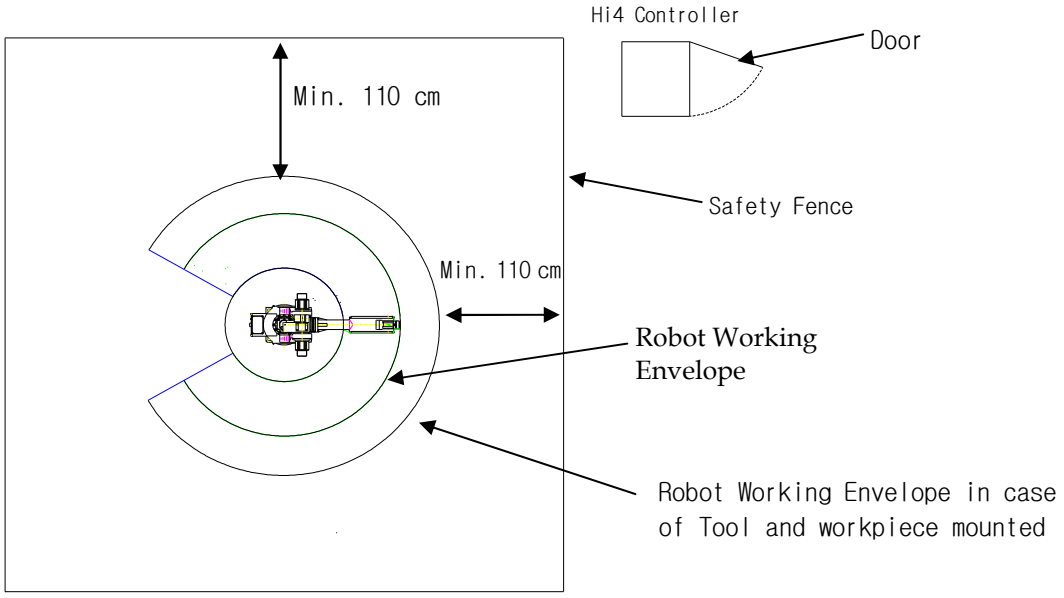


Fig 3.9 Installing Location of Robot and Controller

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

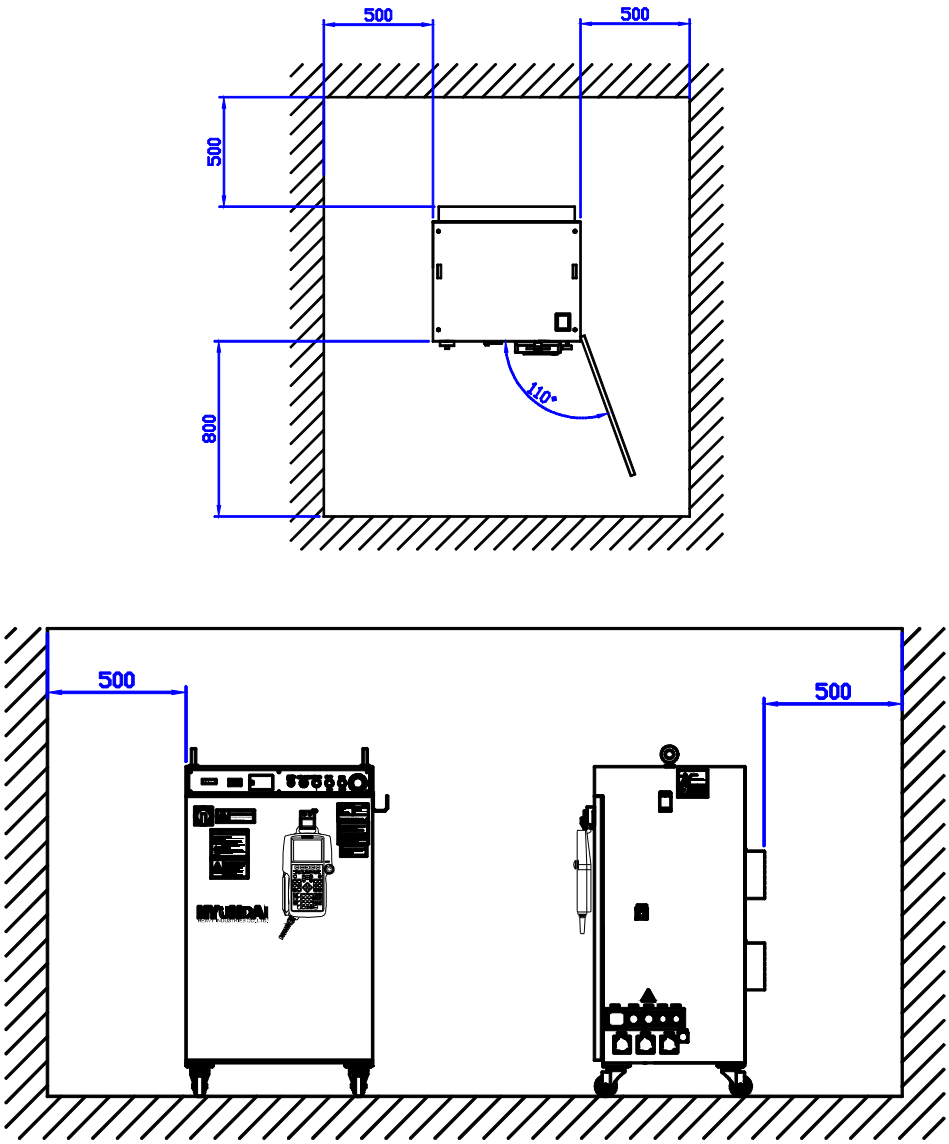


Fig 3.10 Distance from Near Walls

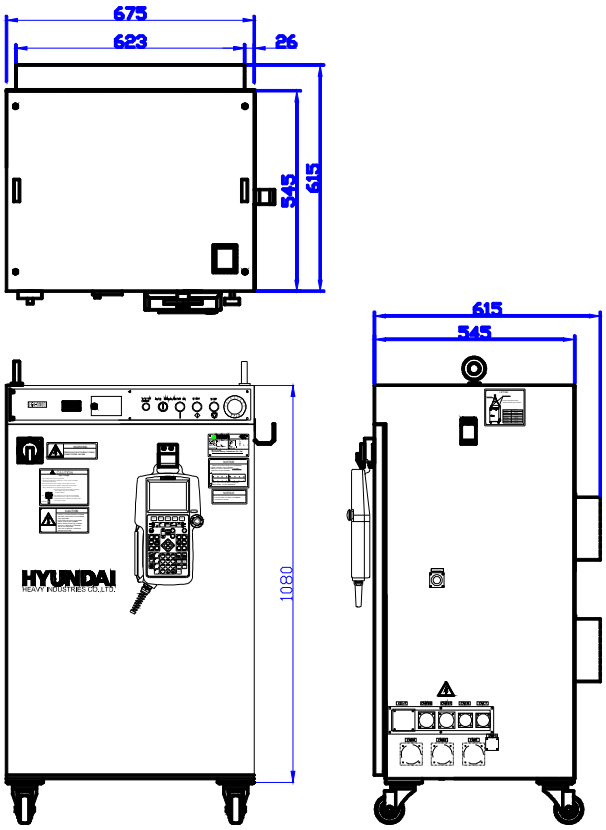


Fig 3.11 Dimension of Hi4 Controller (Unit:mm) Hi4-0010, Hi4-0018, Hi4-0002

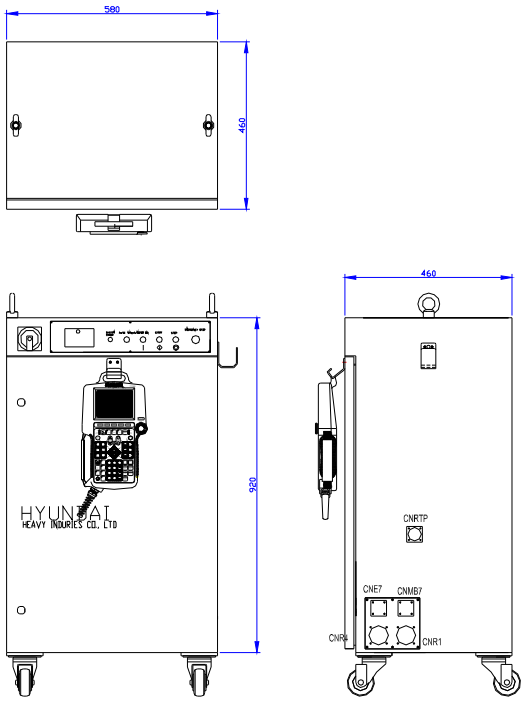


Fig 3.12 Dimension of Hi4 (Unit:mm) Hi4-0000-CP

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.

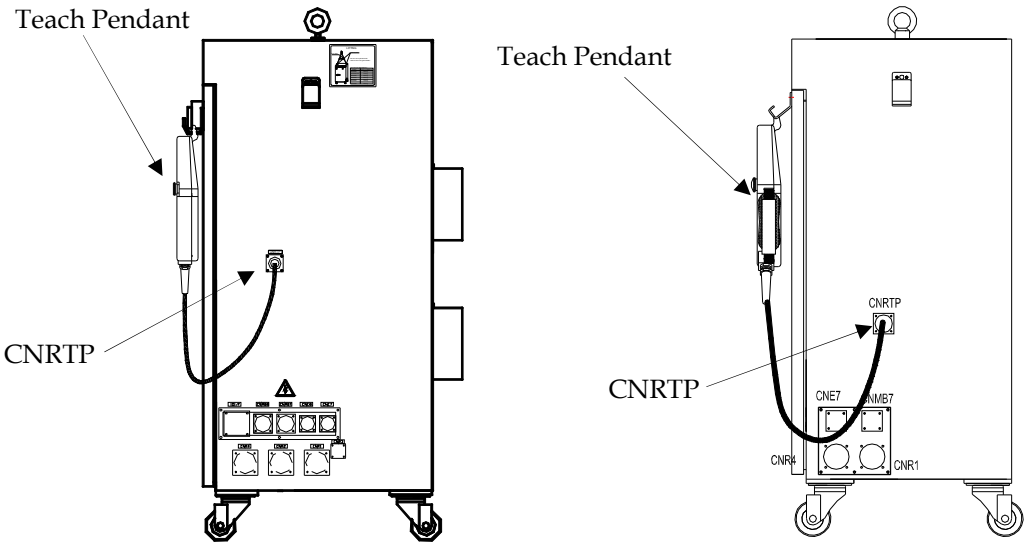
② There is charged energy of DC 400V in the controller. Be careful. Turn the power switch "OFF" to discharge the energy, and wait for 5 minutes at least

③ When handling PCB, be careful of any damages from static electricity.

④ Wiring and interconnecting should be perfomed by a qualified personnel.

3.7.1. Connetion of Teach Pendant

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



Hi4-0010, Hi4-A010,
Hi4-0018, Hi4-A018, Hi4-0002

Hi4-0000-CP

Fig 3.13 Connection of Teach Pendant

3.7.2. Connetion of Manipulator and Controller

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

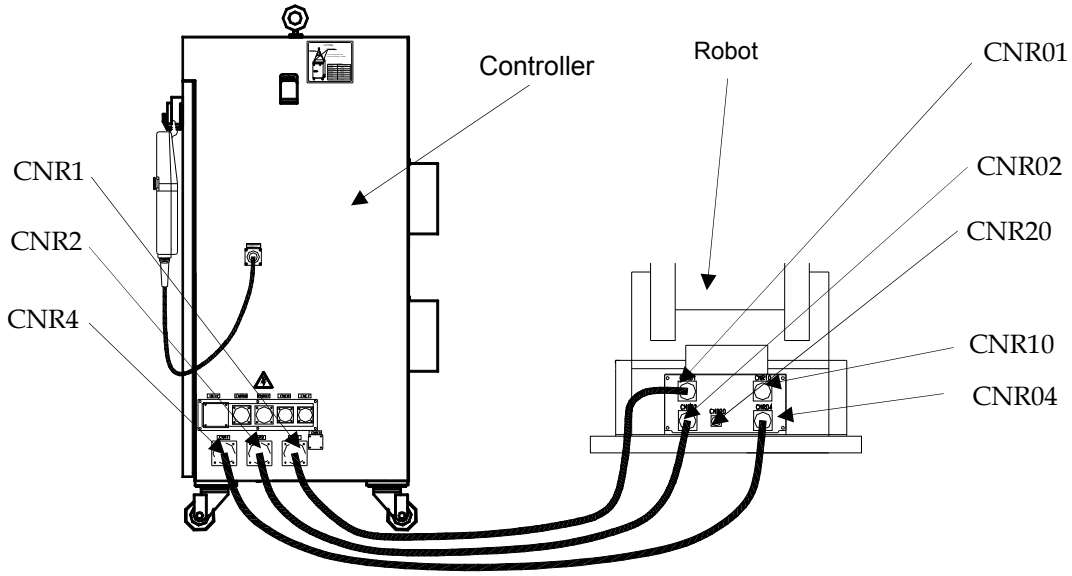


Fig 3.14 Connection of Robot Manipulator and Controller(Hi4-0010, Hi4-A010, Hi4-0018, Hi4-A018)

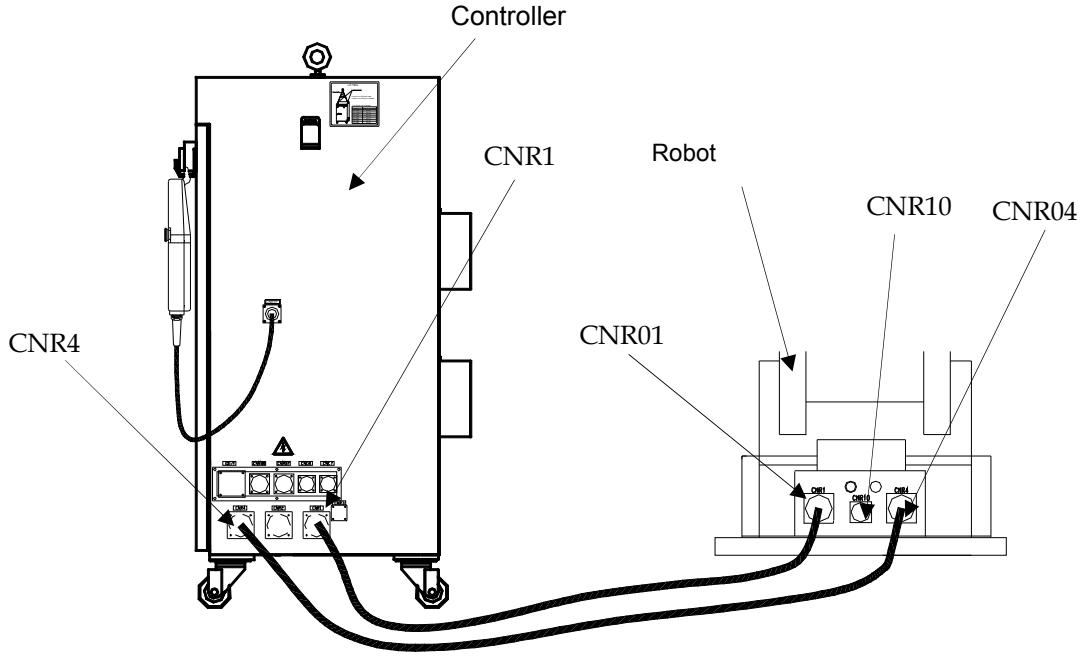


Fig 3.15 Connection of Robot Manipualtor and Controller (Hi4-0002)

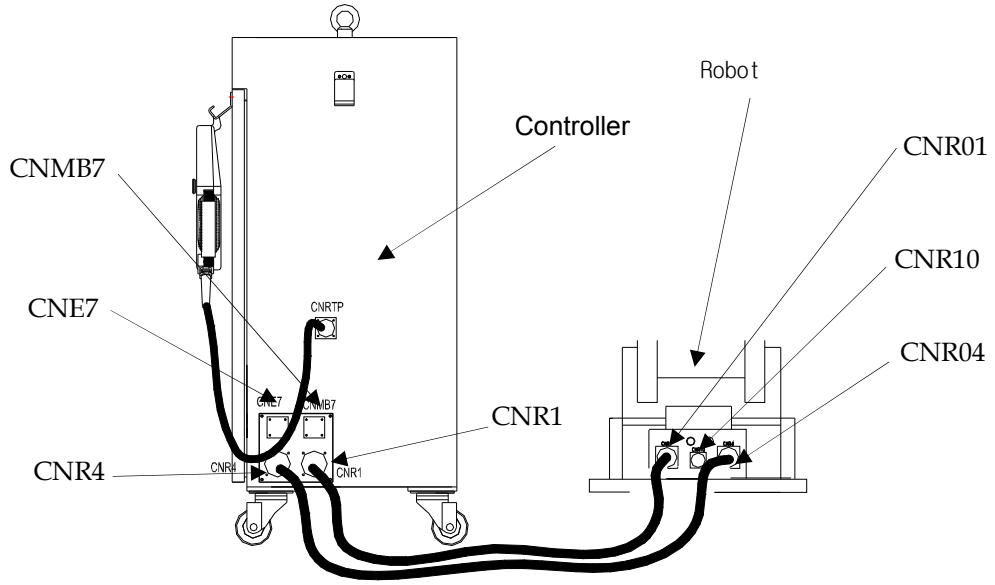
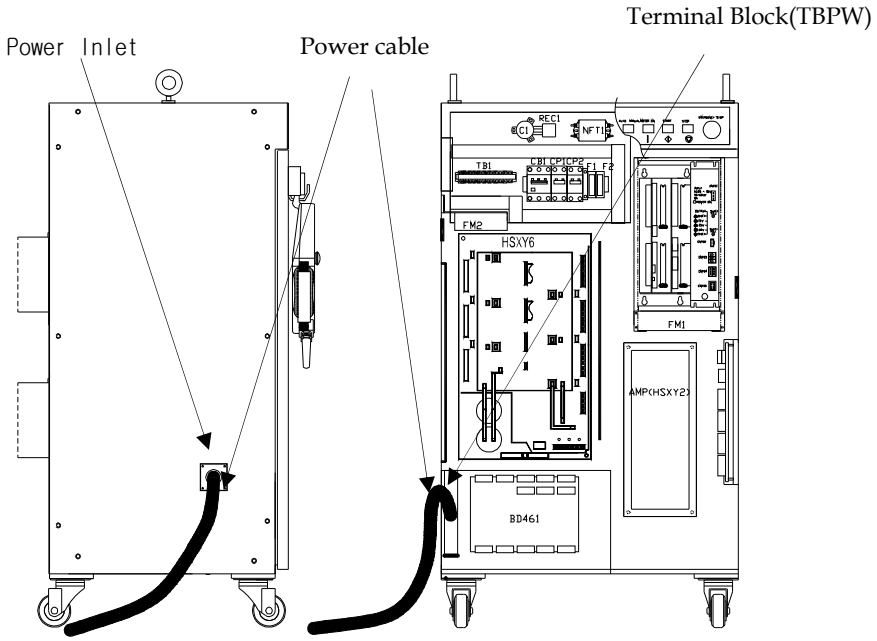


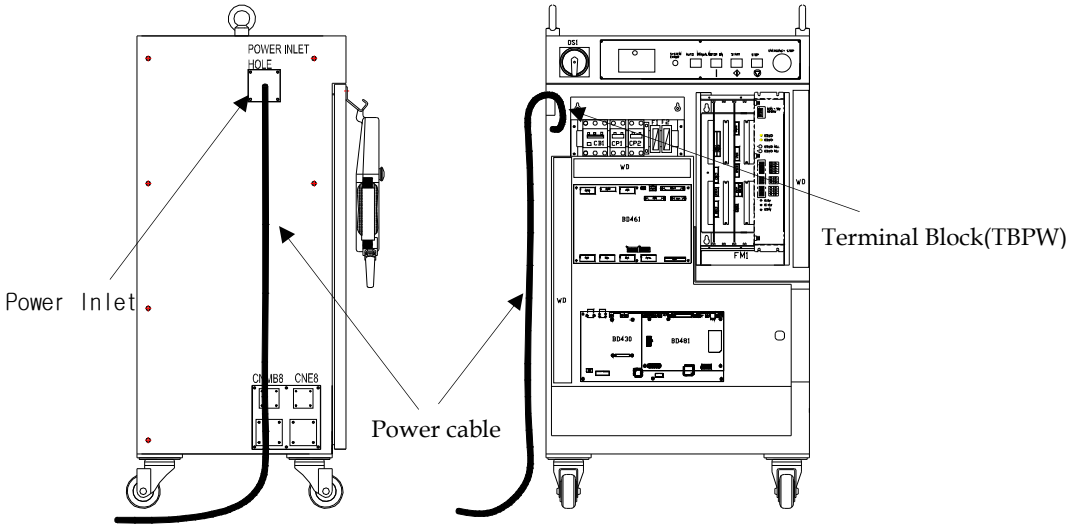
Fig 3.16 Connection of Robot Manipulator and Controller (Hi4-0000-CP)

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 bloc(TBPW).
Here, use a proper size of terminal for the tip of primary power cable.



Hi4-0010, Hi4-A010, Hi4-0018, Hi4-A018, Hi4-0002



Hi4-0000-CP

Fig 3.17 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	Hi4-0010, Hi4-A010 Hi4-0018, Hi4-A018	7.5	200/220/380/400/440	50/60	23
2	Hi4-0002, Hi4-0000-CP	4.5	200/220/380/400/440	50/60	18

Note 1) Voltage Range : ±10% (Hi4 Controller Power Terminal)

Note 2) Max. Current : Current Interruption of Circuit Portector

3.7.3.2. Thickness of Power Cables

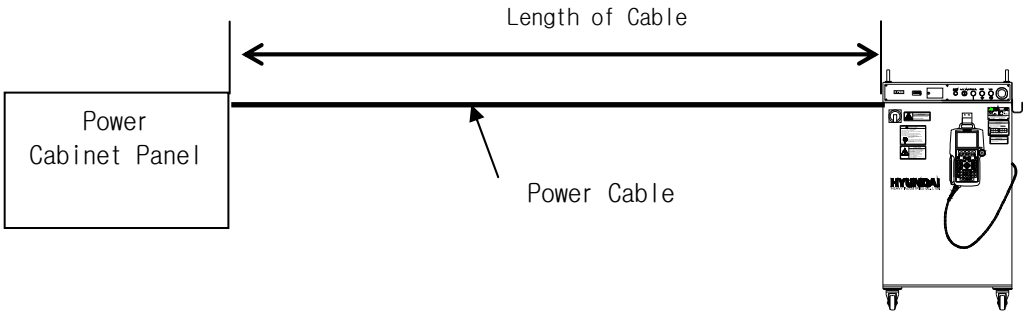


Table 3-4 Recommended Cable of Least Thickness

No.	Length of Cable m(feet)	Thickness of Cable (Hi4-0010, Hi4-0018, Hi4-A010, Hi4-A018)		Thickness of Cable (Hi4-0002, Hi4-0000-CP)	
		mm^2	AWG	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 grouding)

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.

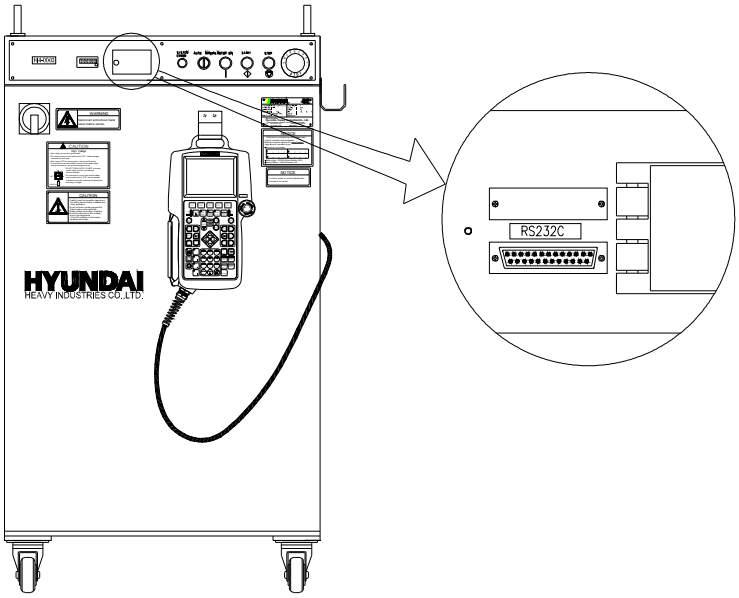


Fig. 3.18 RS232C Port Connection of Small Door Part

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

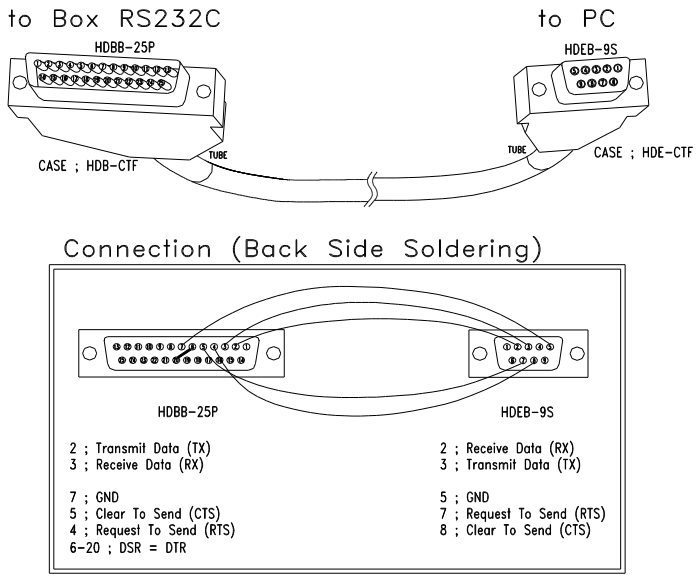


Fig. 3.19 Port Connection of PC and RS232C

4. Components of Hi4 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 Hi4 controller.

4.1. Parts Configuration of Hi4 Controller

Parts configuration of Hi4 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.

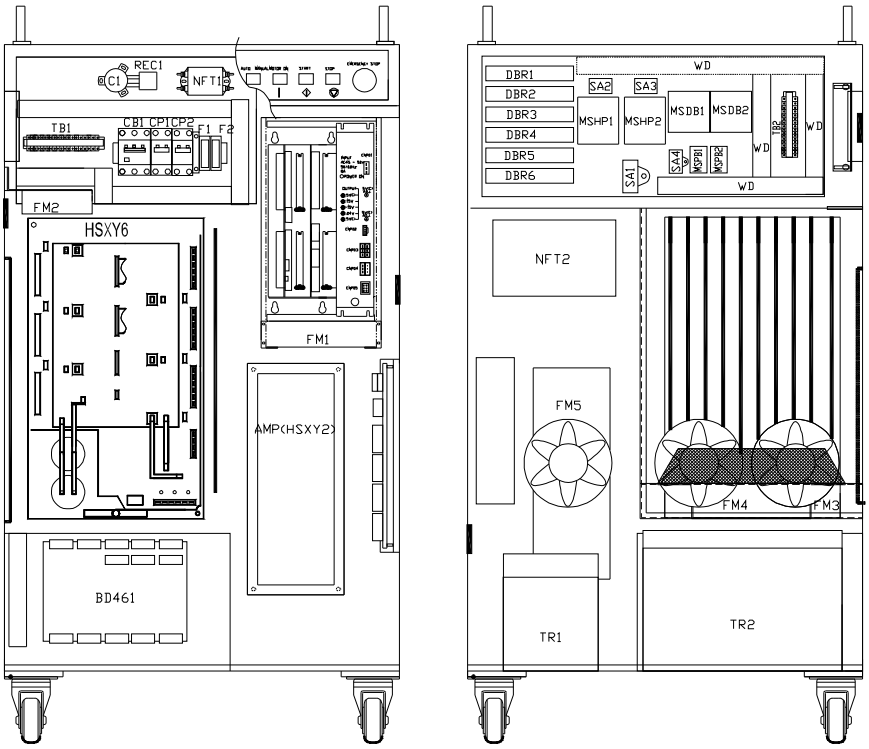


Fig. 4.1 Parts Configuration of Hi4-0010, Hi4-0018 Controller

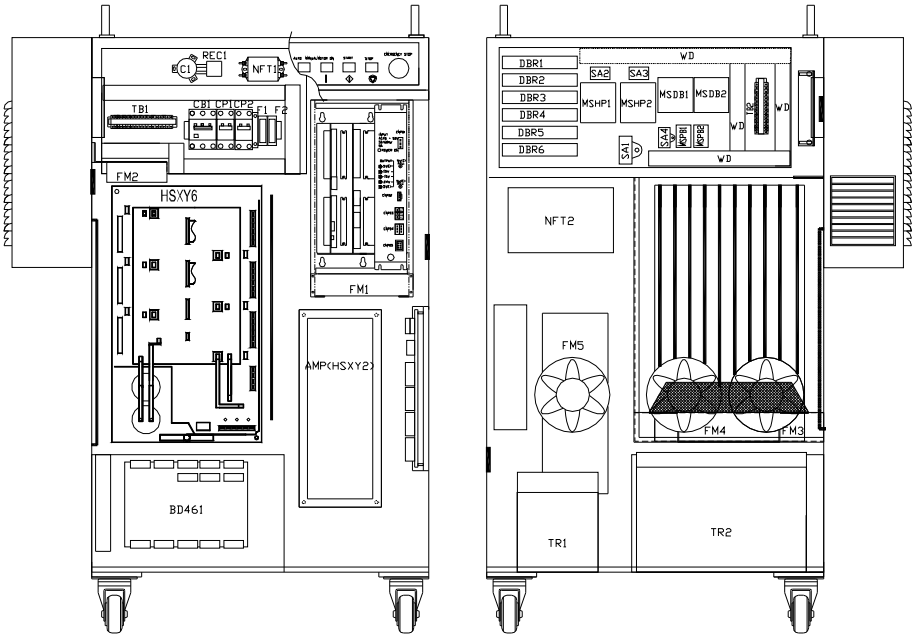


Fig. 4.2 Parts Configuration of Hi4-A010, Hi4-A018 Controller

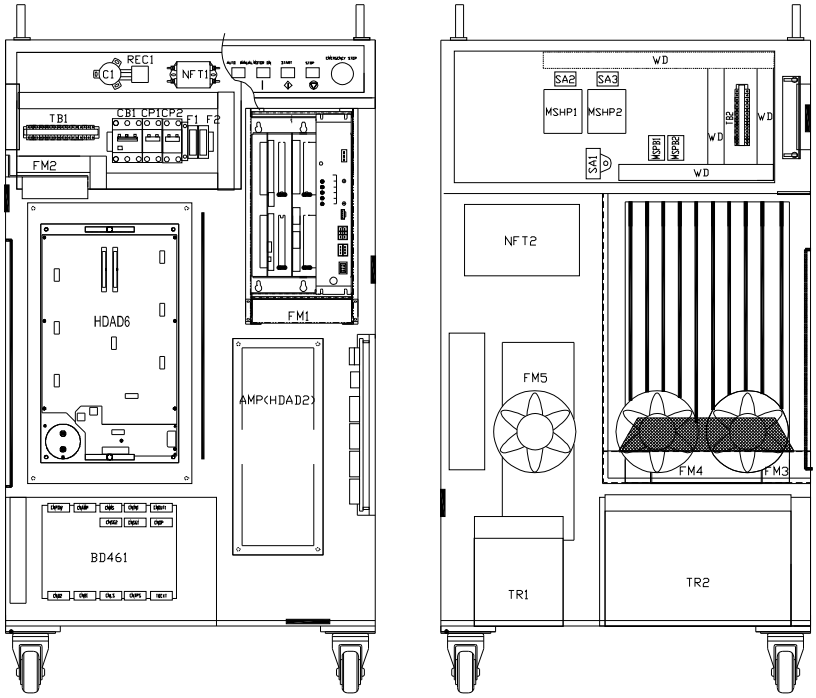


Fig. 4.3 Parts Configuration of Hi4-0002 Controller

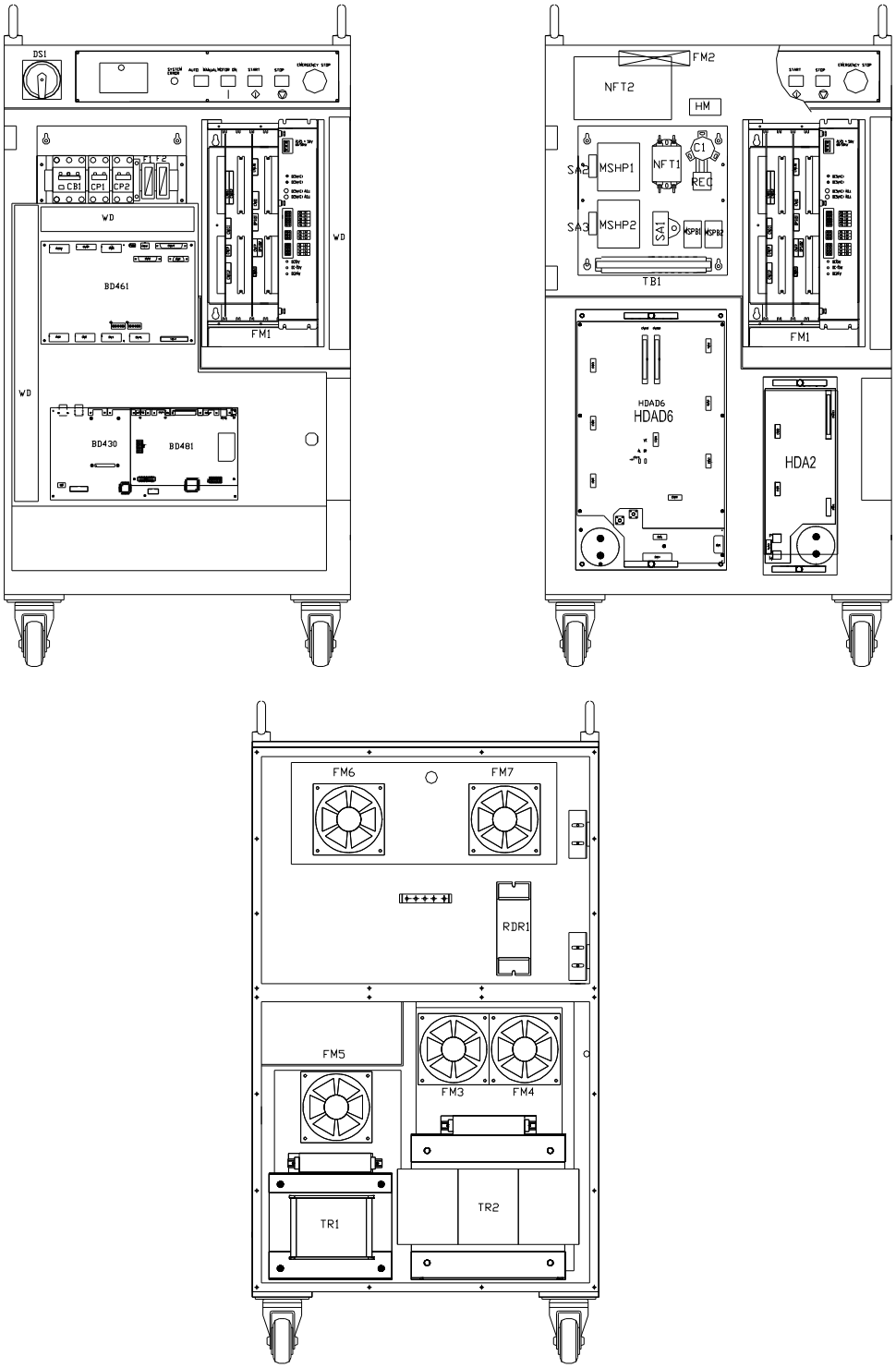


Fig. 4.4 Parts Configuration of Hi4-0000-CP Controller

Table 4-1 Parts Name of Hi4 Controller

No.	Type	Product Name
1	BD411	Main CPU Board
2	BD430	I/O Board
3	BD440	Servo Board
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)
		Mainboard	BD411	Recording a recorded point and calcauting a motion path
				Programming and preserving robot constant
				Communicating with Teach Pendant
				Connecting PC, PC Card and Serial Communication
		I/O Board	BD430/BD431	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	Sequence control within controller
				Processing Input Signals from manipulator
				Safety Circuit
		ARC Board	BD481 (Option)	ARC welder connection, conveyor sychronization, analogI/O

No.	Classifications			Functions
	Type	Name	Specifications	
2	Drive Unit	Servo Amp	Middle-sized 6-Axis : HSXY6 (BD457, BD457A, BD457B) Small-sized 6-Axis : HDAD6(BD453)	Generating power for motor drive unit
				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 Supply (DC+5V/8.29A)
				T/P, I/O Power Supply (DC+24V/1.87A)
				Drive Unit (DC+15V/3.5A, DC-15V/0.8A)
				Encoder Power Supply (DC+5V/4A)
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 tightely.

Mother board connects PCBs mounted on the back side of PCB RACK each other.

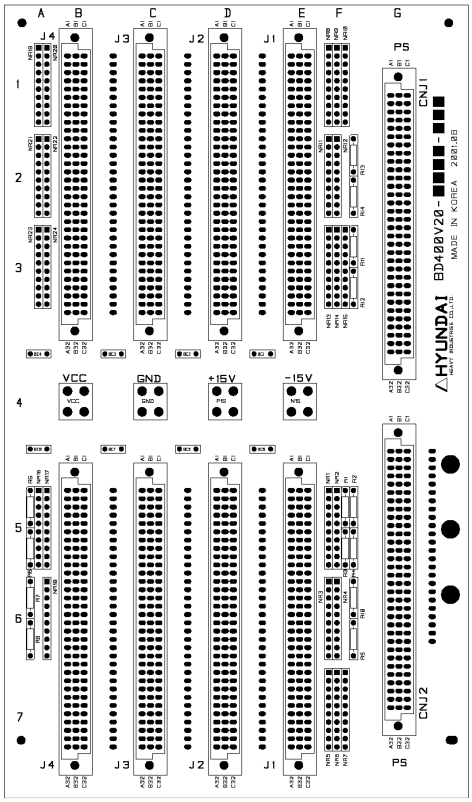


Fig. 4.5 Mother Board(BD400)

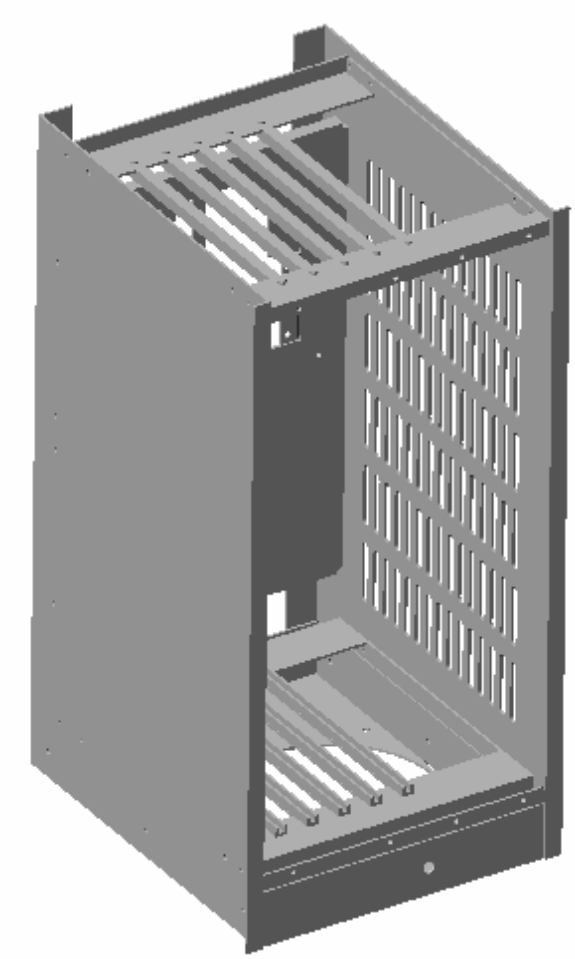


Fig. 4.6 RACK Exterior View

4.2.1.2. Mainboard (BD411)

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.

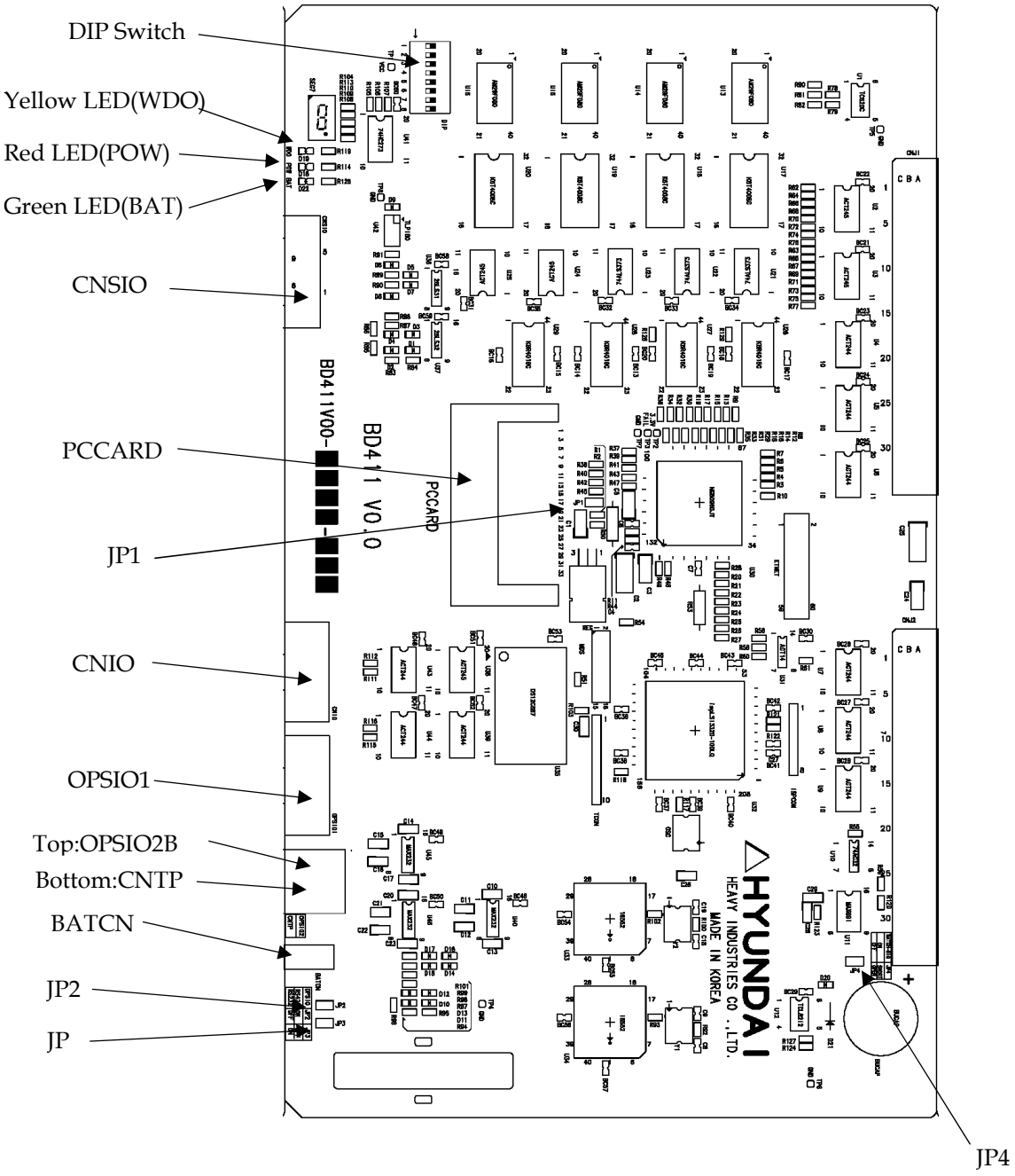


Fig. 4.7 Mainboard (BD411) Exterior View

Table 4-3 Descriptions of Mainboard(BD411) 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	Mainboard replacement - A/S request
POW	Red	Light on	Light out	Check the inserting condition in BD412 board Rack Check the volate between SMPS(SR1) P5⇔& G1(DC 5V)

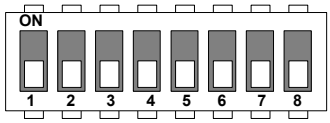
Table 4-4 Mainboard(BD411) Connector Descriptions

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
OPSIO1	Serial Port connection(RS232C); JP2,3 setting	RS232C Serial Interface (Optional)
OPSIO2	Serial Port connection(RS422C); JP2,3 setting	RS422C Serial Interface (Optional)
BATCN	DC power supply for Backup	Connection to battery for Backup

□ Standard Setting of Jumper & DIP Switch

☞ Caution : It may not changed by users except for DIP switch No. 1 & No. 8.

Table 4-5 Descriptions of Mainboard(BD411) DIP1 Switch

Shape									
No.		1	2	3	4	5	6	7	8
Setting Details	**OFF**	TP Screen in Korean	Unchangeable			Embedded PLC OFF	Unchangeable		FLASH ROM BOOTING
	ON	TP Screen in English				Embedded PLC ON			PC CARD BOOTING
Delivery Setting		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

☞ Caution

JP1 may not changed by users because it has been set when delivered from warehouse.

Table 4-6 Descriptions of Mainboard(BD411) Jumper

Jumper No.		**JP1**	**JP2**	**JP3**	**JP4**
Setting Details	**When using RS422(OPSIO2)**	Unchangeable	SHORT	OPEN	-
	When using RS232C(OPSIO1)		OPEN	SHORT	-
	Watch-dog enable		-	-	SHORT
	Watch-dog disable		-	-	OPEN
Delivery Setting		SHORT	OPEN	SHORT	SHORT

4.2.1.3. I/O Board (BD430)

- BD430(Basic type I/O board)
- BD431(Duplex output type I/O board)

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

4.2.1.3.1. BD430 board (NPN open collector type)

- Common (+) Digital(NPN OC type) Input 64 points (8 port)
- Common (+) Digital(NPN OC type) Output 64 points (8 port)
- Possible to install several other option boards
  - ① BD481 Board : Analog I/O, Conveyor pulse counter, Arc welder I/F
  - ② UCS Module
  - ③ CC-Link Module (include BD471 Board)
- IO Expansion : 192 points (24port)
- AC Voltage Detection
- RS-232C Communication (BD411(Mainboard) : 57600bps)

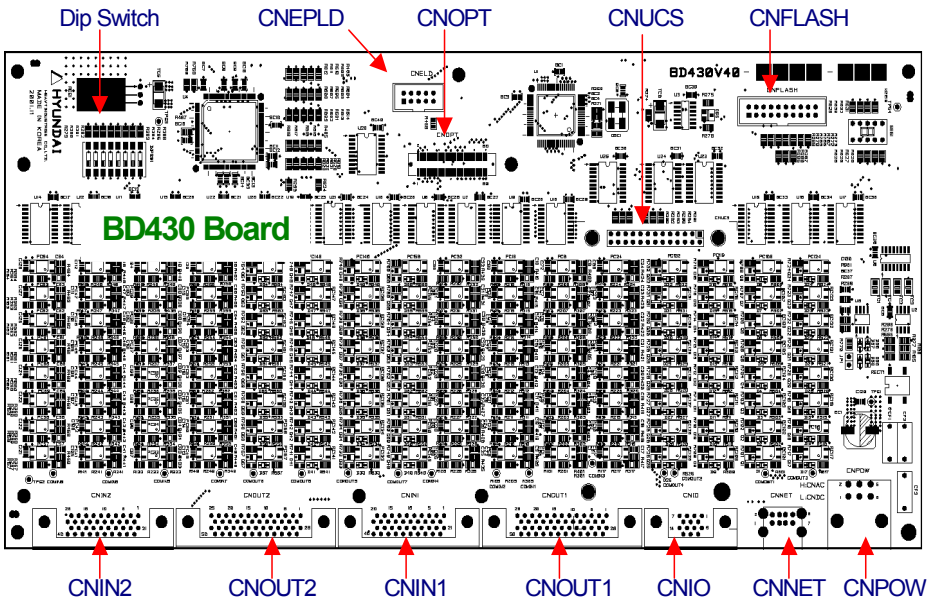


Fig. 4.8 BD430 Board Layout

4.2.1.3.2. BD431 board (NPN/PNP open collector type)

- Common (+) Digital Input 64 points (8 port)
- Common (+) or (-) Digital Output 64 points (8 port)
- Possible to install several other option boards
  - ① BD481 Board : Analog I/O, Conveyor pulse counter, Arc welder I/F
  - ② UCS Module
  - ③ CC-Link Module (include BD471 Board)
- IO Expansion : 192 points (24port)
- AC Voltage Detection
- RS-232C Communication (BD411(Mainboard) : 57600bps)

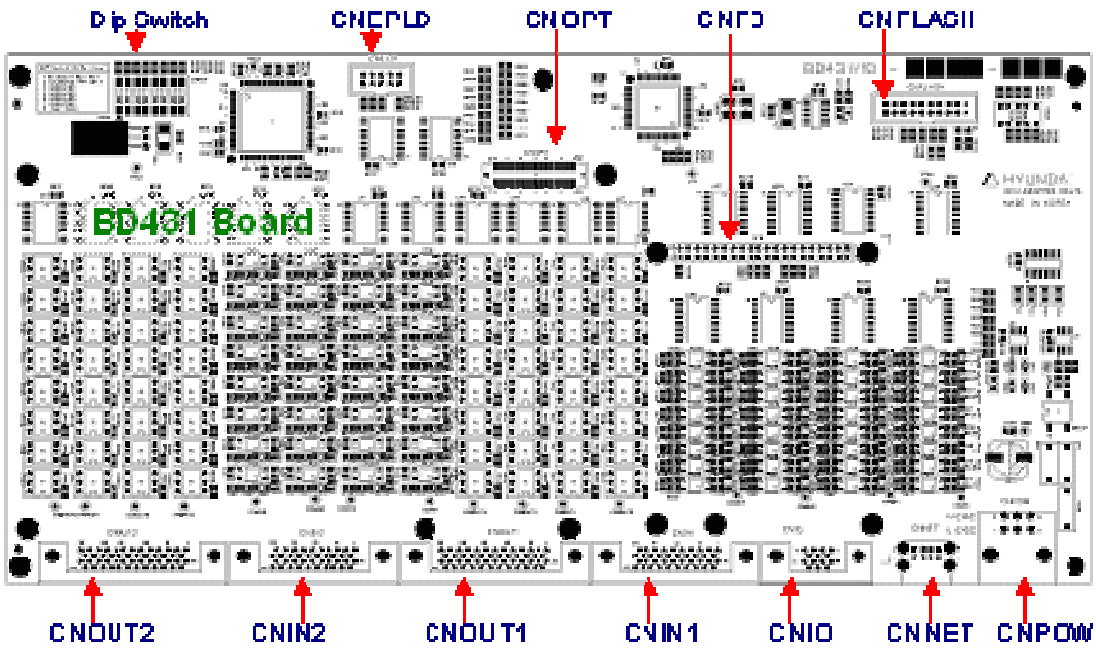


Fig. 4.9 BD431 Board Layout

4.2.1.3.3. Digital Input

Table 4-7 Pin Descriptions (CNIN1)

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
1	SDI01	General Input 1 / MOTON 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

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
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 4-8 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):
10	COMIN5	+24 V (for NPN type) / 0V (for PNP type) (for DI01~DI08)
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):
20	COMIN6	+24 V (for NPN type) / 0V (for PNP type) (for DI09~DI16)
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):

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
30	COMIN7	+24 V (for NPN type) / 0V (for PNP type) (for DI17~DI24)
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):
40	COMIN8	+24 V(for NPN type) / 0V (for PNP type) (for DI25~DI32)

- Connector Specifications

  Board(BD430/1) side : 3M MDR 10240-52A2JL

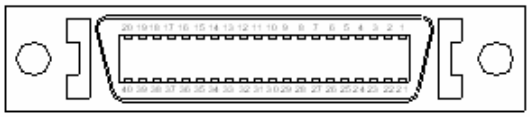


Fig. 4.10 Connector Specifications on Board side

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

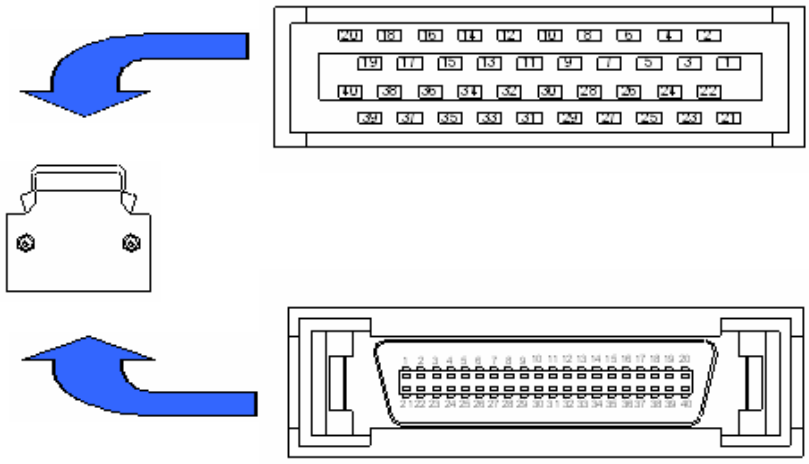


Fig. 4.11 Connector Specifications on Plug side

- Input Specifications

  Input Port Device : AC Input Type Porter Coupler

  Input Impedance = 3 kΩ

  Common(+) Input Volatge = 24VDC

  Common (-) Input Voltage = 0VDC

- Schematic Diagram

① If User System is NPN voltage output type :

User power +24V is used as common signal. (BD430 or BD431)

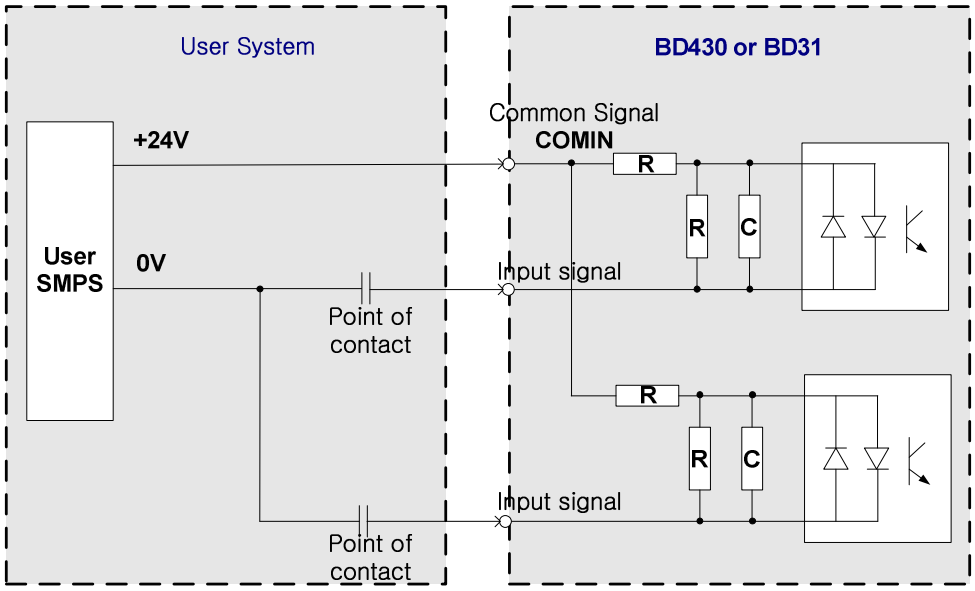


Fig. 4.12 Schematic Diagram(NPN voltage output type)

② If User System is PNP voltage output type:

User power 0V is used as common signal. (Only BD431)

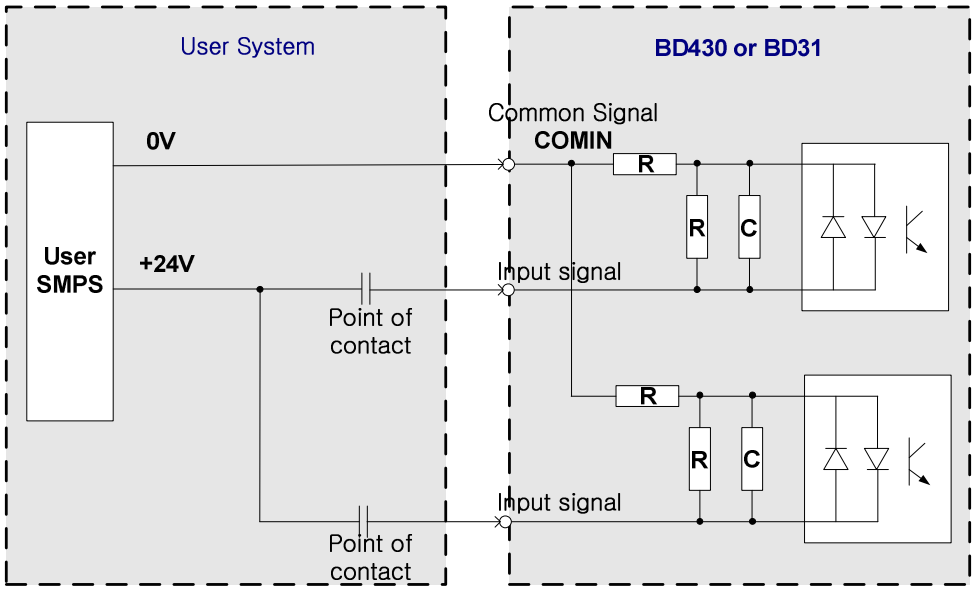


Fig. 4.13 Schematic Diagram(PNP voltage output type)

4.2.1.3.4. Digital Output

Table 4-9 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):
10	COMOUT1	0V (for NPN type) / +24V (for PNP type) (for SDO01~SDO08)
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):
20	COMOUT2	0V (for NPN type) / +24V (for PNP type) (for SDO09~SDO16)
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

Pin No.	Signals	Descriptions (Expanded Board / Basic Board)
28	N.C	Out of Use
29	N.C	Out of Use
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
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):
40	COMOUT3	0V (for NPN type) / +24V (for PNP type) (for SDO17~SDO24)
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):
50	COMOUT4	0V (for NPN type) / +24V (for PNP type) (for SDO25~SDO32)

Table 4-10 Pin Descriptions (CNOUT2)

Pin No.	Signals	Descriptions(Expanded Board / Basic Board)
1	DO01	General Input 1
2	DO02	General Input 2
3	DO03	General Input 3
4	DO04	General Input 4
5	DO05	General Input 5
6	DO06	General Input 6
7	DO07	General Input 7
8	DO08	General Input 8
9	COMOUT5	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNPtype) (for DO01~DO08)
10	COMOUT5	
11	DO09	General Input 9
12	DO10	General Input 10
13	DO11	General Input 11
14	DO12	General Input 12
15	DO13	General Input 13
16	DO14	General Input 14
17	DO15	General Input 15
18	DO16	General Input 16
19	COMOUT6	External Power Input (Power for Users): 0V (for NPN type) / +24V (for PNPtype) (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 Input 17

Pin No.	Signals	Descriptions(Expanded Board / Basic Board)
32	DO18	General Input 18
33	DO19	General Input 19
34	DO20	General Input 20
35	DO21	General Input 21
36	DO22	General Input 22
37	DO23/GUN1	General Input 23 / Gun Signal 1
38	DO24/GUN2	General Input 24 / Gun Signal 2
39	COMOUT7	External Power Input (Power for Users):
40	COMOUT7	0V (for NPN type) / +24V (for PNPtype) (for DO17~DO24)
41	DO25/MX	General Input 25 / MX Signal
42	DO26/Program_END	General Input 26 / Output for ending program
43	DO27/Interlock failure	General Input 27 / Output in occurrence of error in system
44	DO28/General failures	General Input 28 / Output in excess of input signal standby time
45	DO29/Operation-ON	General Input 29 / Output of operation-ON status
46	DO30/AUTO mode	General Input 30 / Output in AUTO mode
47	DO31/Robot Standby OK	General Input 31 / Output in completion of robot operation standby
48	DO32/Original position	General Input 32 / Output of original position status
49	COMOUT8	External Power Input (Power for Users):
50	COMOUT8	0V (for NPN type) / +24V (for PNPtype) (for DO25~DO32)

- Connector Specifications

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

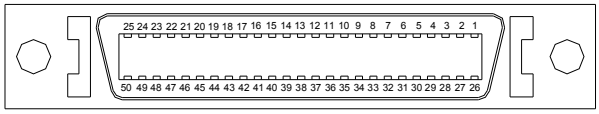


Fig. 4.14 Connector Specifications on Board side

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

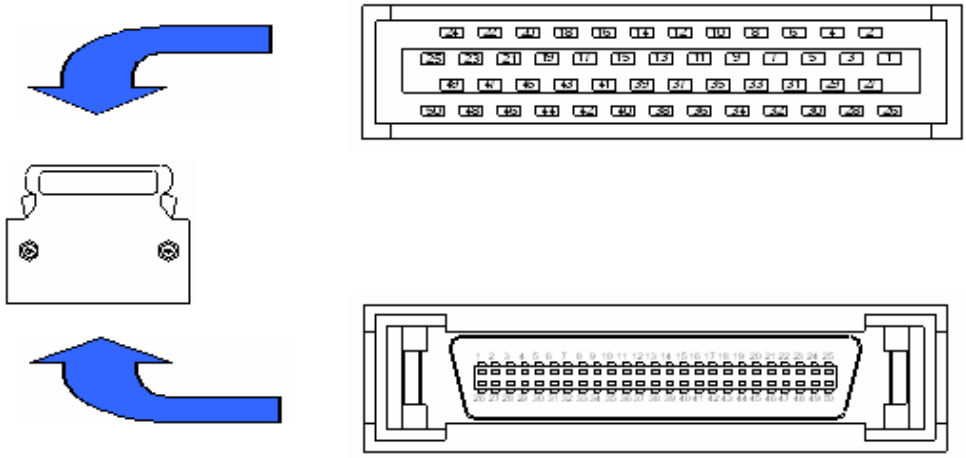


Fig. 4.15 Connector Specifications on Plug side

- Output Specifications

  * BD430

  Output Port Device : NPN Transistor open collector

  Rated Output = 125mA(Continuous load current), 24V DC

  Common (-) Input Voltage = 0V DC (NPN type)

  * BD431

  Output Port Device : MOS relay

  Rated Output = 125mA (Continuous load current), 24V DC

  Common (+) Input Voltage = 24V DC (NPN type)

  Common (-) Input Voltage = 0V DC (PNPtype)

- Schematic Diagram

① If User System is NPN voltage output type :

User power 0V is used as common signal.

BD430 board

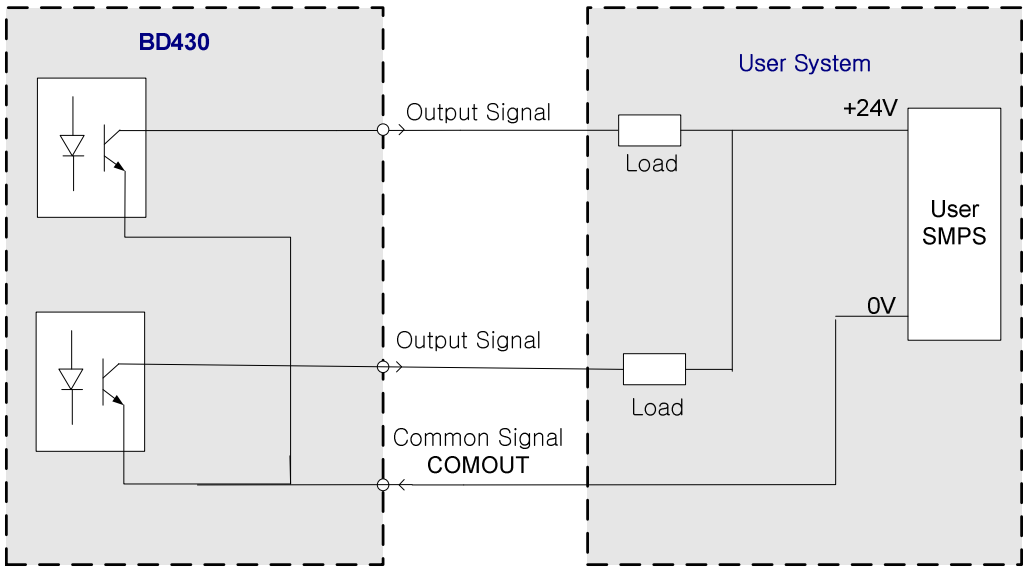


Fig. 4.16 BD430 Board Schematic Diagram(NPN voltage output type)

BD431 board

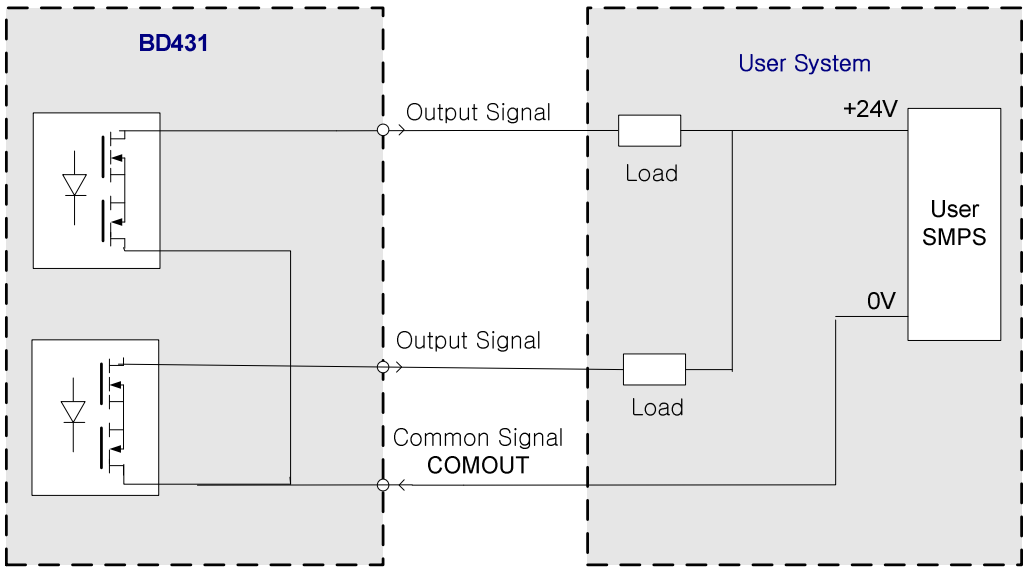


Fig. 4.17 BD431 Board Schematic Diagram(NPN voltage output type)

② If User System is PNP voltage output type:

User power 24V is used as common signal. (Only BD431)

BD431 board

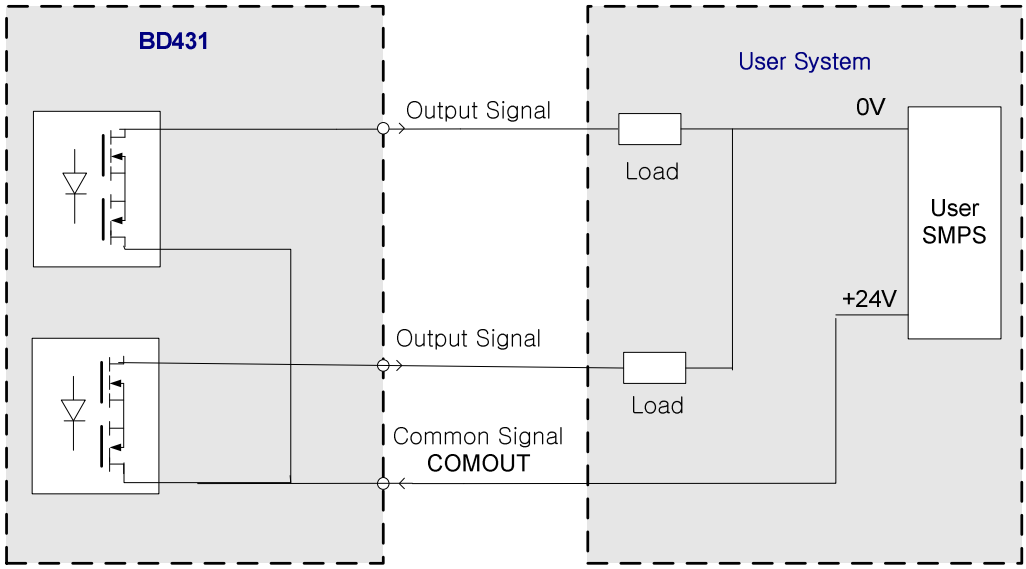


Fig. 4.18 BD430V50Board Schematic Diagram(PNP voltage output type)

4.2.1.3.5. Connector of BD430/BD431

Table 4-11 I/O Description of I/O board (BD430/BD431) connector

Name	Usage	Interface with external unit
CNIO	Data communication port with mainboard	BD411board 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 expansion of I/O board	Expansion 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

4.2.1.3.6. Description of DIP switch, jumper setting/LED

- **Setting of DIP switch**

☞ **Caution**

Followings cannot be changed by users at random and for expanding I/O board, contact our corporation.

Table 4-12 Description of I/O board (BD430) DIP switch

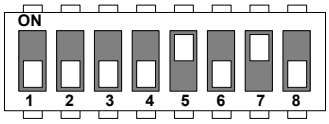
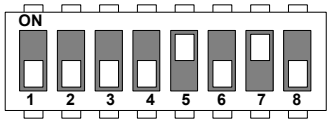
Shape									
Switch number		1	2	3	4	5	6	7	8
Settings Details	**OFF**	Number : 1 2 Basic board: OFF,OFF Expantion1 : ON ,OFF Expantion2 : OFF,ON Expantion3 : ON ,ON		BD481 disable	power failure detection enable	CPU error detection disable	Normal mode	38400bps	Normal mode
	ON			BD481 enable	power failure detection disable	CPU error detection enable	Download	57600bps	Test mode
Delivery Setting		OFF	OFF	OFF	OFF	ON	OFF	ON	OFF

Table 4-13 Description of I/O board (BD431) DIP switch

Shape									
Switch number		1	2	3	4	5	6	7	8
Settings Details	**OFF**	Number : 1 2 Basic board: OFF, OFF Expantion1 : ON, OFF Expantion2 : OFF, ON Expantion3 : ON , ON		Reserved	Reserved	Reserved	Reserved	Reserved	Normal mode
	ON			Reserved	Reserved	Reserved	Reserved	Reserved	Test mode
Delivery Setting		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

4.2.1.3.7. Installation BD430/431 board

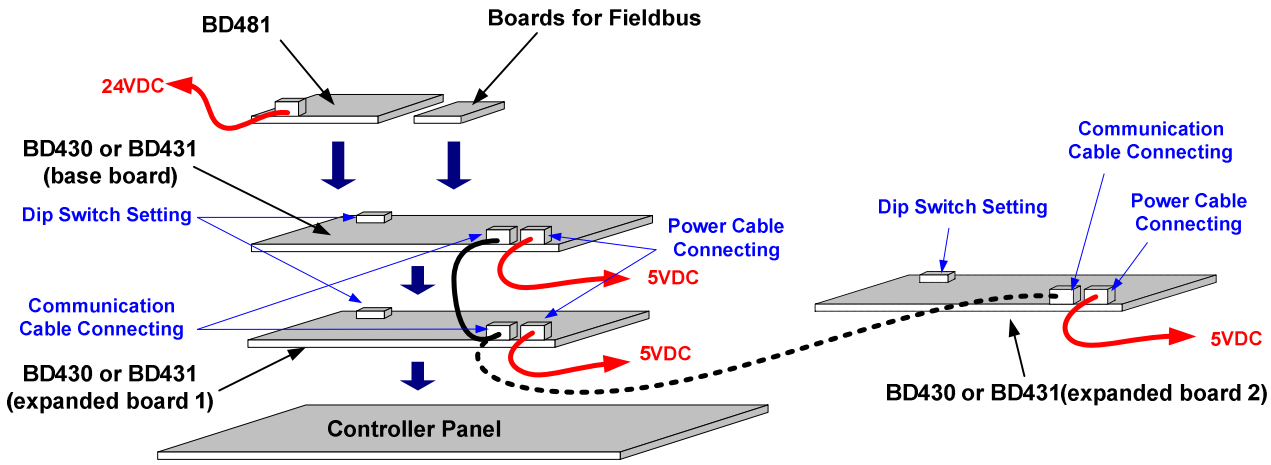


Fig. 4.19 Installation of BD430/BD431

■ BD430 Board

If using BD430 as an Expansion board,

① Dip switch No.4 of expansion board is on (power detection invalid), No.5 is off setup in the position of (CPU error detection invalid).

② Set up the Dip switch No.1, 2 of expansion board corresponding to the expansion board number.

③ Mount the base board and option board in sequence on the expansion board.

④ Connect the power cable and communication cable (RS485) as shown in the above figure.

⑤ Turn on power.

■ BD431 Board

If using BD431 as an Expansion board,

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.

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

④ Turn on power.

4.2.1.4. Servo Board (BD440)

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

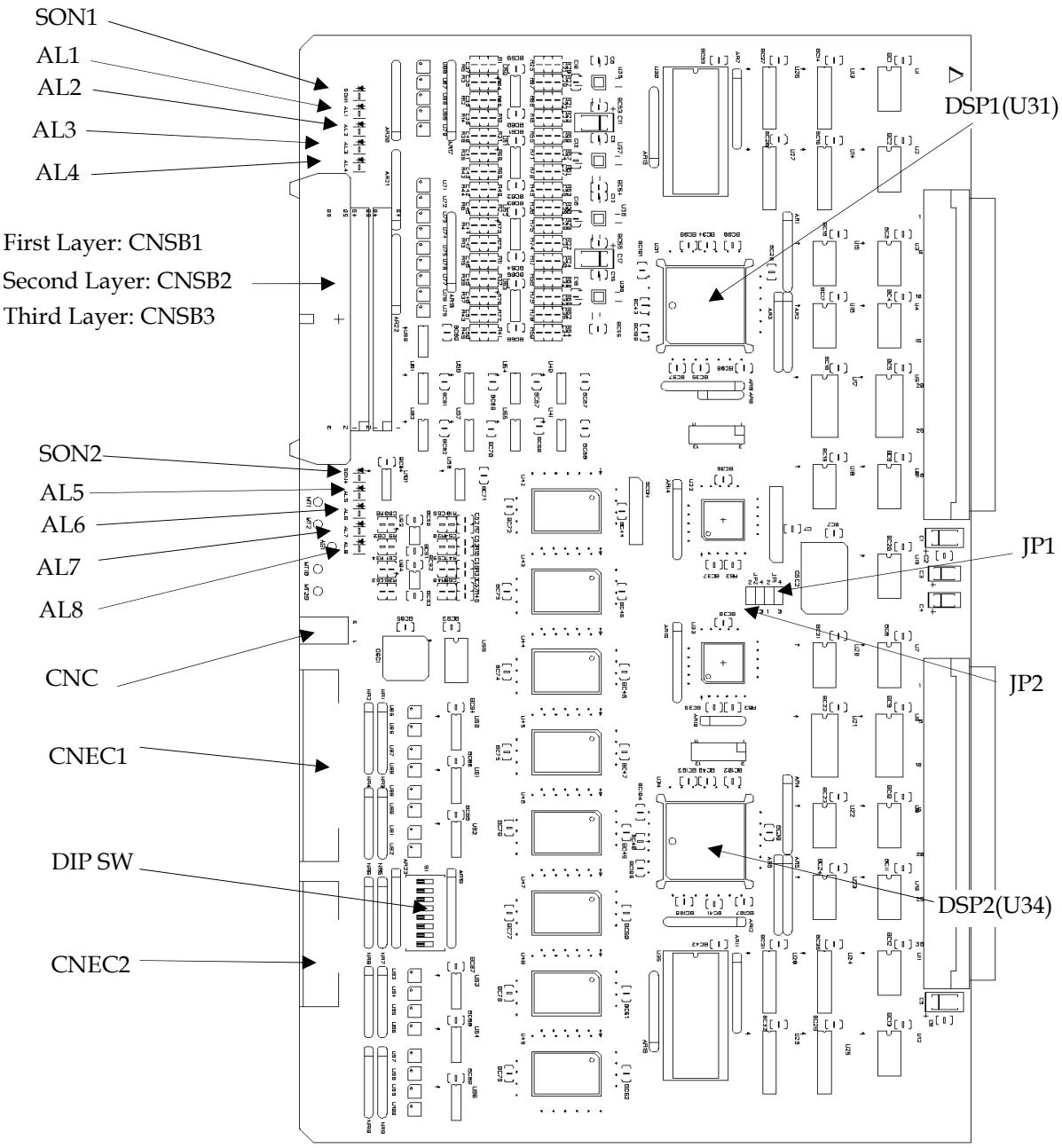


Fig. 4.20 Exterior View of BD440 Board

Table 4-14 Descriptions of Servo Board(BD440) 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 sychronization between servo boards when controlling more than 9 axes	Additional Servo Board (BD440) CNCK
CNISO	Downloading Port for the ispLSI program	Download tool for ispLSi program

Table 4-15 Servo Board(BD440) LED

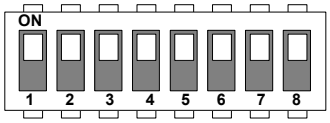
Status / Name	Color	Normal	Abnormal	Remarks
AL1~8	Red	Light Out	Light Up	ALX : Asix X (X=1~8)
SON1~2	Green	Light Up when motor is ON	Light Out when motor is OFF	SON1; 1st DSP, SON2; 2nd DSP

■ Standard Setting for Jumper & DIP Swtich

☞ Caution

Users cannot change the DIP Swtich arbitrarily because it has been set to ON when delievered from warehouse.

Table 4-16 Descriptions of Servo Board(BD440) 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 4-17 Descriptions of Servo Board(BD440) 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

4.2.1.5. Sequence Board (BD461)

It receives all kinds of signals from robot manipulator and controller, and the sequence in the controller as a hardware such as MSHP ON/OFF, MSPR ON/OFF, BRAKE RELEASE/HOLD by the Main order, maintaining a safety circuit.

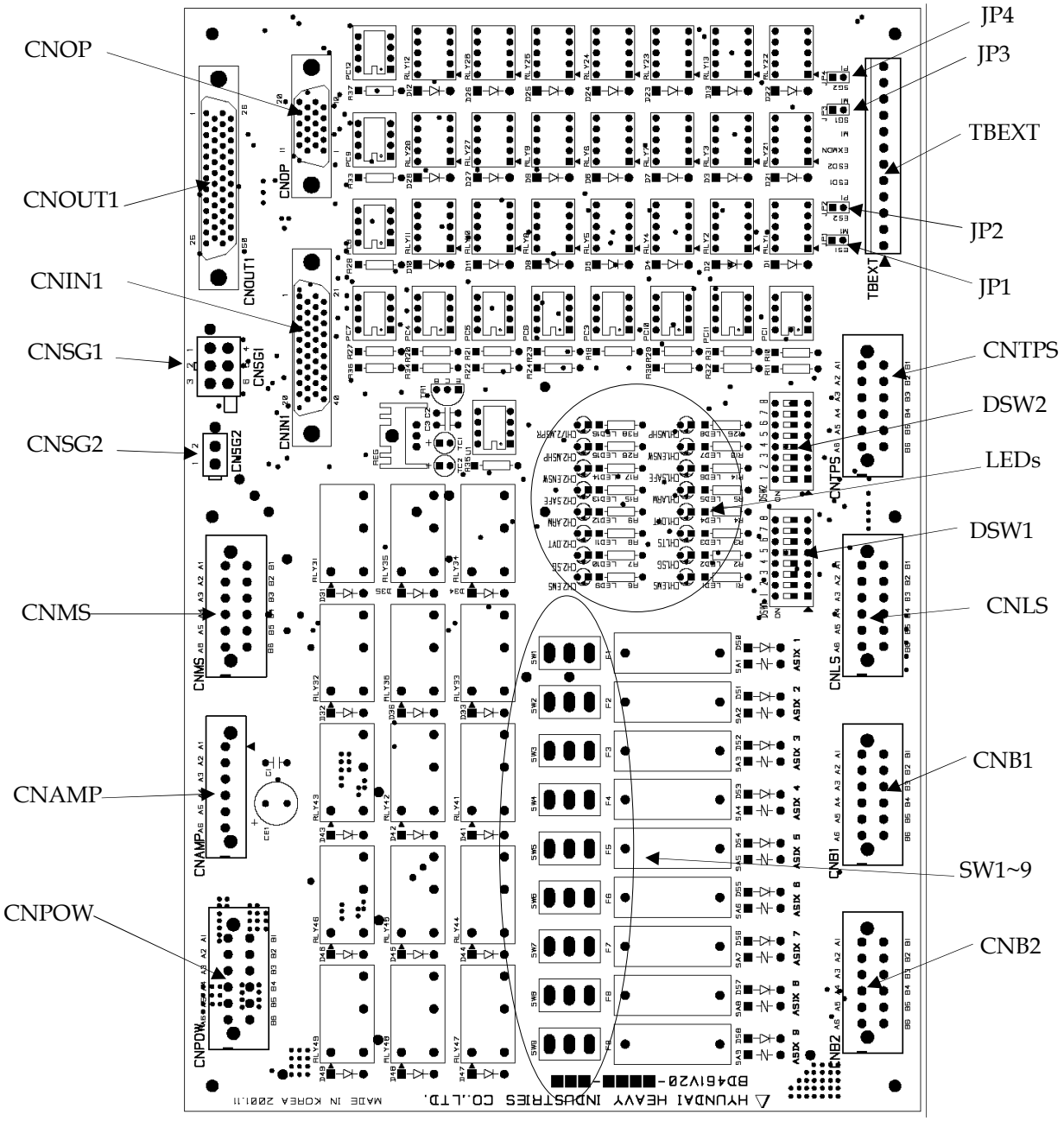


Fig. 4.21 Exterior View of Sequence Board(BD461)

Table 4-18 Descriptions of Sequence(BD461) 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 detect Arm interference & 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
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

Table 4-19 Descriptions of Sequence(BD461) Terminal Block

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	ESO1	Contact point of Emergency Stop output	For the use if it is necessary for external system
6	ESO2		
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)	

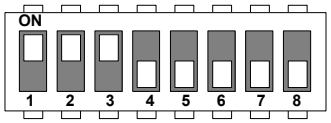
Table 4-20 Descriptions of Sequence (BD461) Jumper

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	Safetguard Chain 1 disable	Safetguard Chain 1 enable	Short (disable)
JP04	SG2	Safetguard Chain 2 disable	Safetguard Chain 2 enable	Short (disable)

■ Standard Setting for DIP Swtich

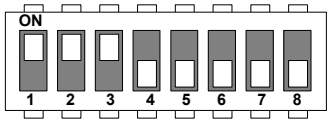
☞ **Caution** : These jumpers may not changed arbitrarily by users.

Table 4-21 Descriptions of Squence Board(BD460) DIP Switch

Shape								
No.	1	2	3	4	5	6	7	8
Settings	A/M_SW2	OVT2A	ARM2	ENSW2	MSHPON2	DMANEN1	DMANEN2	ENSW1
Delivery Setting	ON	ON	ON	OFF	OFF	OFF	OFF	OFF

☞ **Caution** : These jumpers may not changed arbitrarily by users.
In case of additional axis installation, Make contact with our company.

Table 4-22 Descriptions of Squence Board(BD461) DIP Switch

Shape									
No.		1	2	3	4	5	6	7	8
Setting Details	**OFF**	TS input in use for additional axis	Overtravel input1 in use for additional axis	Overtravel input2 in use for additional axis	unchangeable				TS input enable
	ON	TS input out of use for additional axis	Overtravel input1 out of use for additional axis	Overtravel input2 out of use for additional axis					TS input disable
Delivery Setting		ON	ON	ON	ON	OFF	OFF	OFF	OFF

▶ Connection of Safeguard

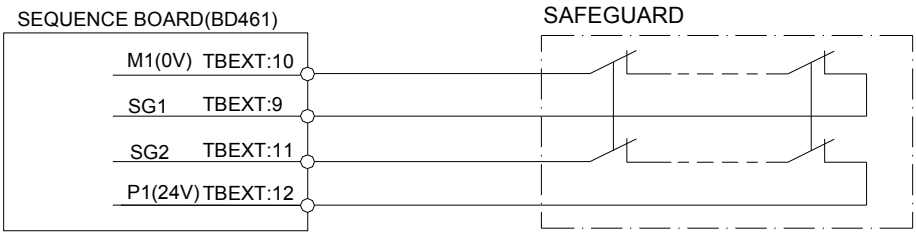


Fig. 4.22 Connection of Safeguard

▶ Connection of emergency stop in external system and external emergency stop output (ESOUT1,2)

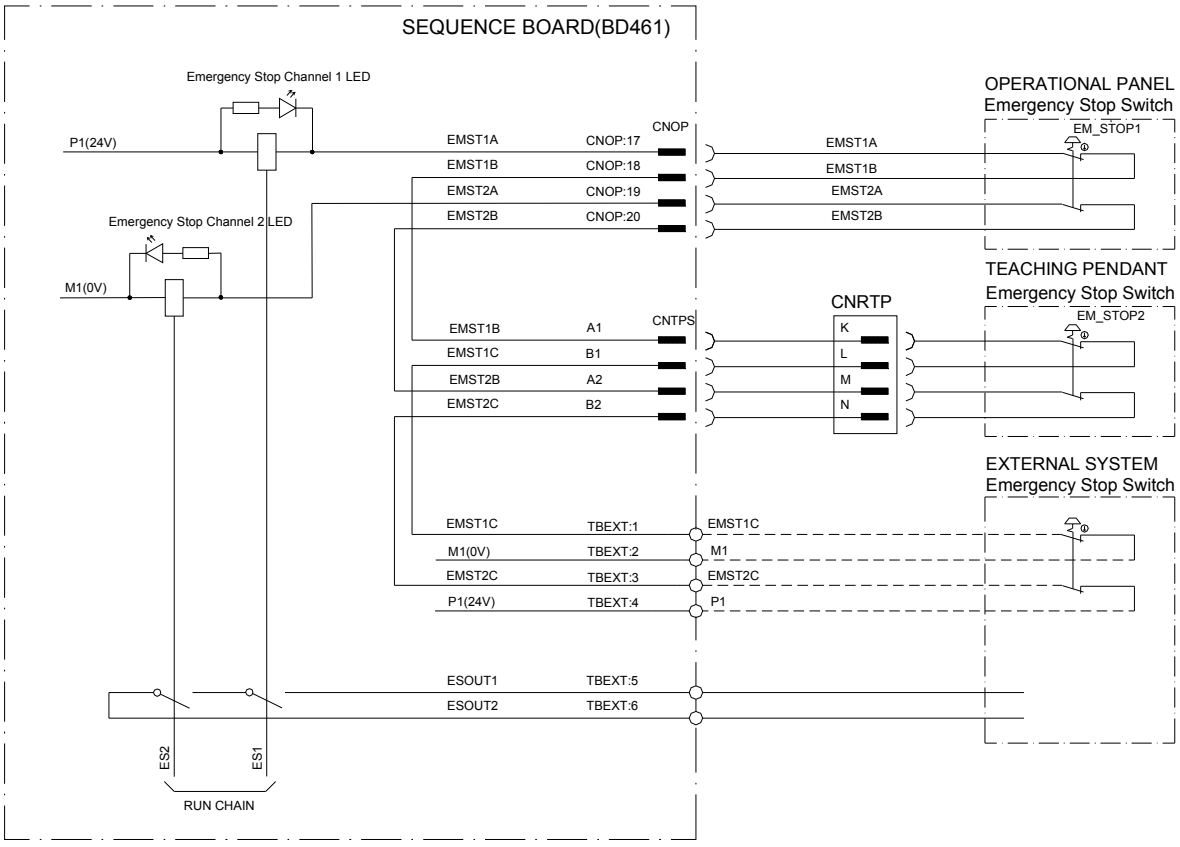


Fig. 4.23 Connection of Emergency Stop Switch in External System

▶ Connection of EXMON(External Motor ON) Input

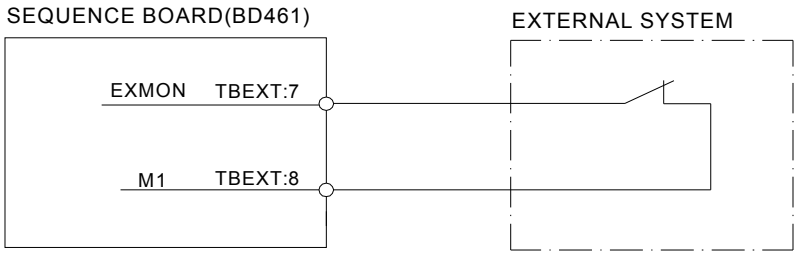


Fig. 4.24 Connection of External Motor ON Input

4.2.1.6. ADIO Board (BD481:optional)

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

- General analog input 4 port
- General 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.

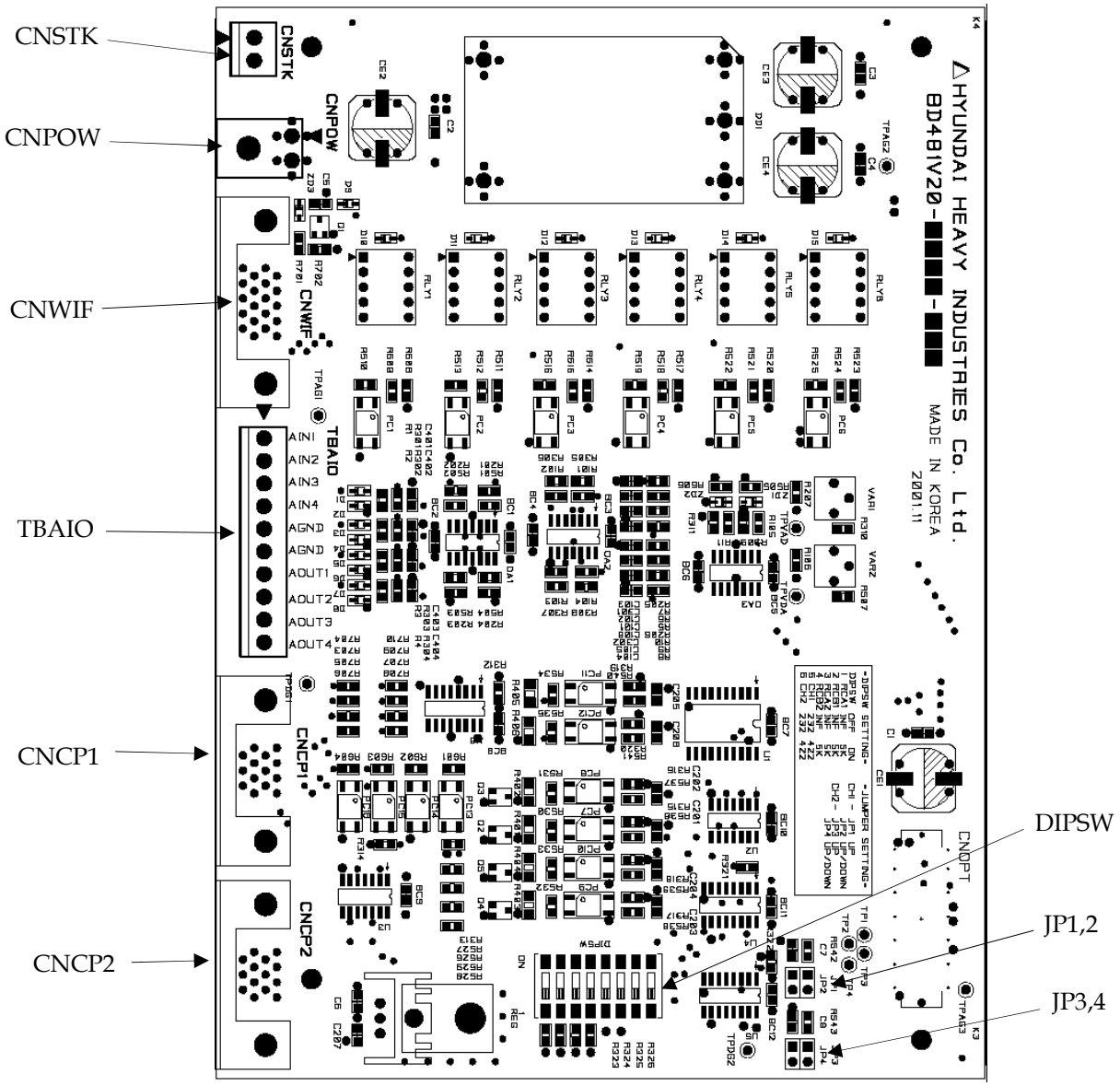


Fig. 4.25 ADIO Board(BD481) Layout

■ **Connectors**

Table 4-23 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

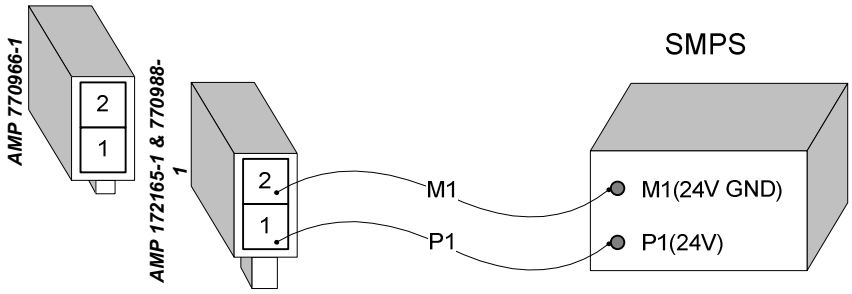


Fig. 4.26 CNPOW Connector Specifications

Table 4-24 CNPOW connector Specifiations

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

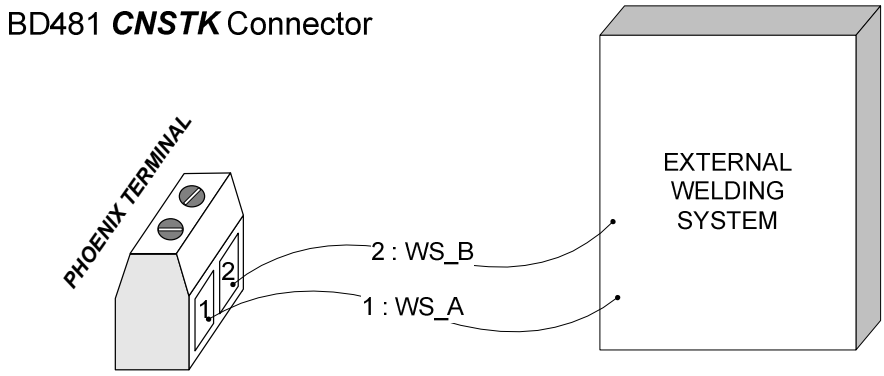


Fig. 4.27 CNSTK Connector Specifications

Table 4-25 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

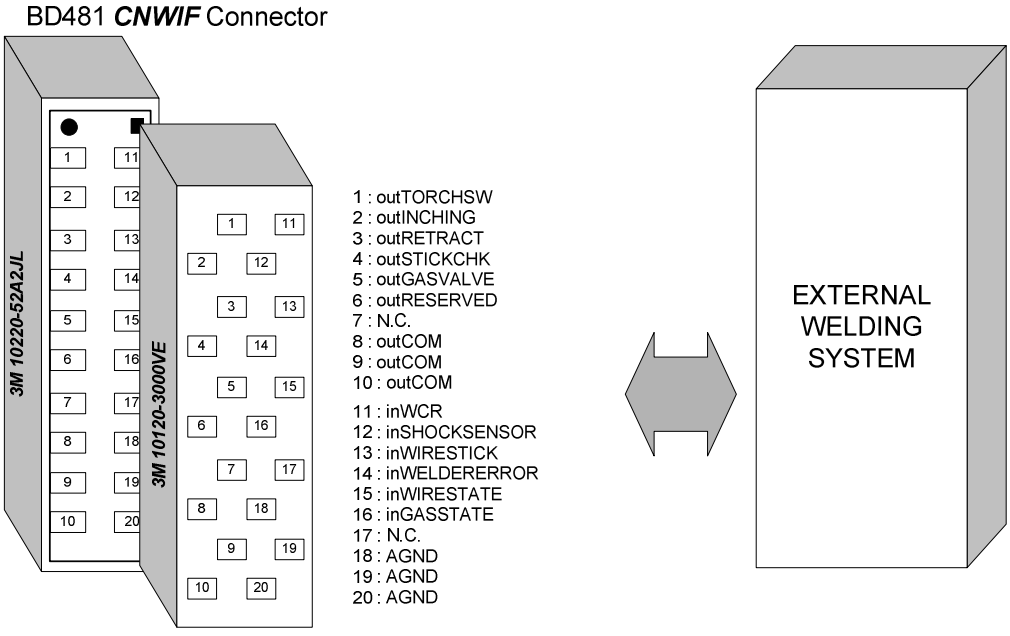


Fig. 4.28 CNWIF connector Specifications

Table 4-26 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>

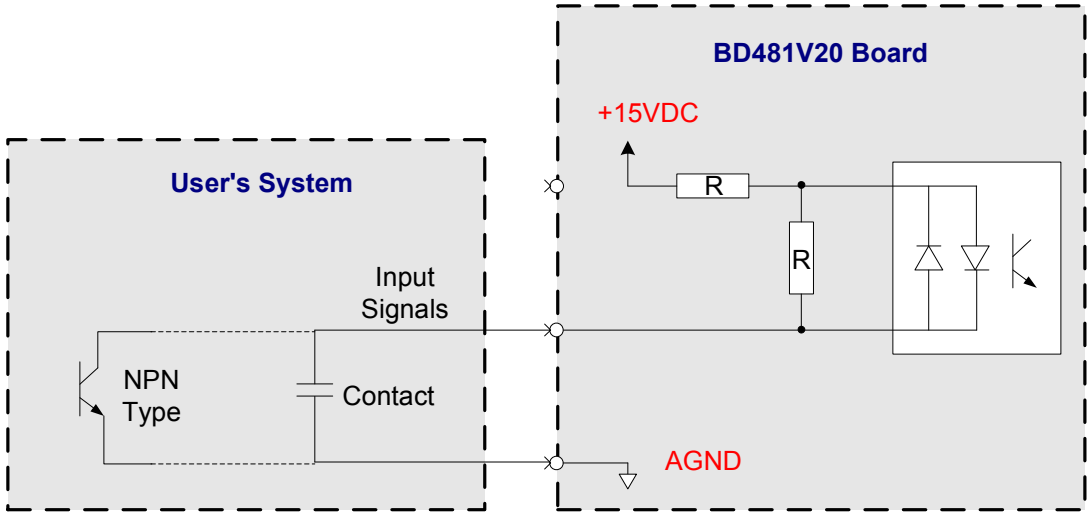


Fig. 4.29 CNWIF Input Signal Connecting Method

< Output signal connecting method >

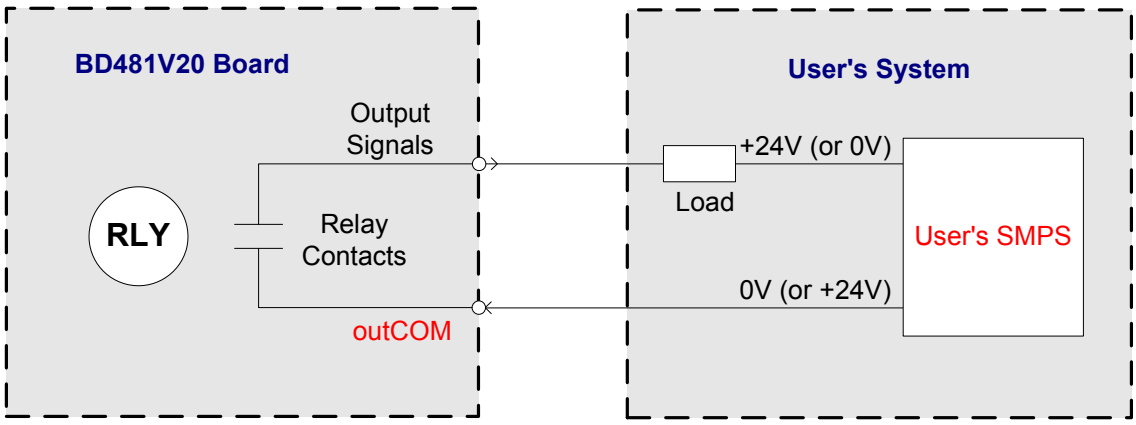


Fig. 4.30 CNWIF Output Signal Connecting Method

- CNCP1, 2 Connector Specifications

BD481 ***CNCP1 (CNCP2)*** Connector

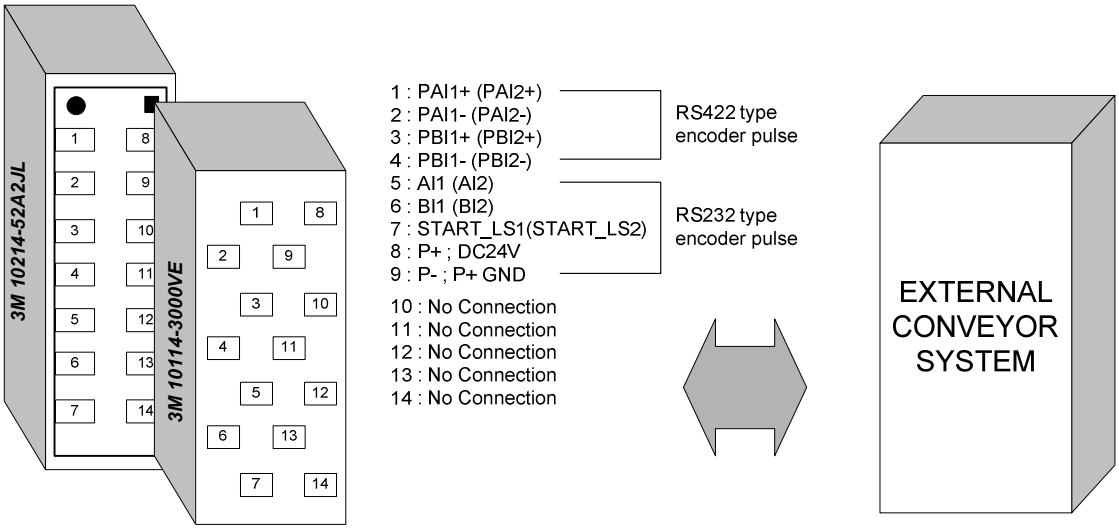


Fig. 4.31 CNCP1,2 Connector Specifications

Table 4-27 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

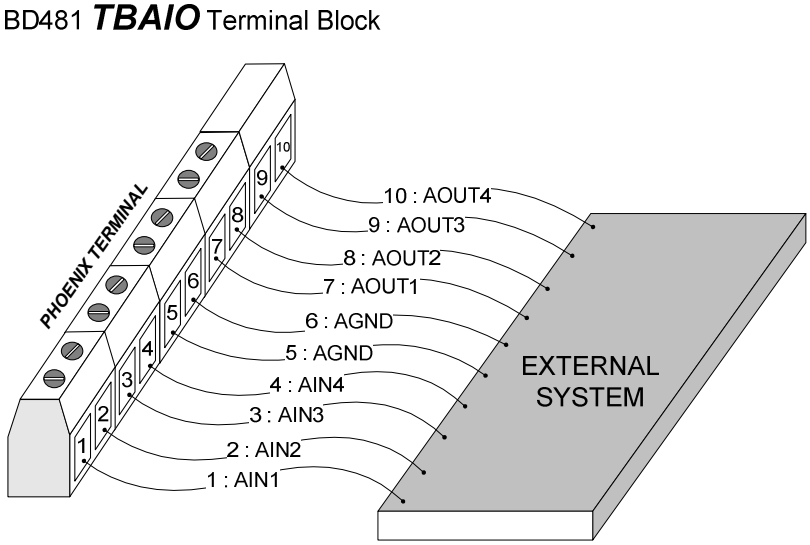


Fig. 4.32 TBAIO Terminal Block Specifications

Table 4-28 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

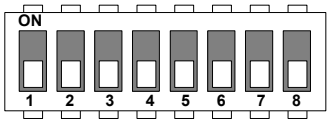
Table 4-29 Pin Specifications

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 4-30 Descriptions of ADIO Board(BD481) DIP Switch

Shape									
Switch No.		1	2	3	4	5	6	7	8
Settings	**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 4-31 Descriptions of ADIO Board(BD481) Jumper

<table>
<tr><th colspan="2">Jumper No.</th><th>JP1</th><th>JP2</th><th>JP3</th><th>JP4</th></tr>
<tr><td rowspan="4">Setting Details</td><td>Channel 1 Conveyor pulse UP count</td><td>SHORT</td><td>OPEN</td><td colspan="2" rowspan="2">unchangeable</td></tr>
<tr><td>Channel 1 Conveyor pulse UP/DOWN count</td><td>OPEN</td><td>SHORT</td></tr>
<tr><td>Channel 2 Conveyor pulse UP count</td><td colspan="2" rowspan="2">unchangeable</td><td>SHORT</td><td>OPEN</td></tr>
<tr><td>Channel 2 Conveyor pulse UP/DOWN count</td><td>OPEN</td><td>SHORT</td></tr>
<tr><td colspan="2">Delivery Setting</td><td>OPEN</td><td>SHORT</td><td>OPEN</td><td>SHORT</td></tr>
</table>

4.2.2. Drive Unit

4.2.2.1. Drive Unit Specifications

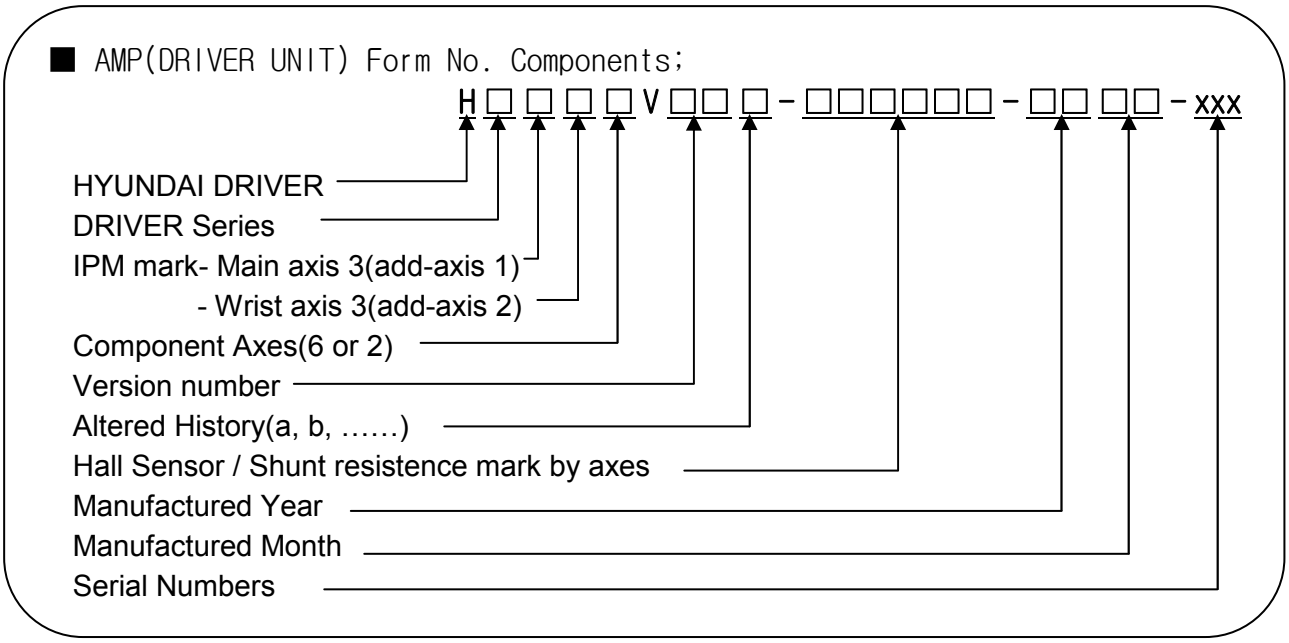


Table 4-32 Driver Series Formal Mark

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 4-33 Drive Unit Specifications

<table>
<tr><th>Components</th><th colspan="2">Classifications</th><th colspan="2">Application</th></tr>
<tr><td rowspan="8">IPM Capacity</td><td>Main Axis 3 (additional axis 1)</td><td>Wrist Axis 3 (additional axis 2)</td><td></td><td></td></tr>
<tr><td>L</td><td>Y</td><td>Special application</td><td rowspan="3">6-axis monolithic type</td></tr>
<tr><td>X</td><td>Y</td><td>HR120, HR150, HR100P, HX165 application</td></tr>
<tr><td>A</td><td>D</td><td>HR006, HR015 application</td></tr>
<tr><td>L</td><td>Y</td><td rowspan="3">Additional axis 1 applied, additional axis 2 servo gun applied</td><td rowspan="3">For 2-axis additional type</td></tr>
<tr><td>X</td><td>Y</td></tr>
<tr><td>A</td><td>D</td></tr>
<tr><td rowspan="2">6-axis/2-axis</td><td colspan="2">6</td><td colspan="2">6-axis monolithic type</td></tr>
<tr><td colspan="2">2</td><td colspan="2">For 2-axis additional type</td></tr>
<tr><td>Year</td><td colspan="2">00 ~ 99</td><td colspan="2">Production year : 2000 ~ 2099</td></tr>
<tr><td>Month</td><td colspan="2">01 ~ 12</td><td colspan="2">Production month : Jan. ~ Dec.</td></tr>
<tr><td>Serial Number</td><td colspan="2">001 ~ 999</td><td colspan="2">Production per month : 1 unit~ 999 units(=piece)</td></tr>
</table>

Table 4-34 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 4-35 Hall Sensor/Shunt Resistence Mark

AMP Model	Hall Sensor Mark (specification)	Shunt Resistence Mark (resistence value)	Full Scale Current(Im)	Feedback constant(Iv) of AMP
Large Size 6-axis/additional 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/additional 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/additional 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 4-36 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

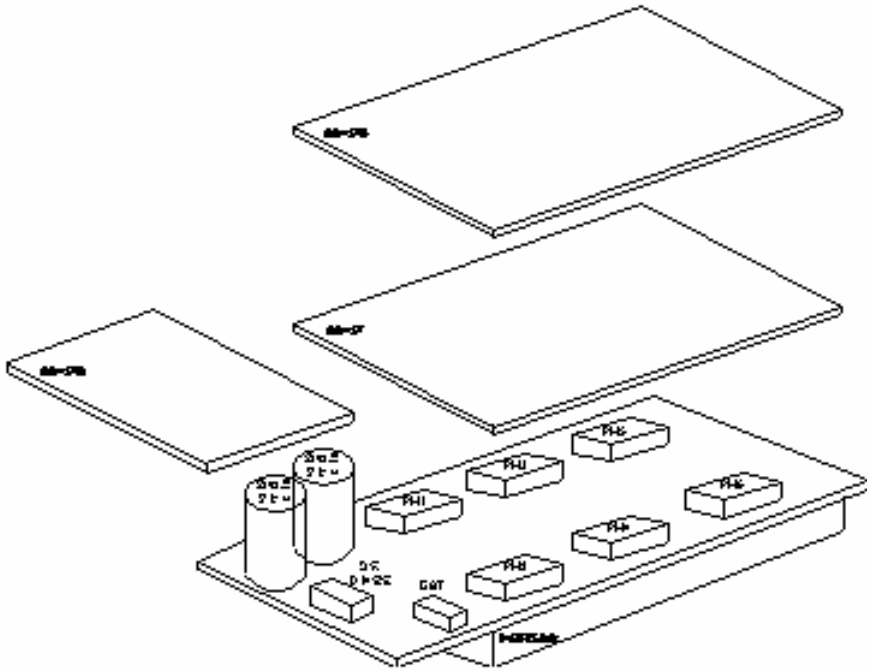


Fig. 4.33 Exterior View of HSXY6 Drive Unit

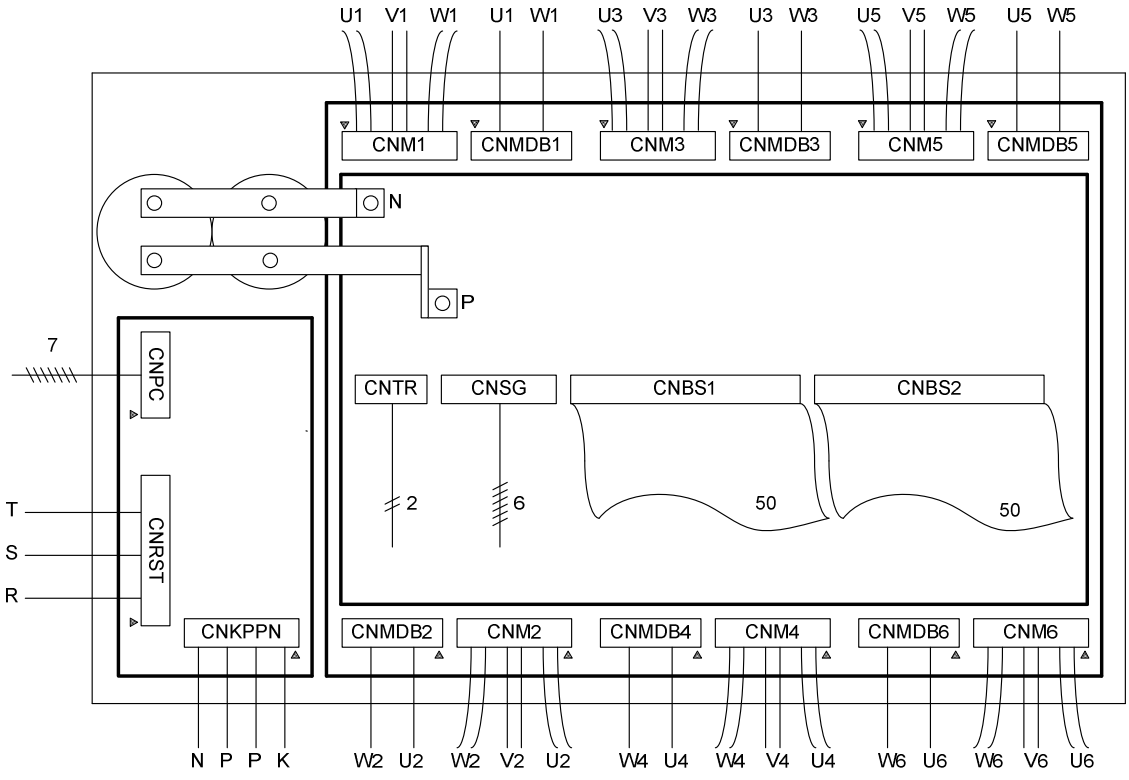


Fig. 4.34 HSXY6 Drive Unit connection

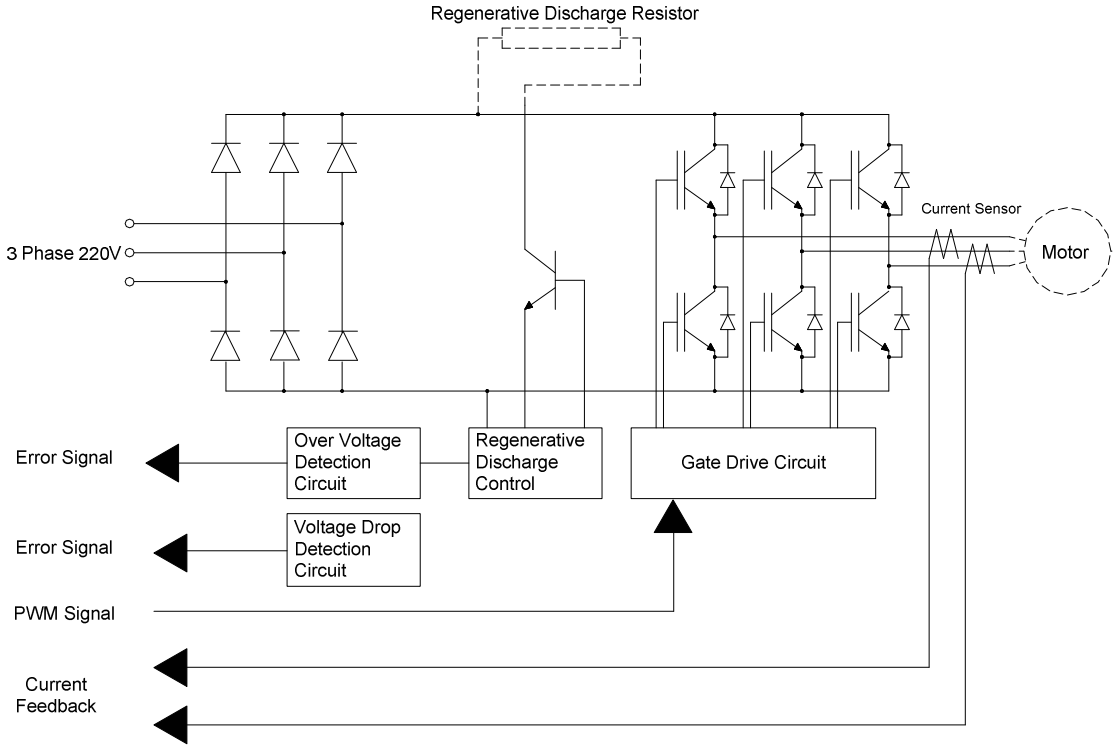


Fig. 4.35 Outline of HSXY6 Drive Unit

☞ Caution

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

Table 4-37 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 resistence	Temperature sensor attached to regeneration resistence
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 resistence in additional axis	Servo drive unit for regeneration discharge resistence in additional axis

Table 4-38 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 4-39 Components of HDAD6(Small Sized 6-Axis Monolithic Type of Drive Unit)

Componenets		Fuction
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	Swtiching Device
	Regeneration TR	Regeneration Control

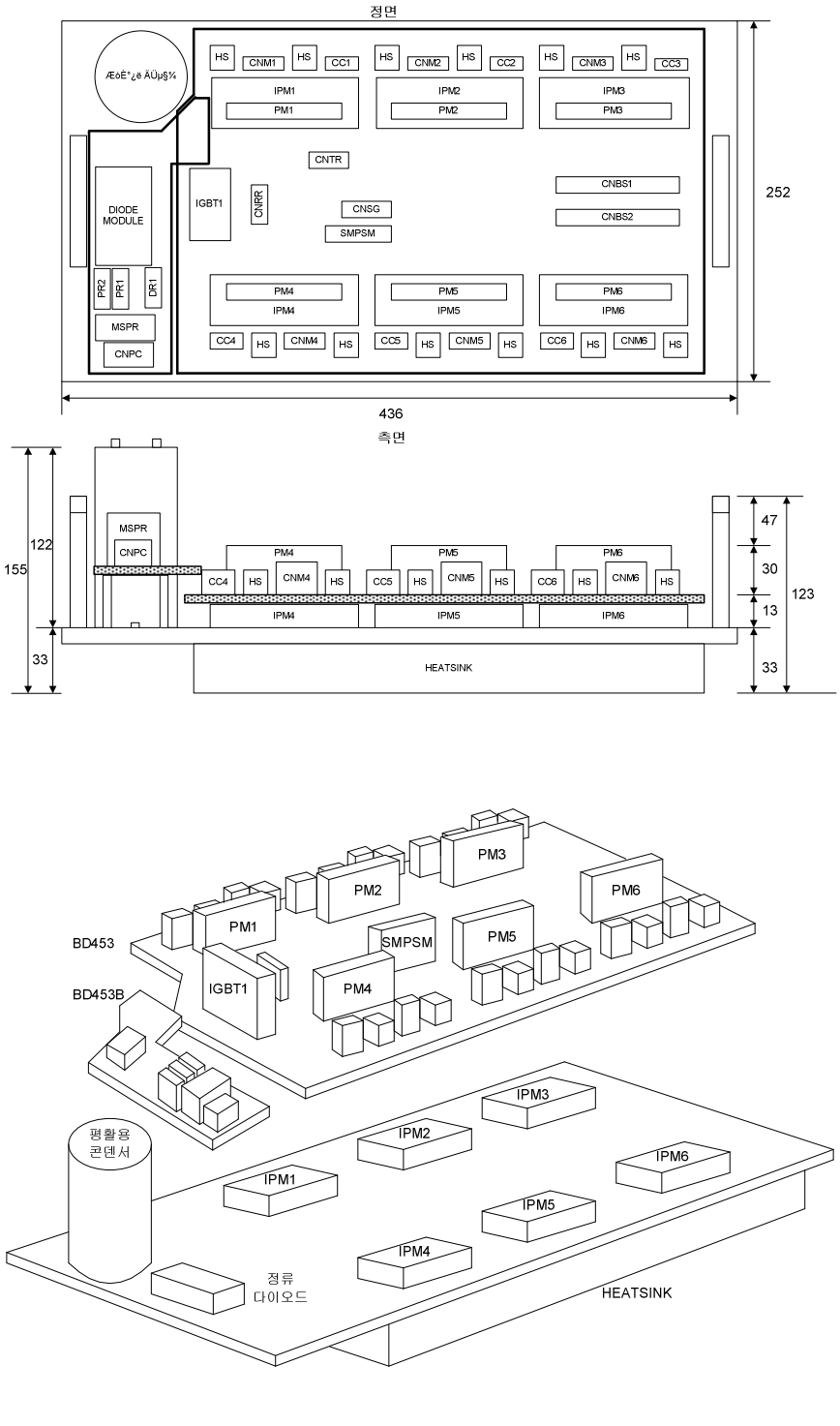


Fig. 4.36 Exterior View of HDAD6 Drive Unit

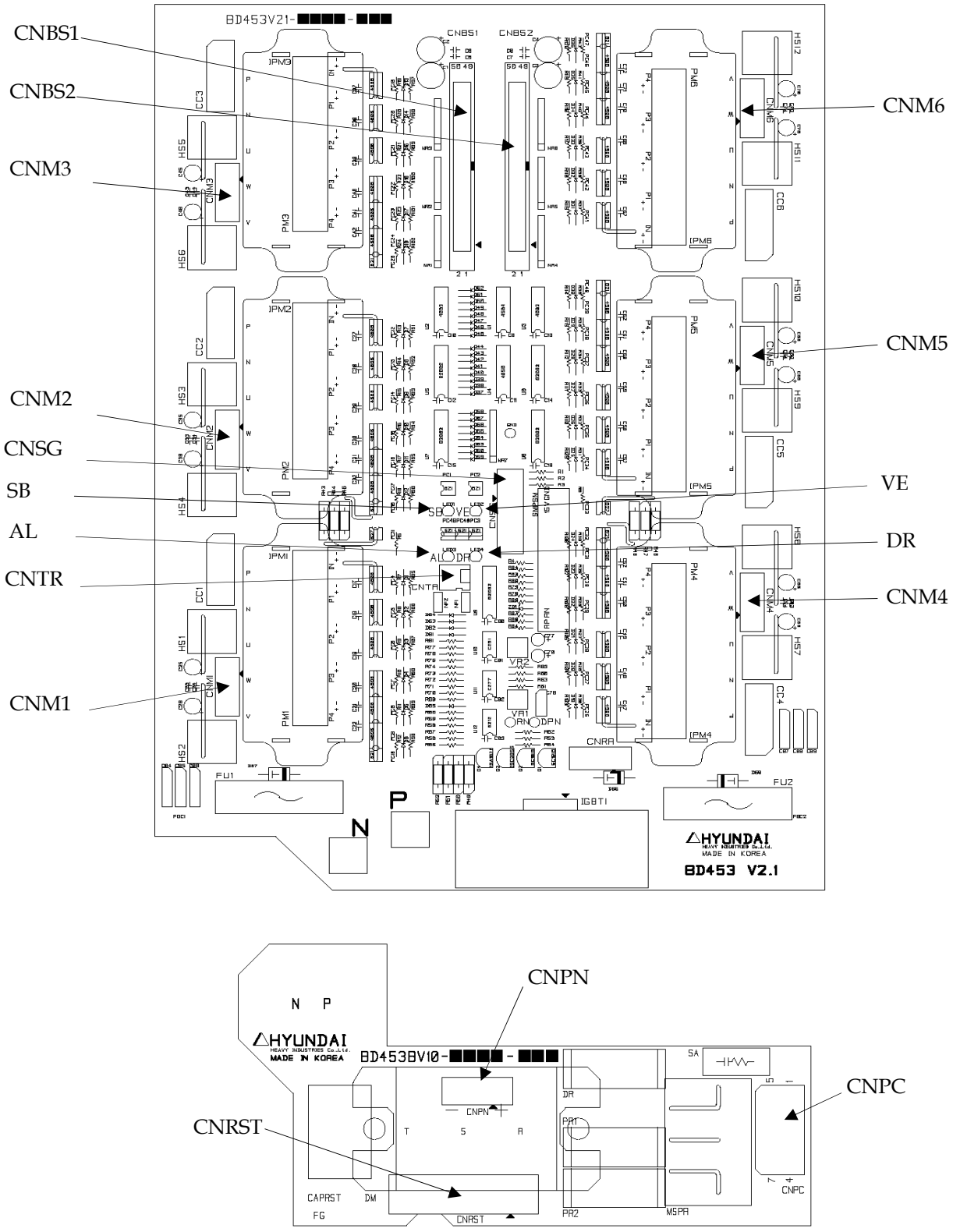


Fig. 4.37 Connection of HDAD6 Drive Unit

Table 4-40 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 resistence	Temperature sensor attached to regeneration resistence
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 resistence in case of regeneration discharge	Regeneration discharge resistence

Table 4-41 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 whe Alarm occurs

4.2.2.4. 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 4-42 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	Swtiching Device

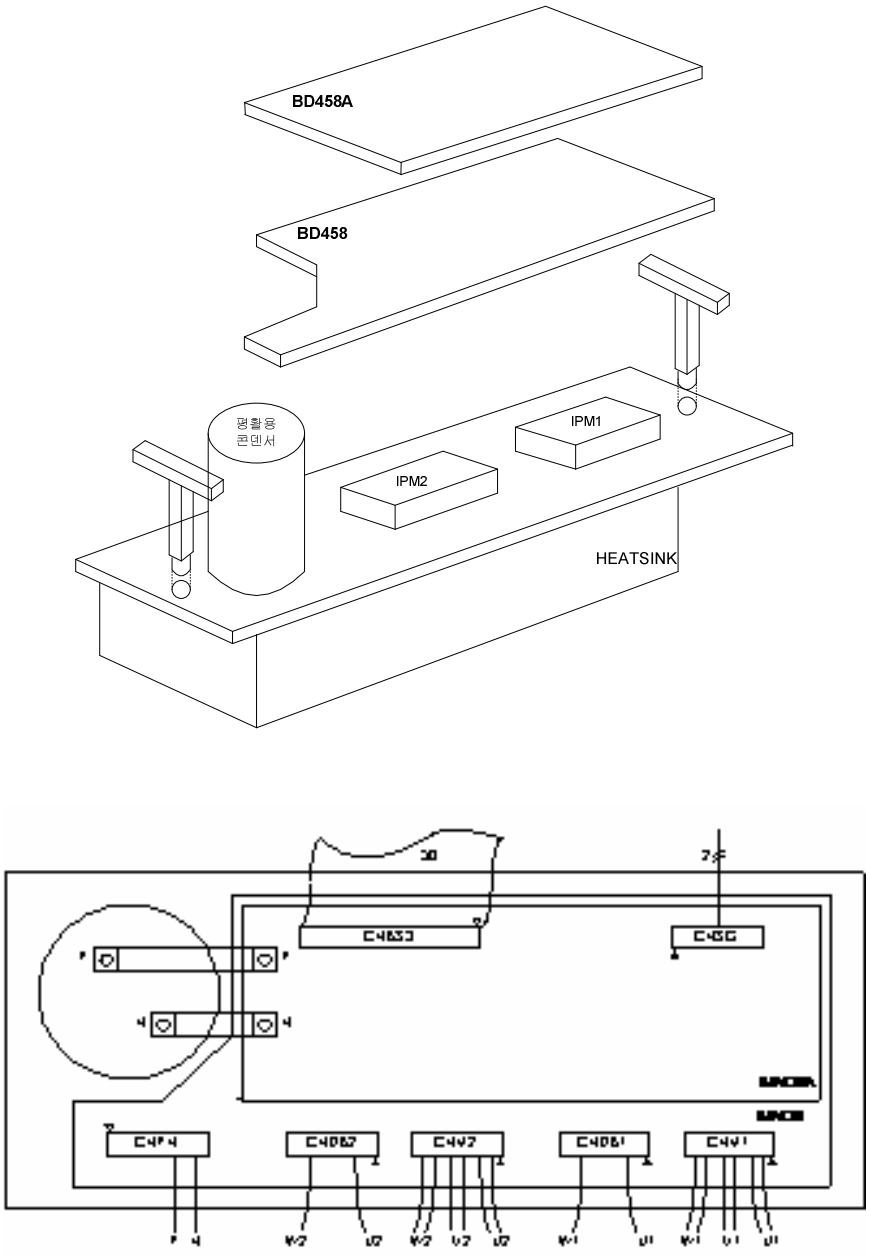


Fig. 4.38 Parts Configuration of HSXY2 Drive Unit

4.2.2.5. 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 4-43 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 gete power
	Current Detecting Part	Detecting a current in motor
Other Parts	**Heat Sink**	Emitting out heat generated from IPM
	IPM	Swtiching device

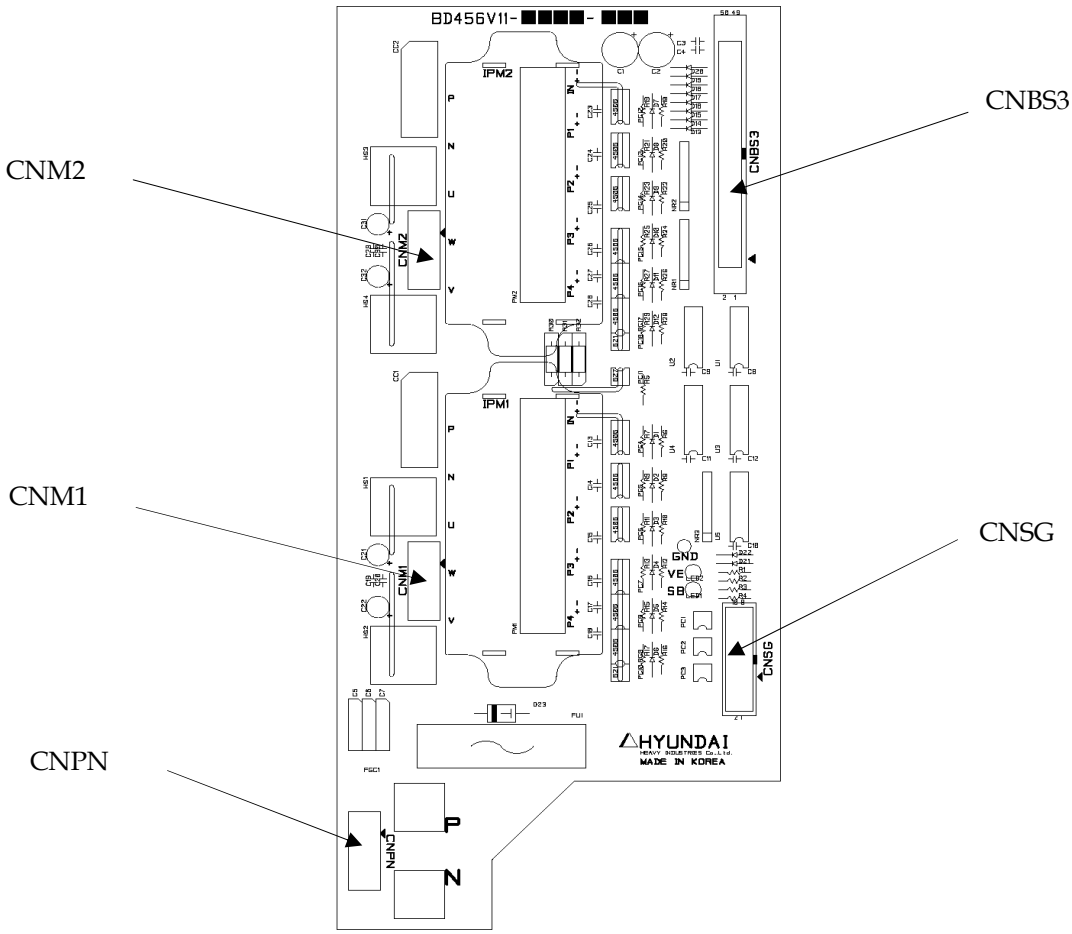


Fig. 4.39 Parts Configuration of HDAD2 Drive Unit

Table 4-44 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 4-45 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.

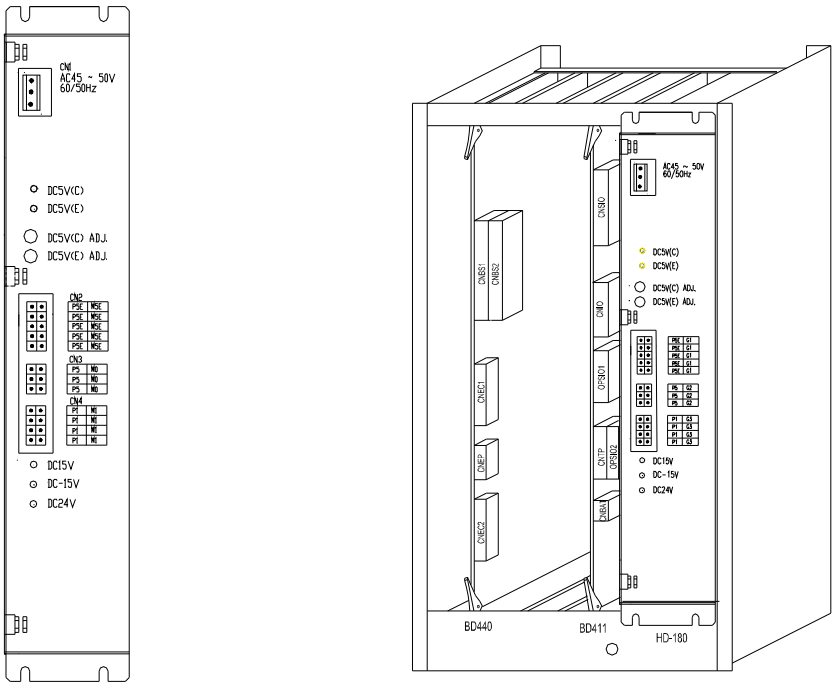


Fig. 4.40 Exterior View of SMPS SR1 & Its Locaton in Rack

Table 4-46 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**	Contol 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

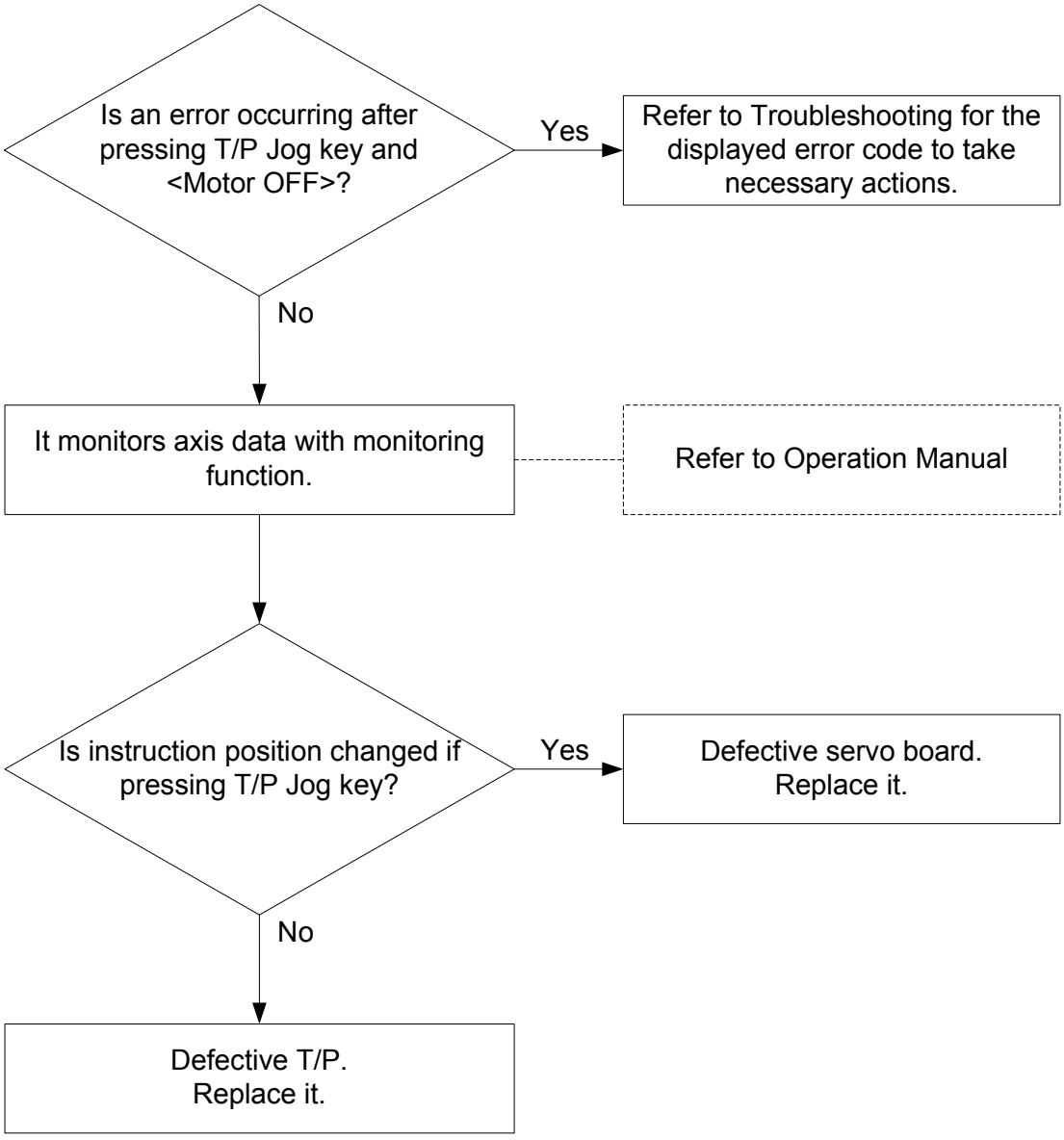
5. Troubleshooting

5.1. Troubleshooting cases

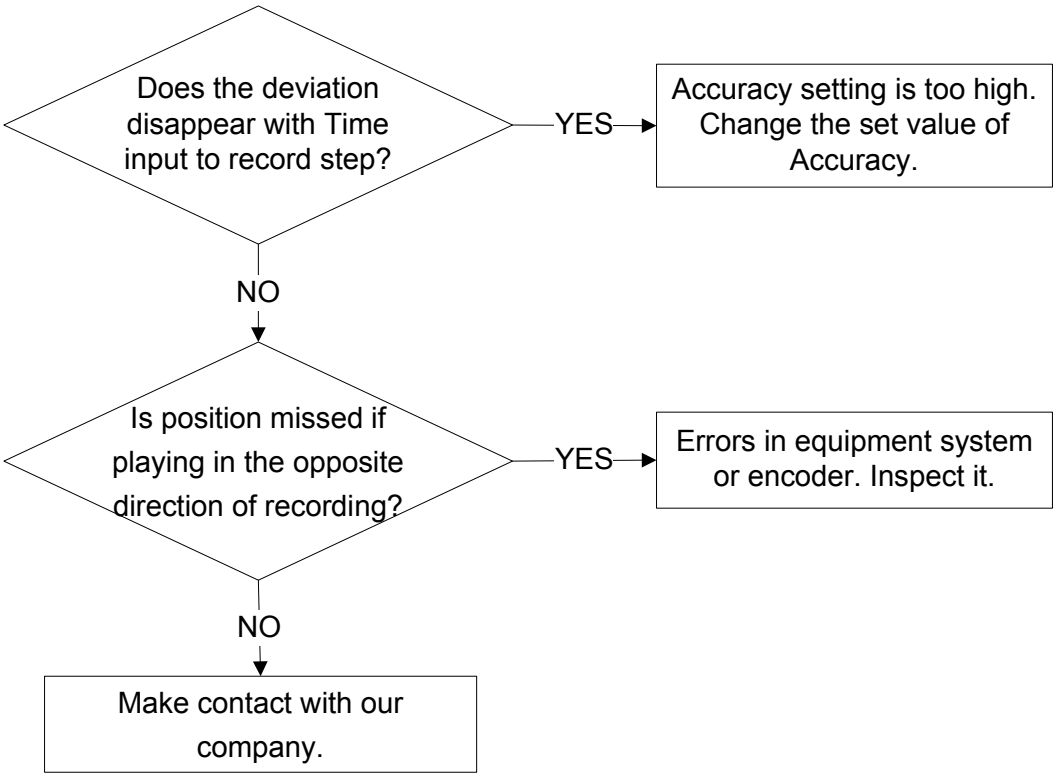
Hi4 controller emphasizes on high-precision and high-speed(promptness). So, it is designed to facilitate troubleshooting when troubles occur.
Please be fully aware of this MANUAL for troubleshooting.

5.1.1. Some axis does not move

(If a certain axis does not move in a manual mode)

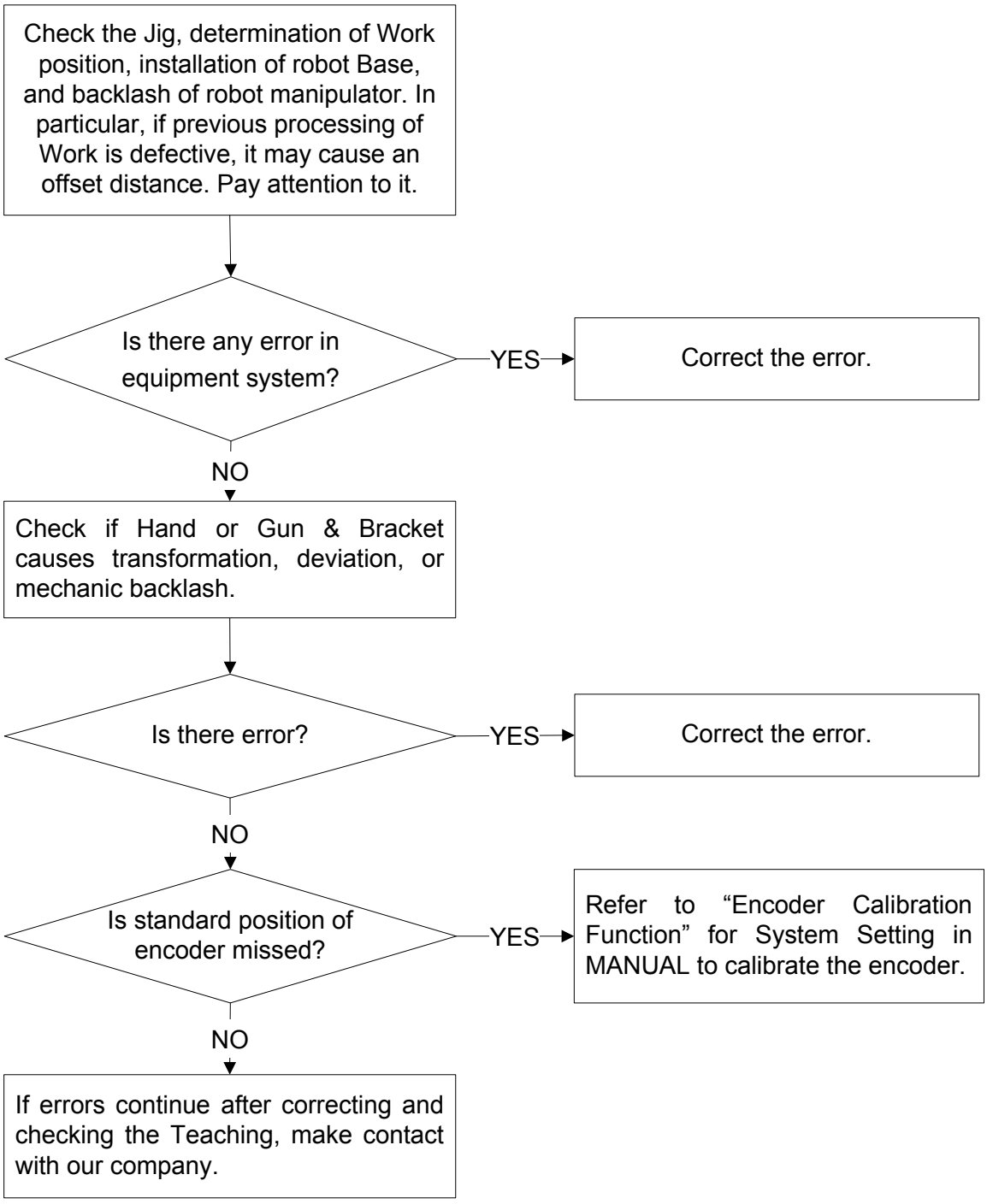


5.1.2. Deviation of Recorded and Playback Points

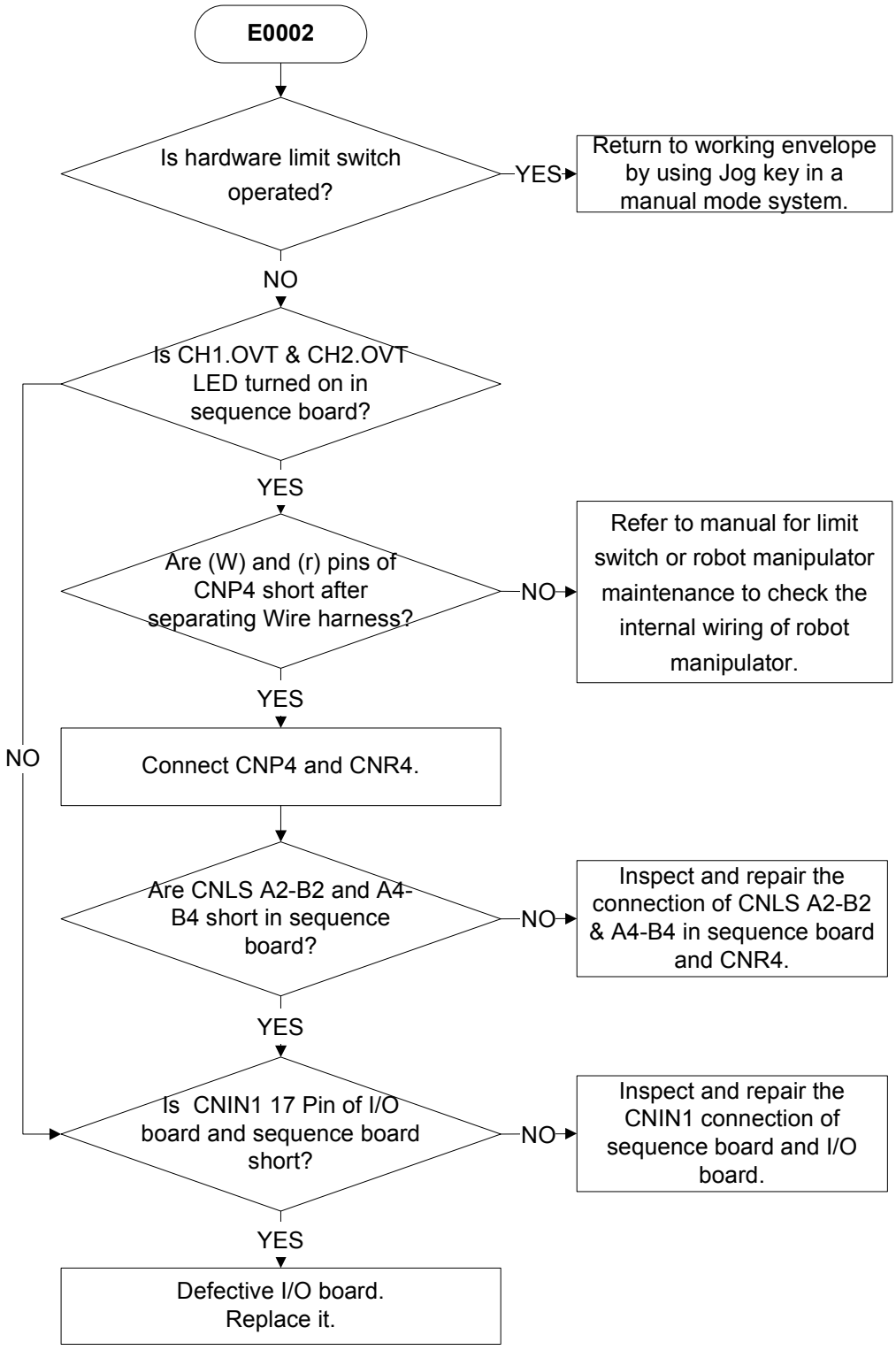


5.1.3. Variation of playback points

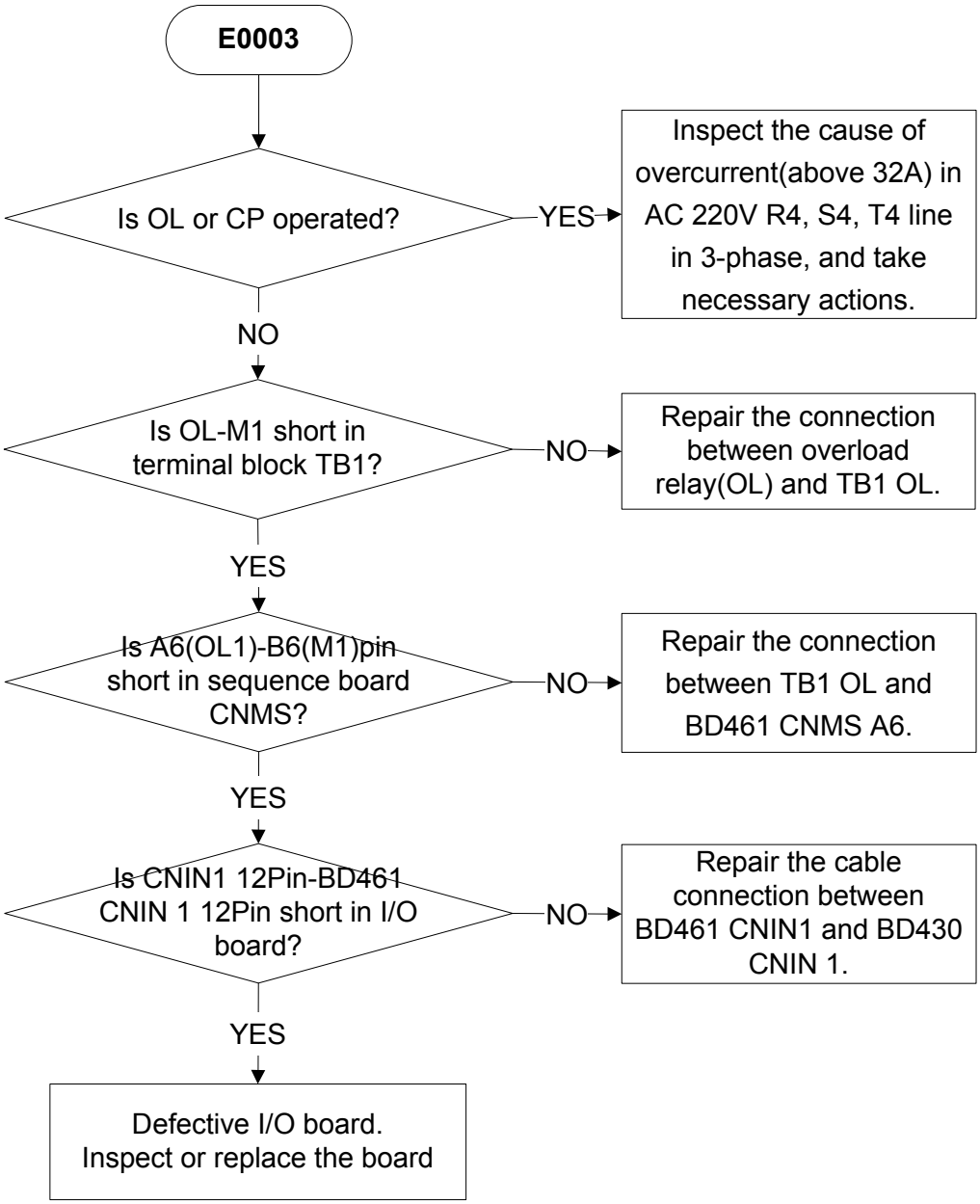
(If playing location is missed with the passage of time even if it was normally operated to some extent)



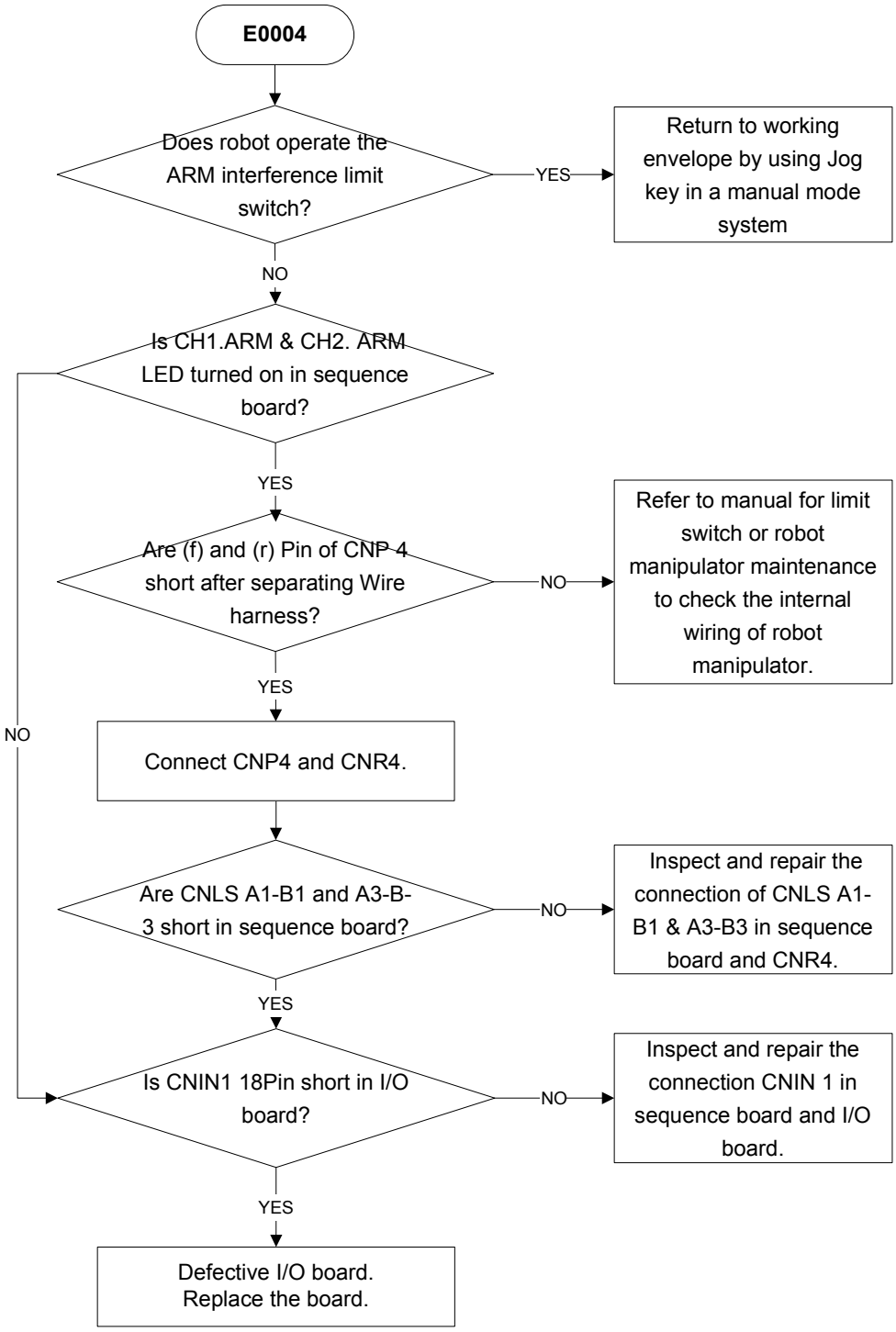
5.1.4. E0002 H/W LMT switch on



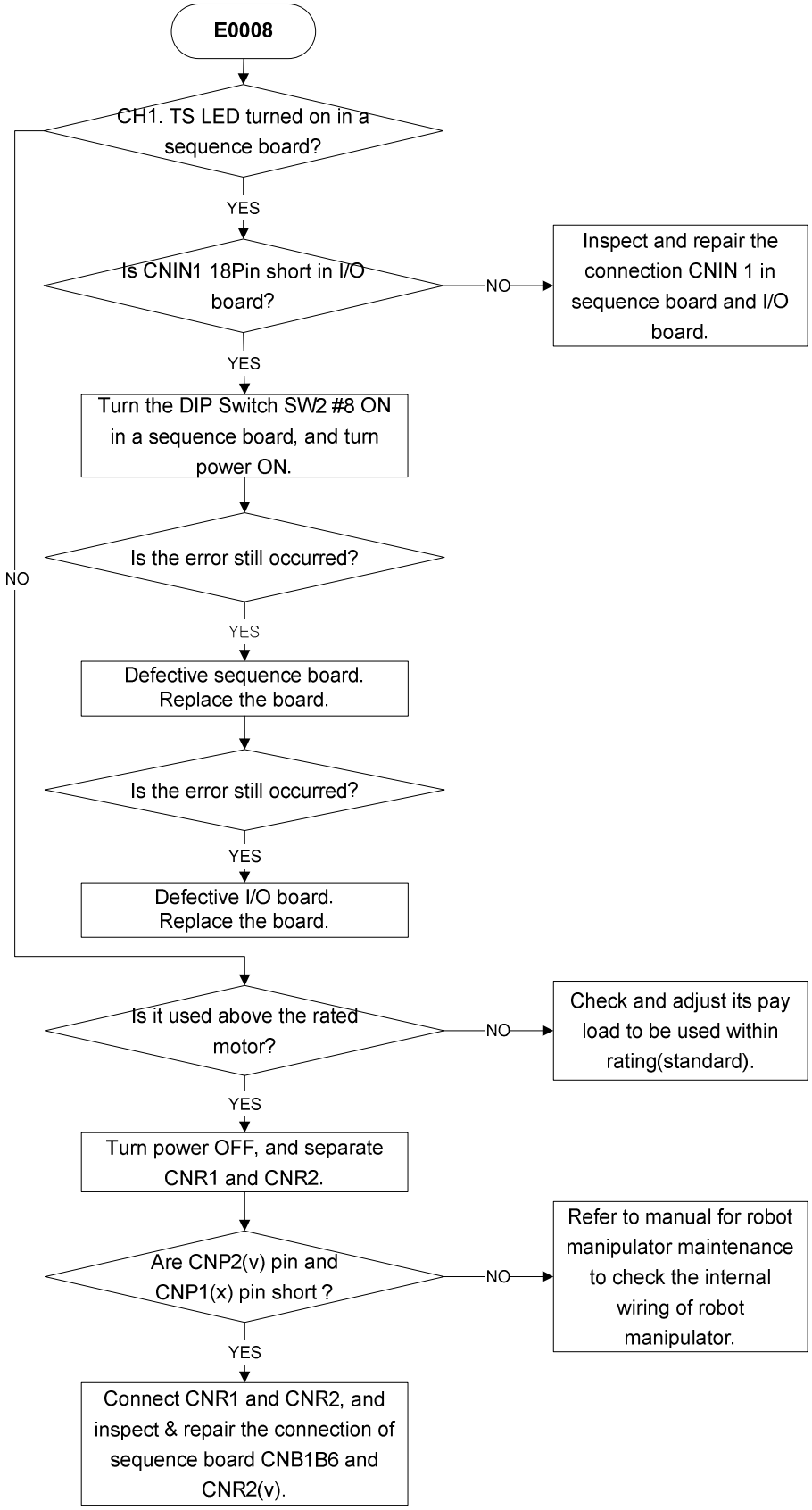
5.1.5. Overload relay or CP tripped



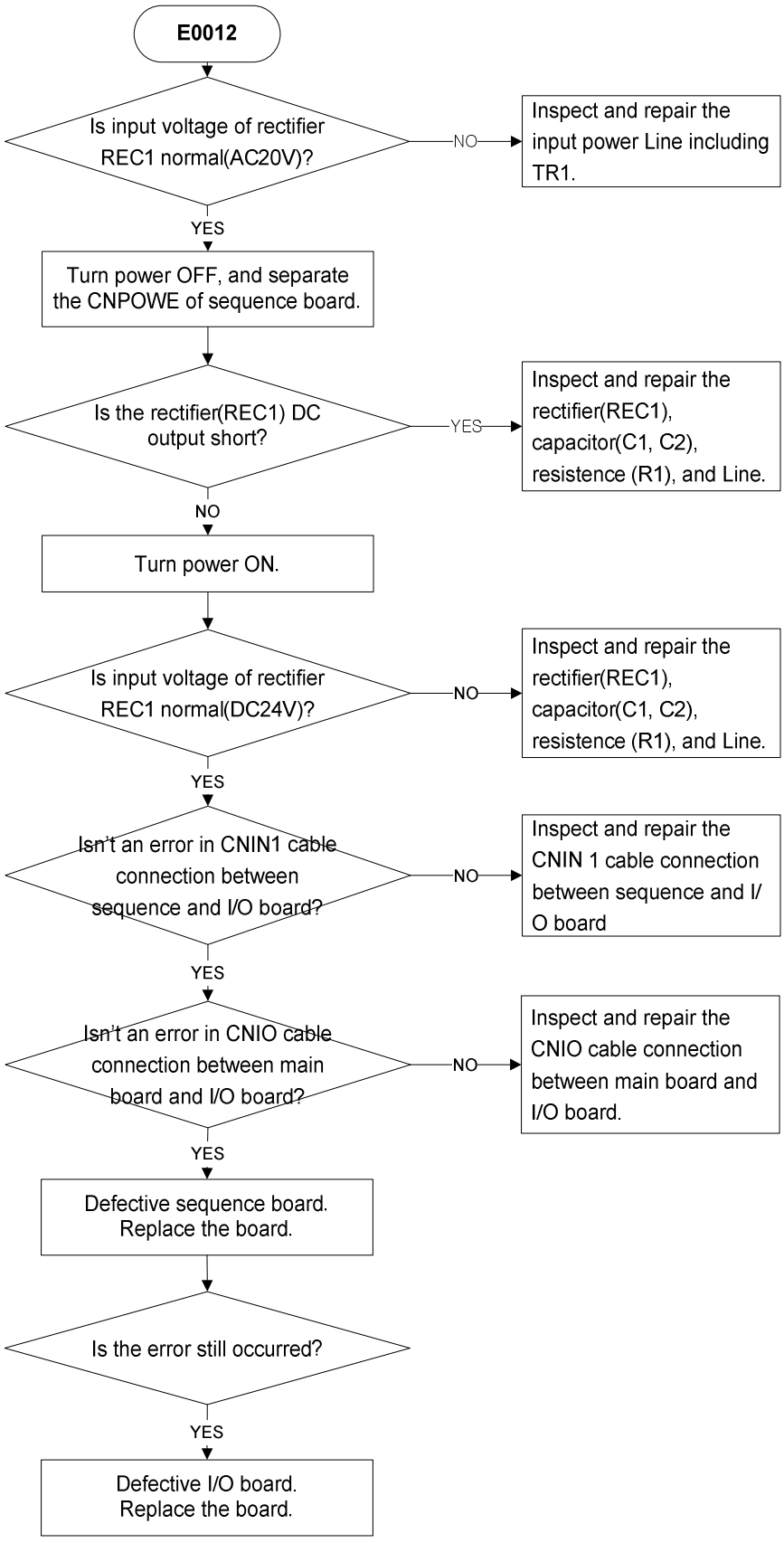
5.1.6. E0004 Arm interference switch on



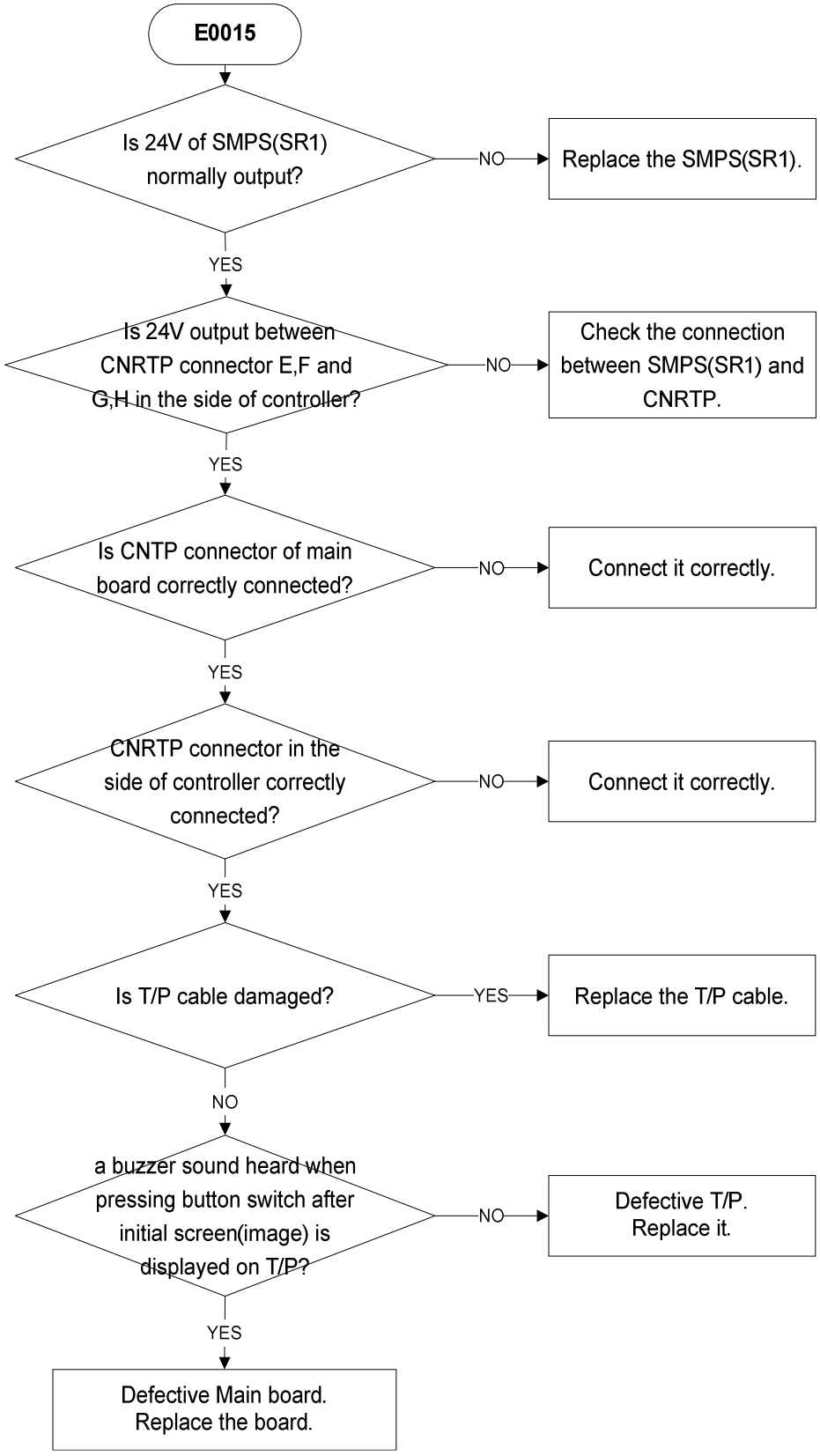
5.1.7. E0008 Motor temperature is risen



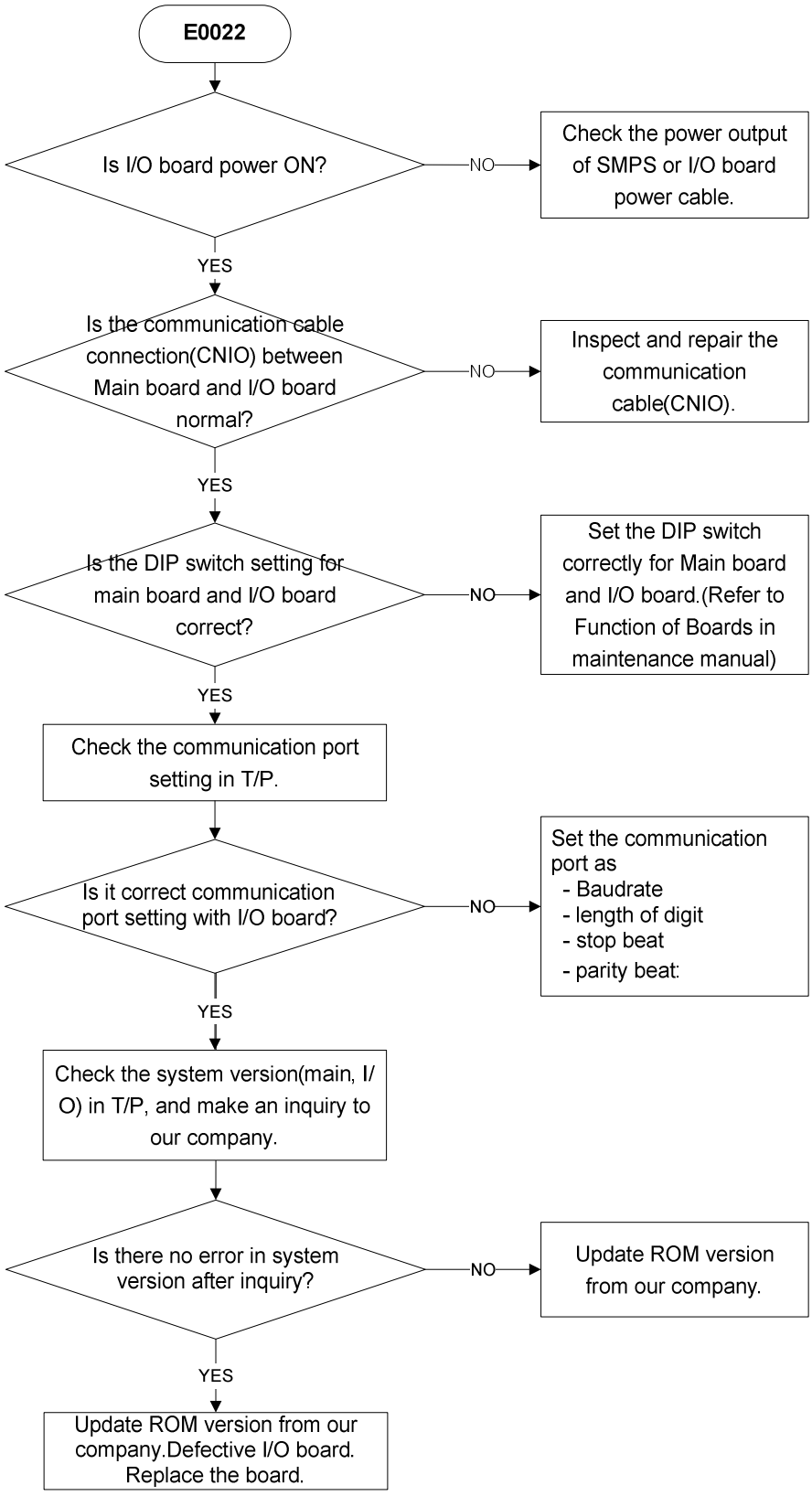
5.1.8. E0012 Brake power error



5.1.9. E0015 Teaching pendant does not work



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

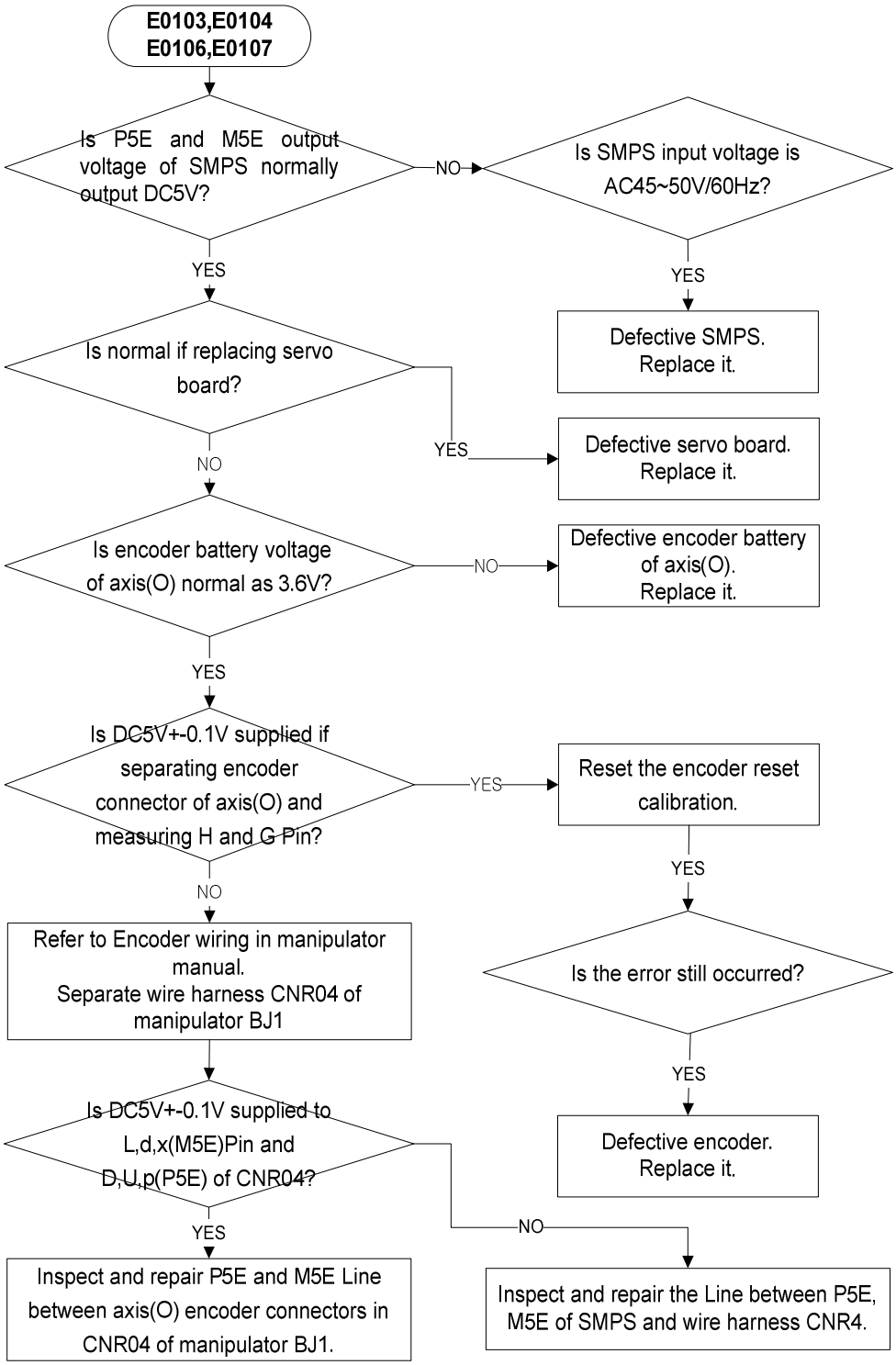


5.1.11. E0103 (Axis ○) Enc Err:Process time over

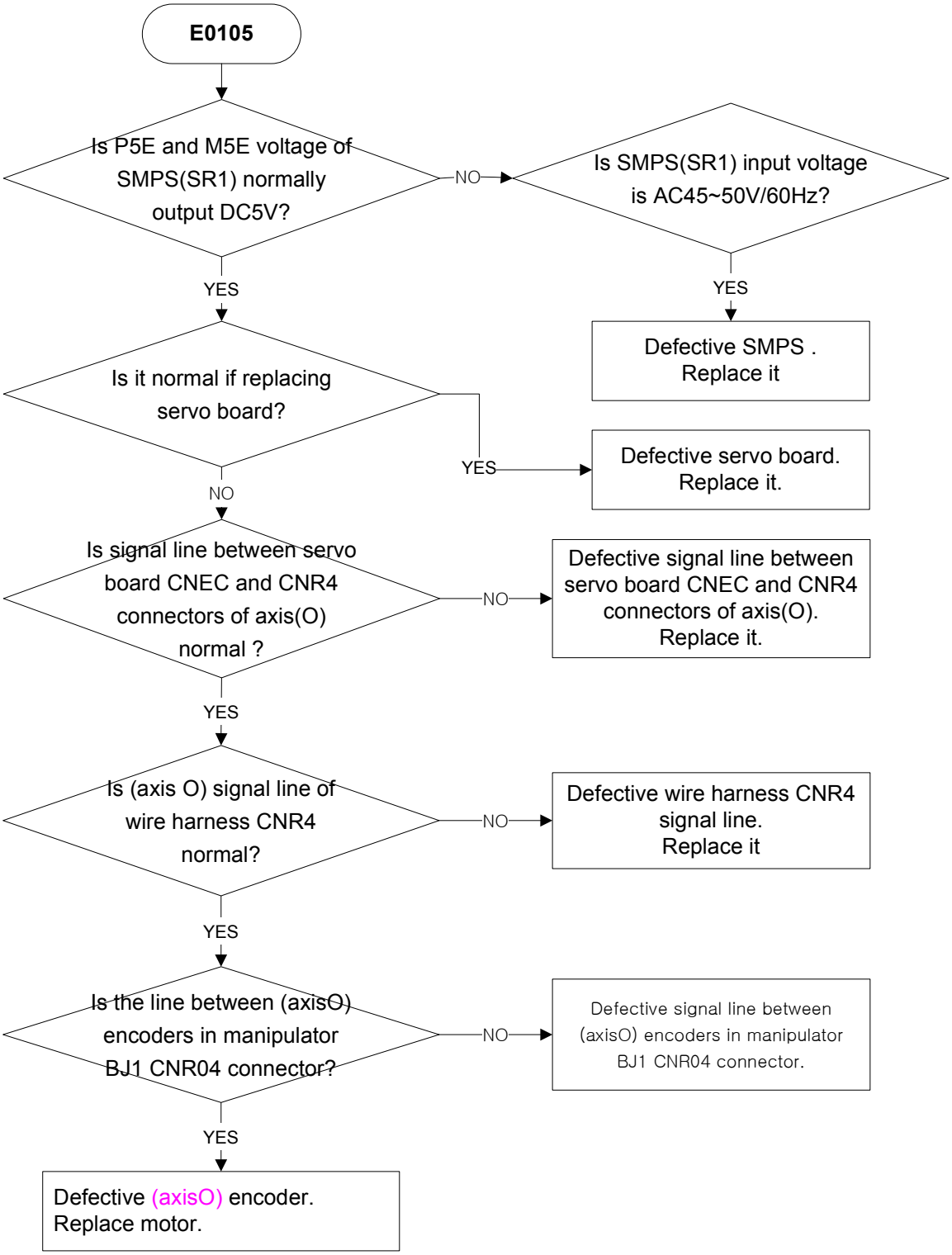
5.1.12. E0104 (Axis ○) Enc Err:Imperfect data frame

5.1.13. E0106 (Axis ○) Enc Err:Bad input data

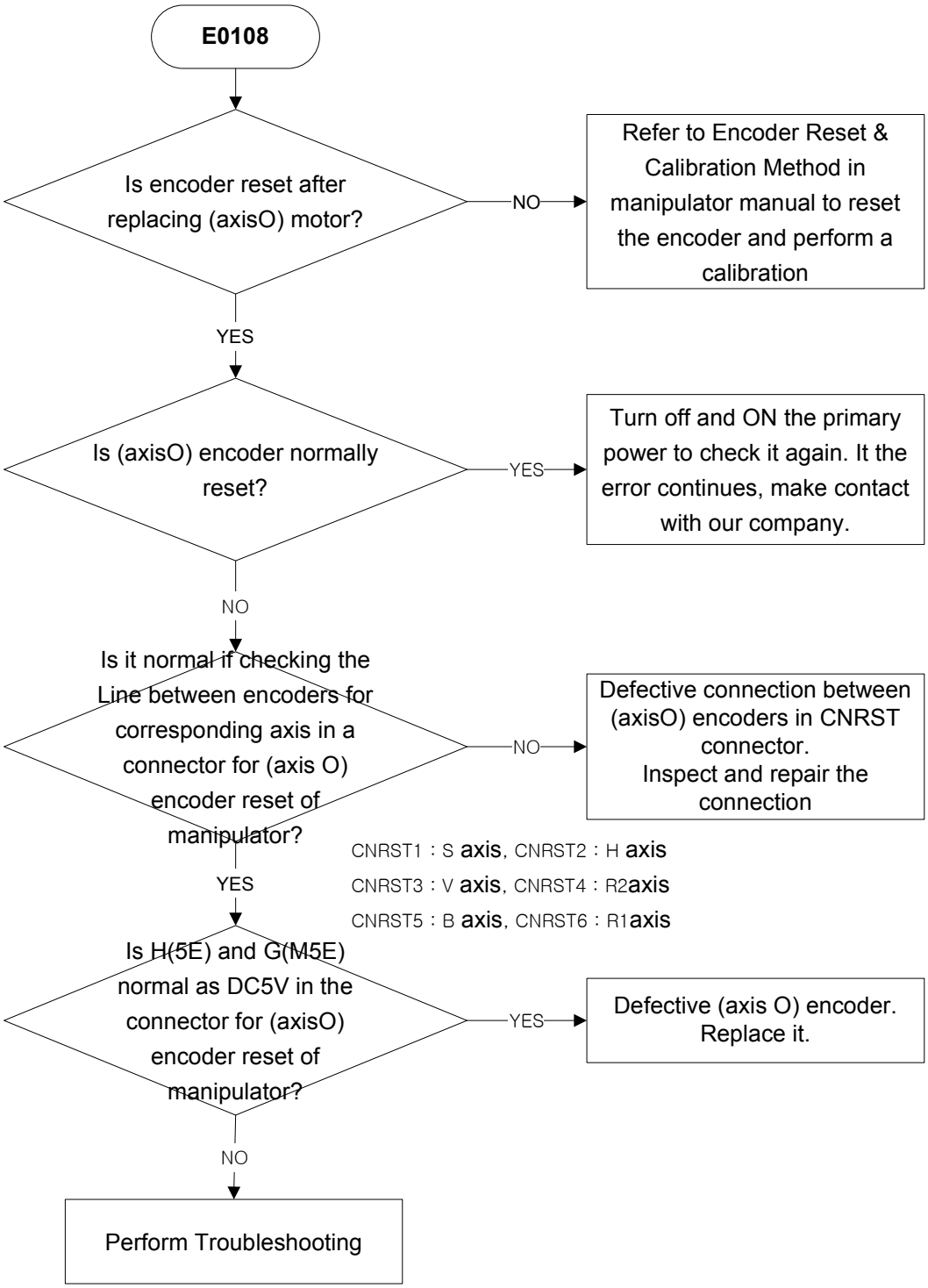
5.1.14. E0107 (Axis ○) Enc Err:Bad bit sequence



5.1.15. E0105 (Axis ○) Enc Err:Cable not connected

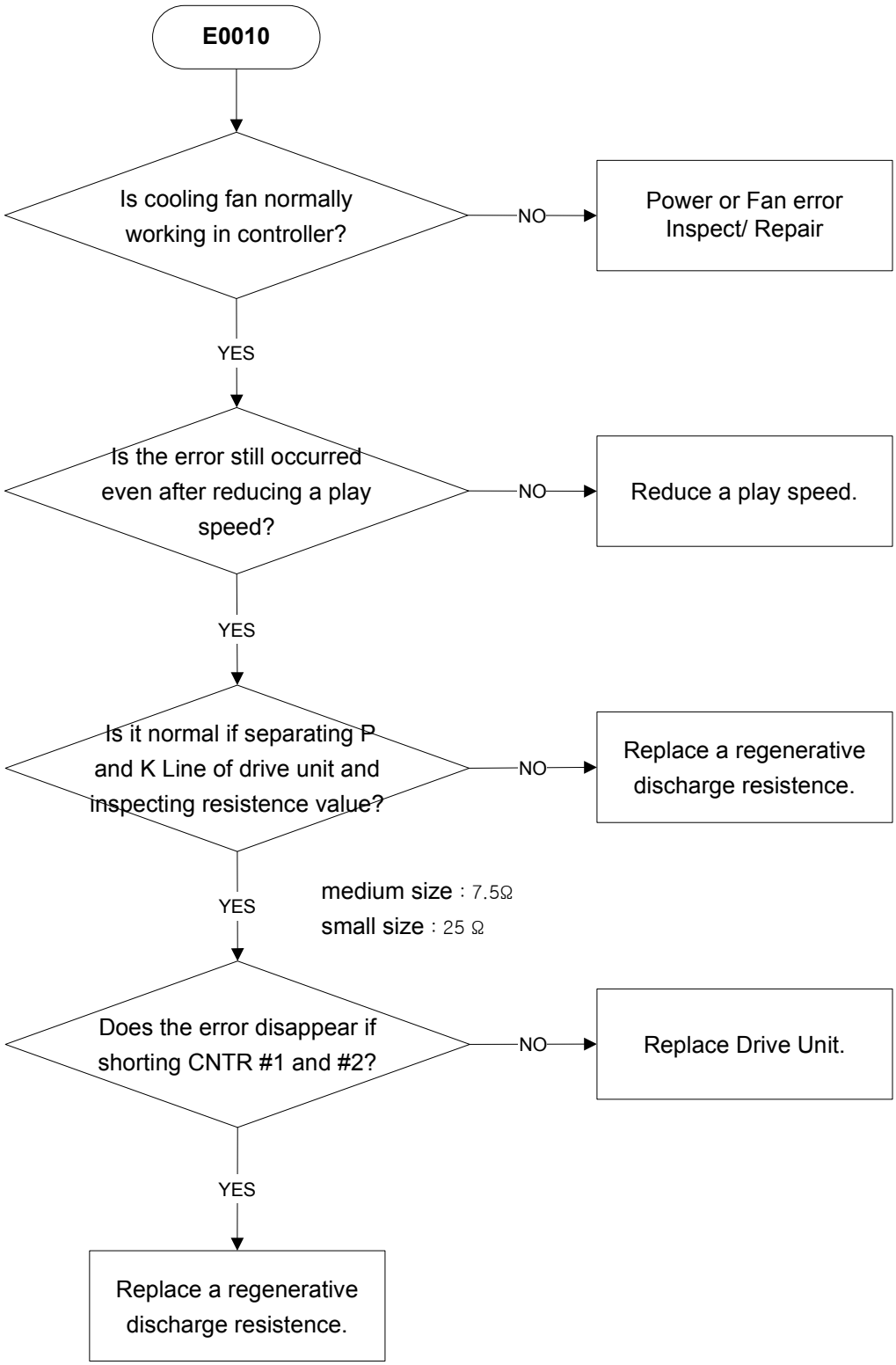


5.1.16. E0108 (Axis ○) Enc Err:Encoder reset needed

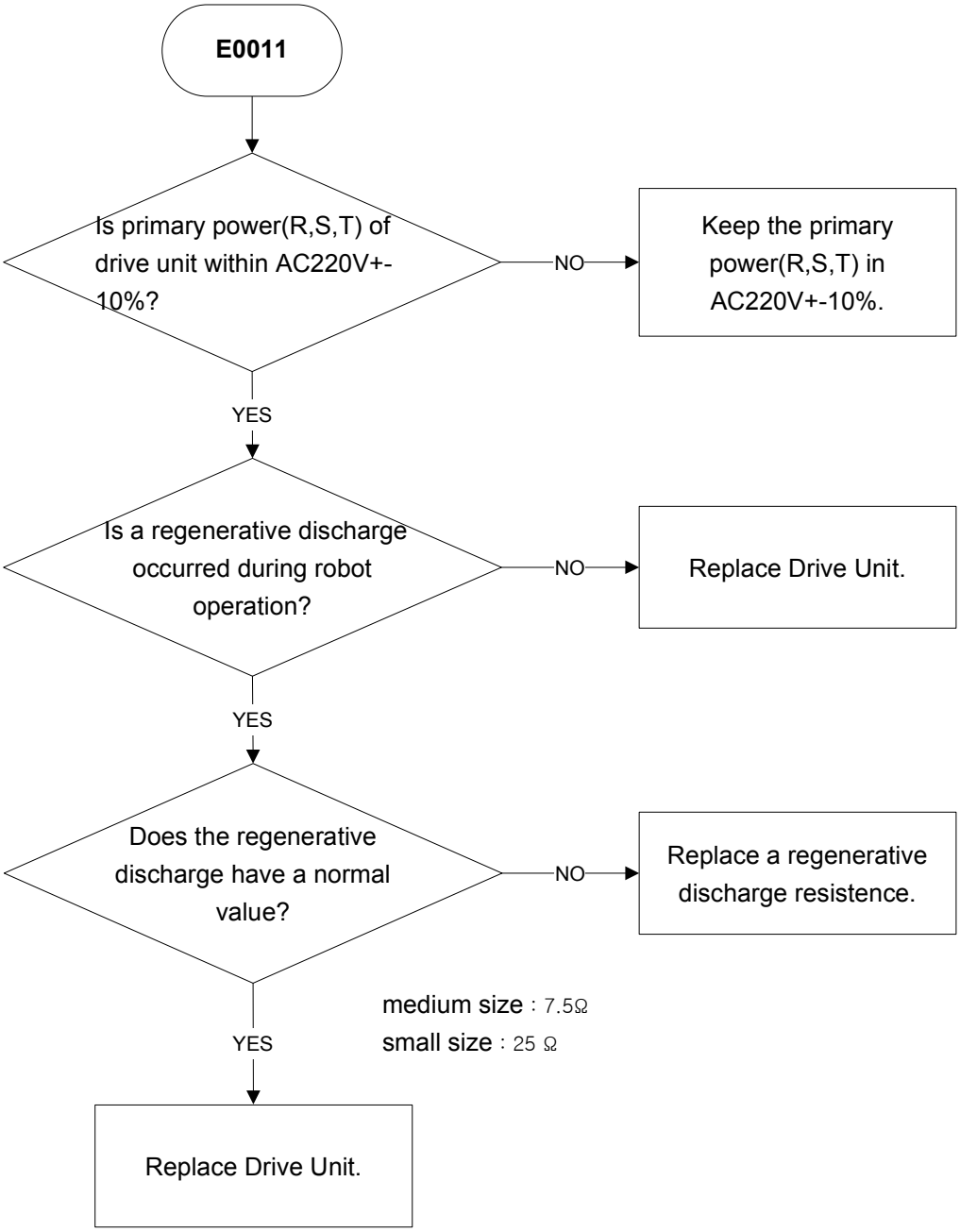


※ To reset encoder, connect the encoder connector R pin(RESET) to H pin(DC+5V) more than 5 seconds while controller power is ON.

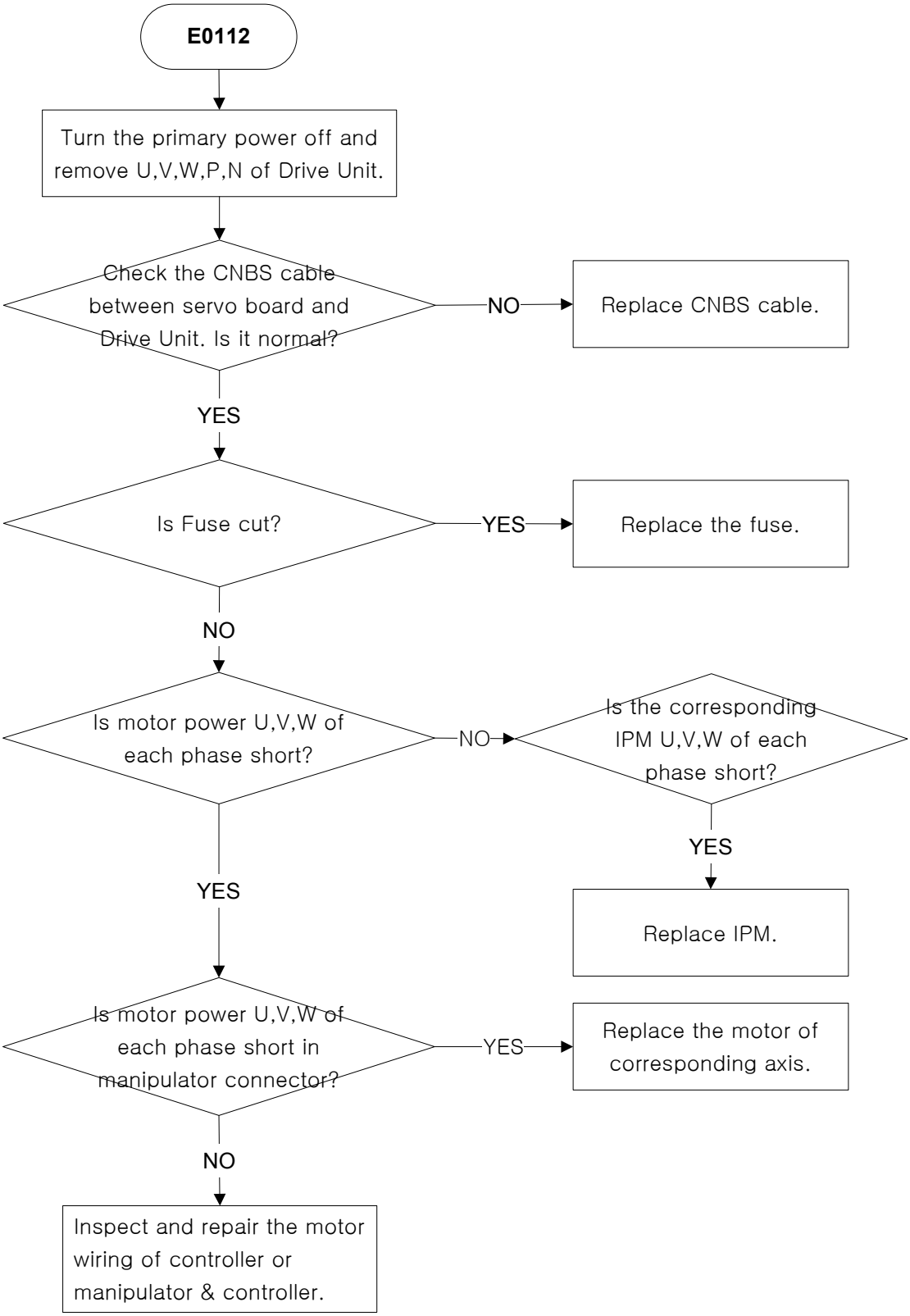
5.1.17. E0010 Discharge resister overheated(AMP)



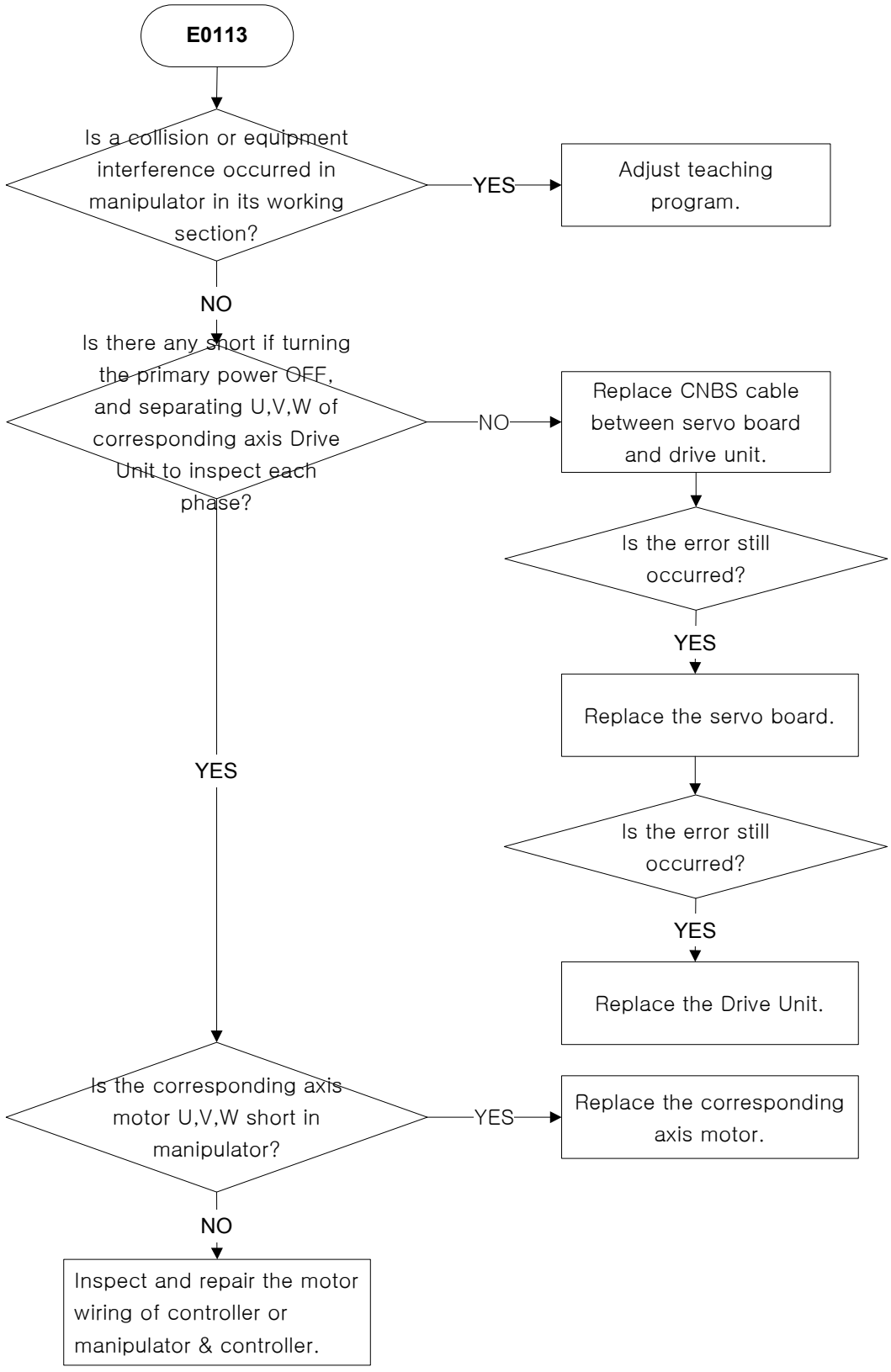
5.1.18. E0011 Overvoltage in the drive unit



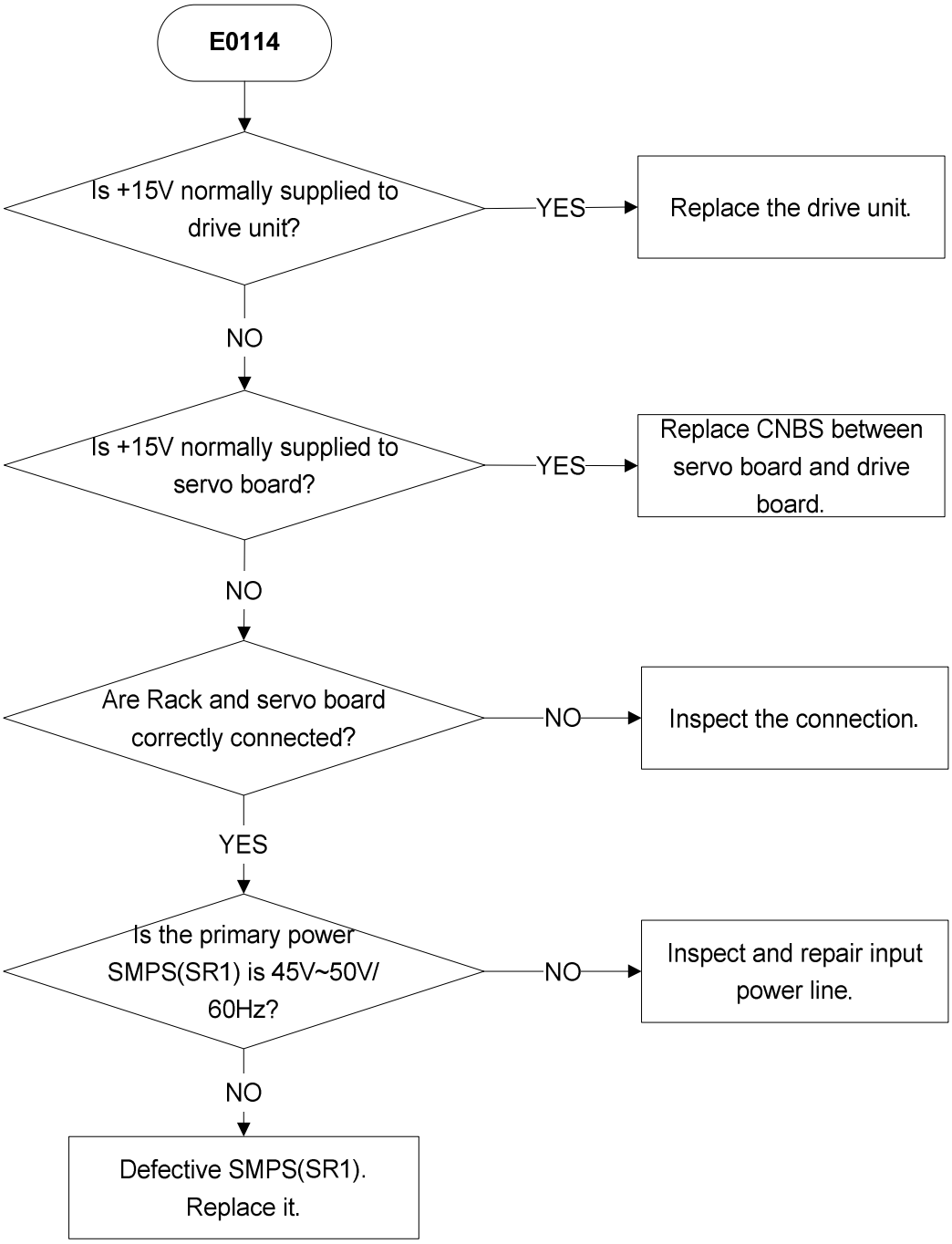
5.1.19. E0112 (Axis ○) Fuse blown or IPM fault(6Amp)



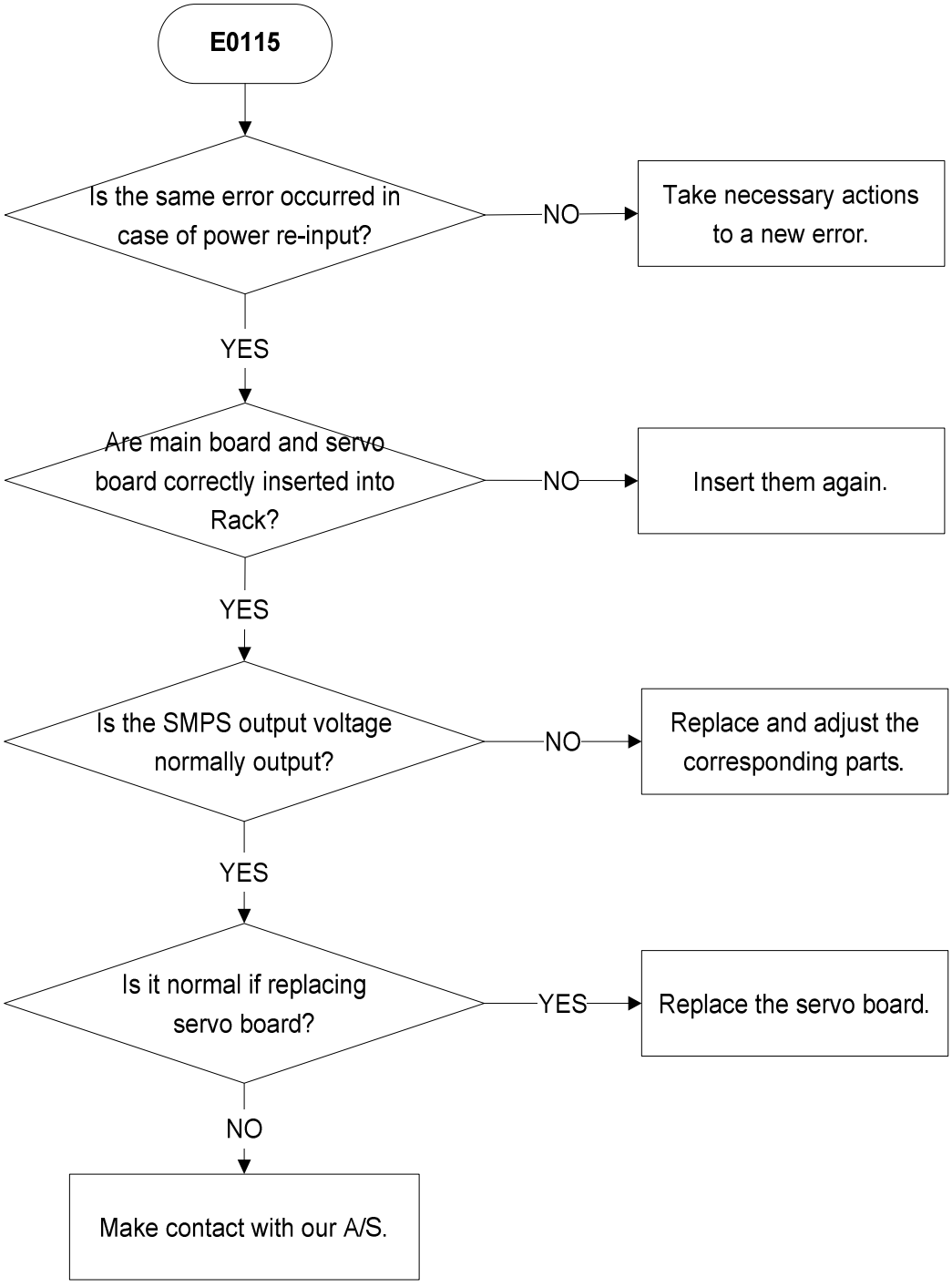
5.1.20. E0113 (Axis ○) Overcurrent



5.1.21. E0114 Control voltage drop(AMP)

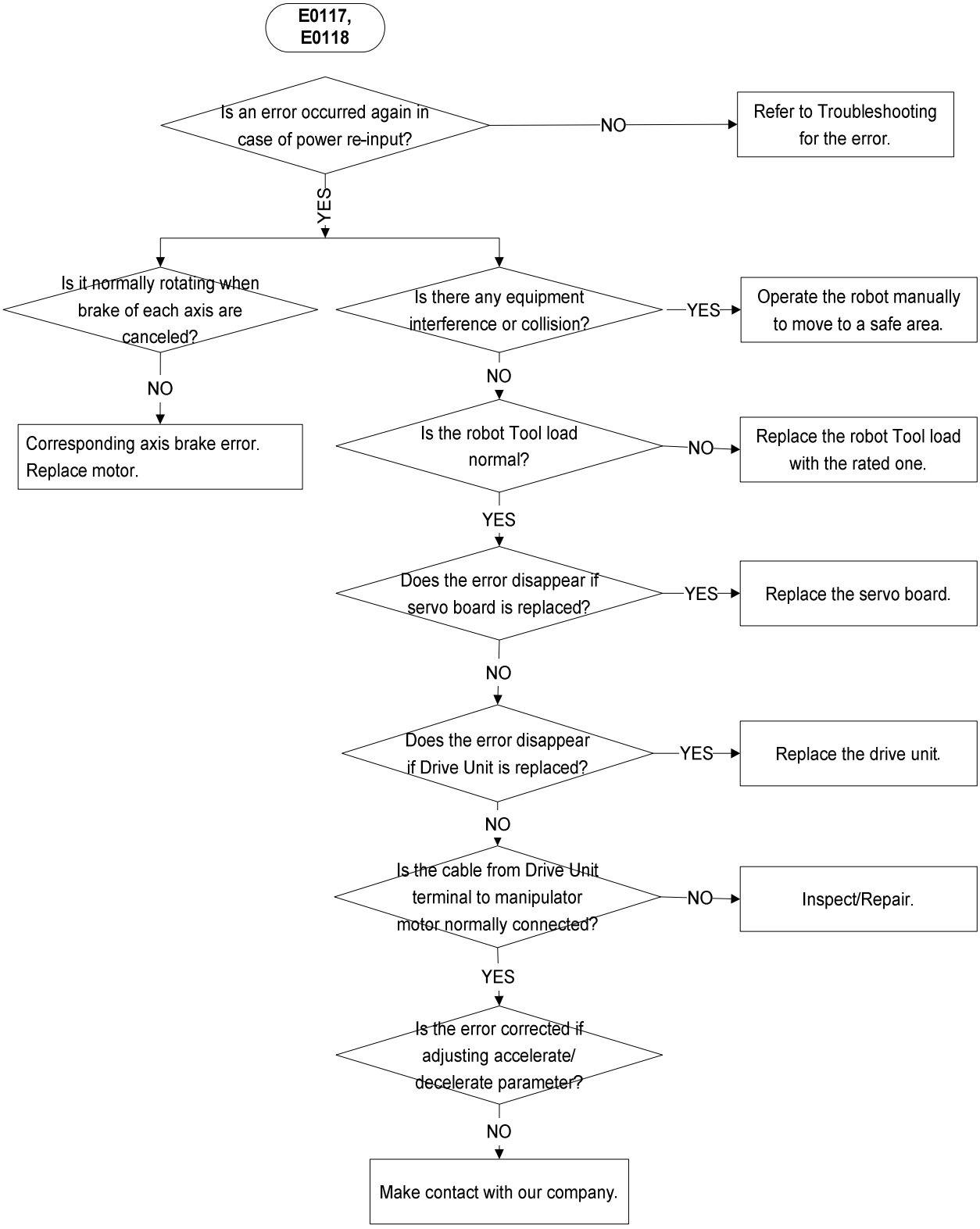


5.1.22. E0115 (Axis ○) Command Error



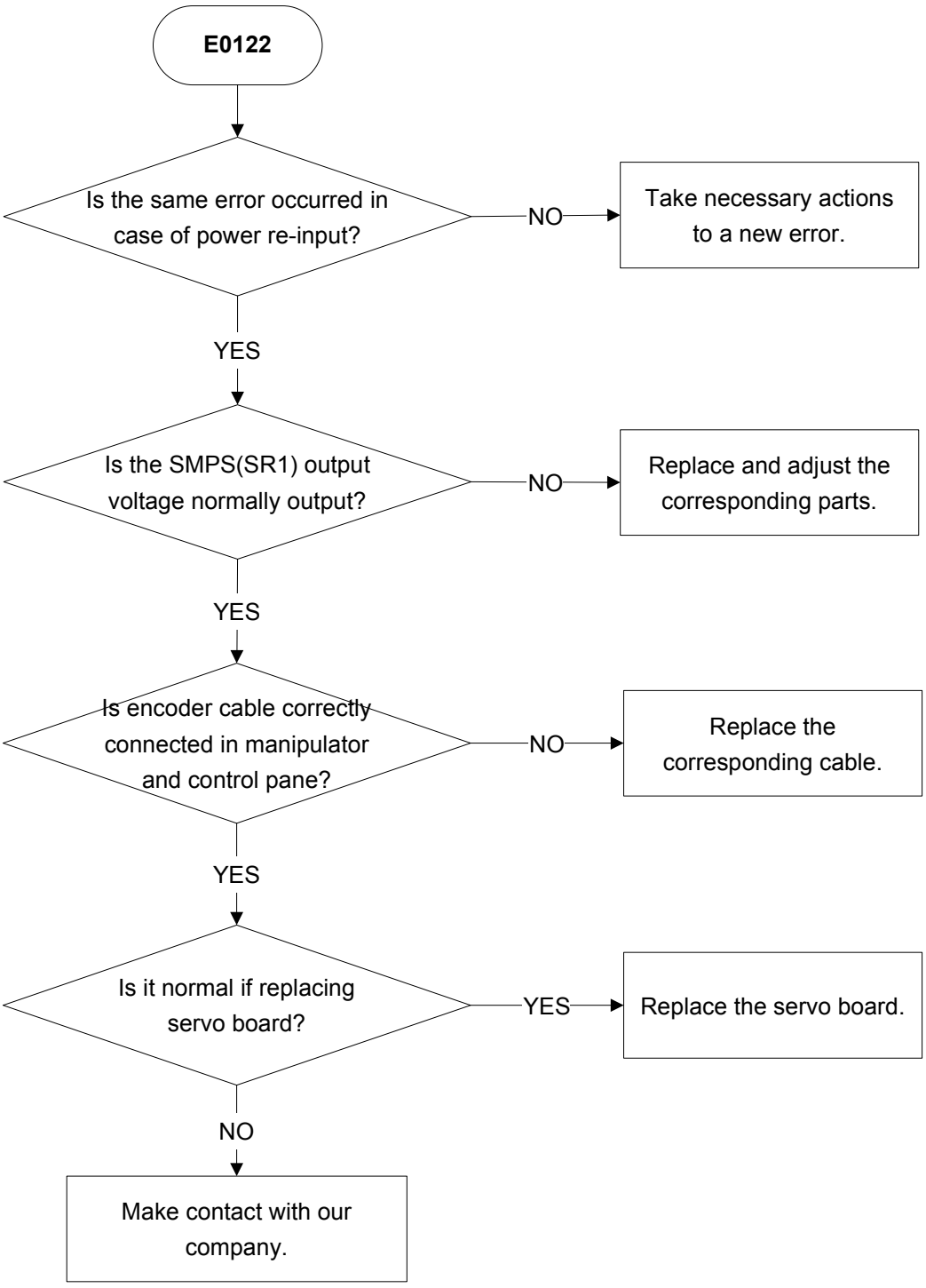
5.1.23. E0117 (Axis ○)Too large position drift

5.1.24. E0118 (Axis ○)Too large speed drift

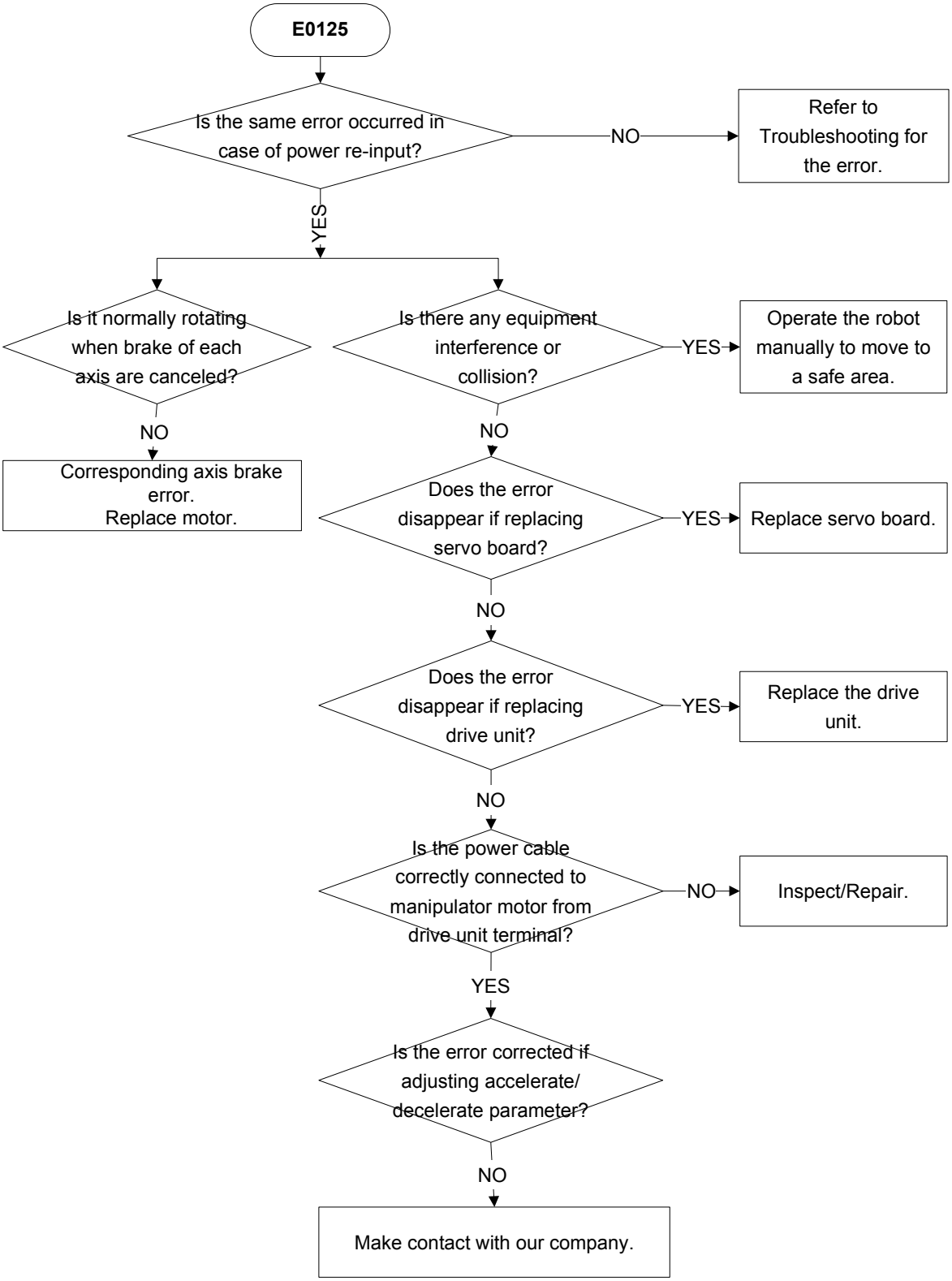


5.1.25. E0119 (Axis ○) Overload

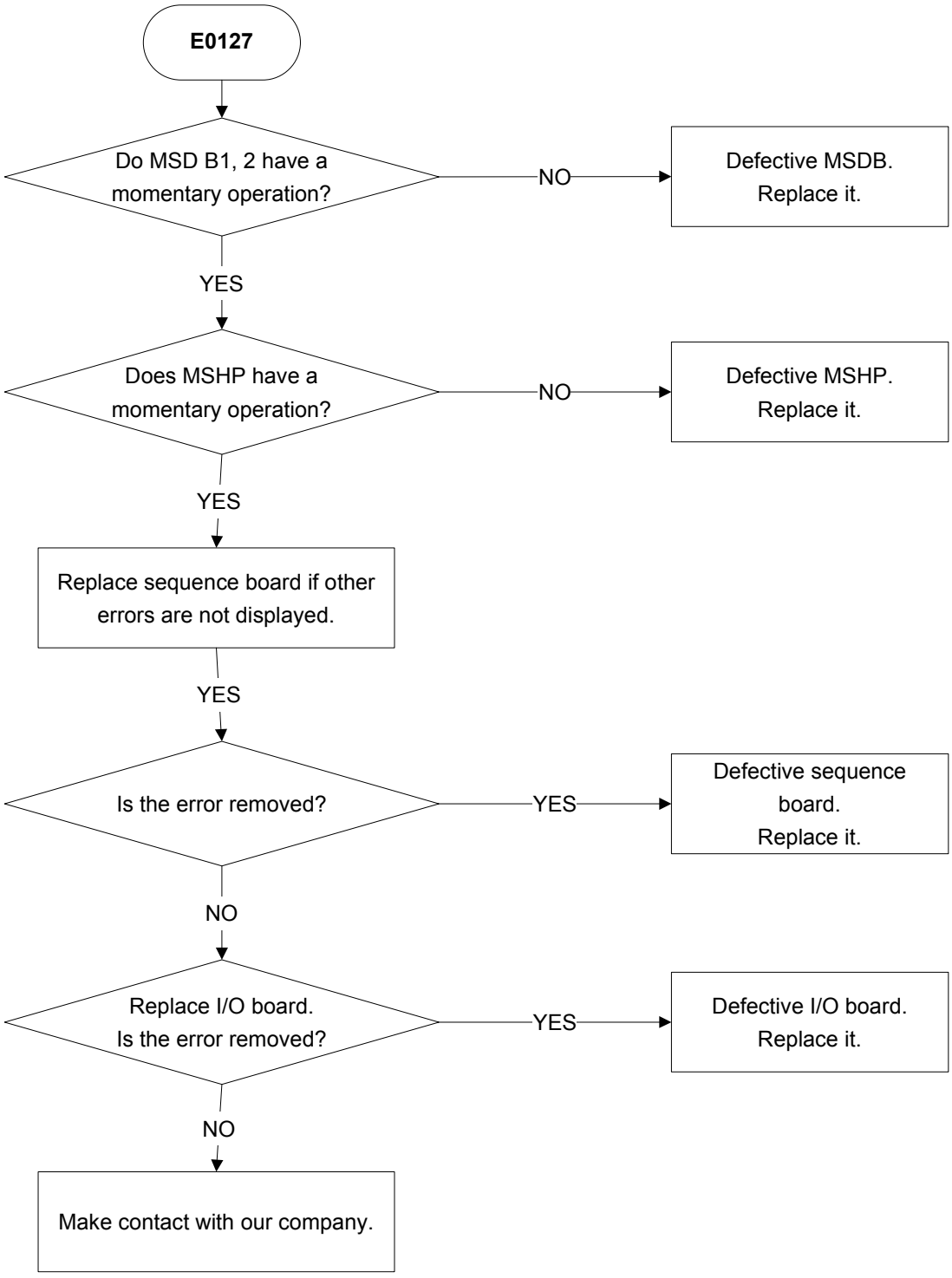
5.1.26. E0122 Cannot make servo on



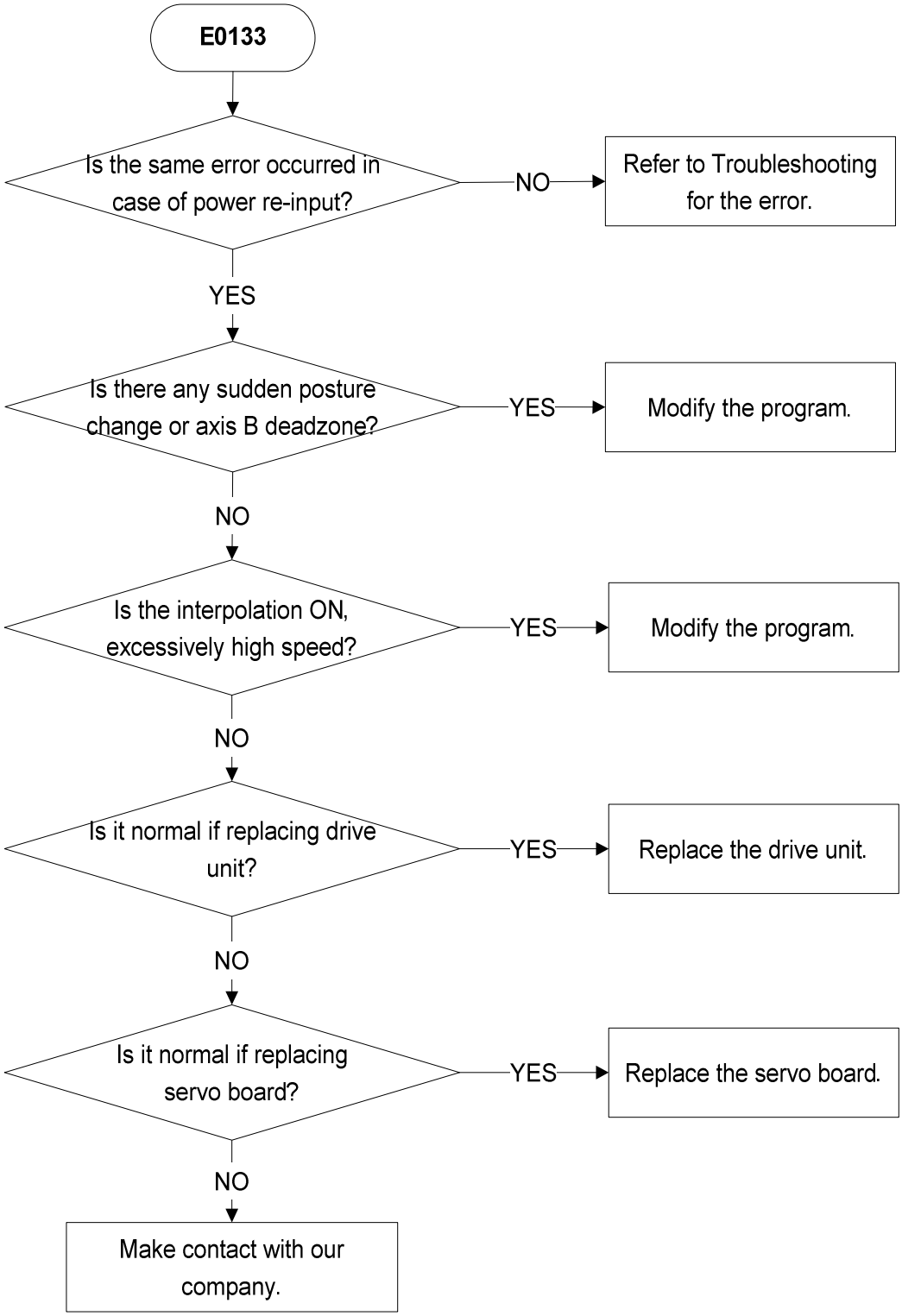
5.1.27. E0125 Accuracy not satisfied



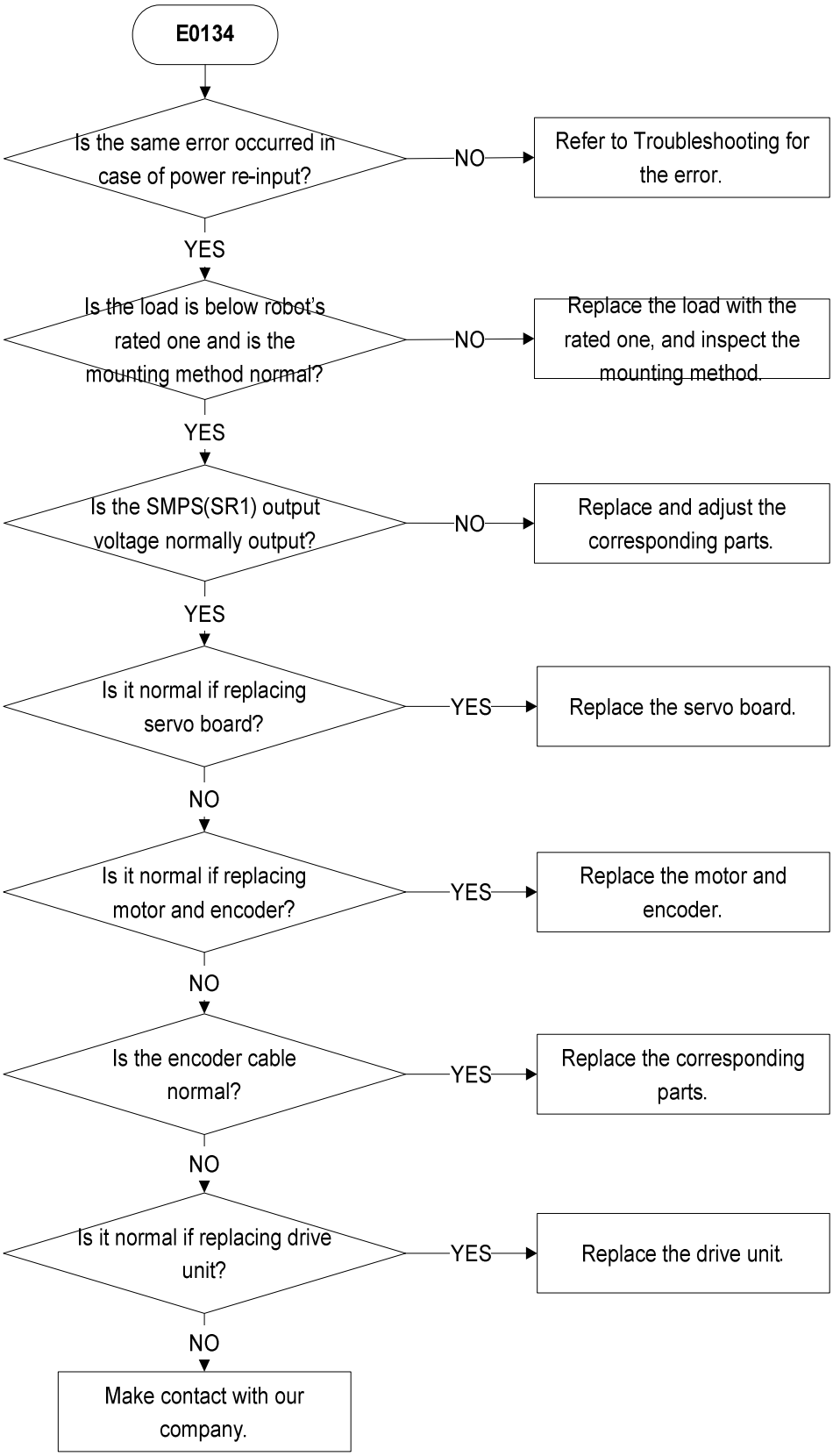
5.1.28. E0127 MSHP not work



5.1.29. E0133 (Axis ○) Command error



5.1.30. E0134 (Axis ○) Overspeed



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 Make your body(hands) potendiodynamic with 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 BD412 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 BD412 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 cauations, 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 guiderail 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 guiderail 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 supporing 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 BD411 board.**

Make a copy of the program/constant data which is copied prior to the replacement of BD411 in BD411 board memory by using (Notebook) PC or SRAM 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 damge 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 damge 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 Lithum 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 Lithum battery.

② Disconnect the primary power of controller.

③ Replace Lithum 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 guiderail 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 5-1 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 resistence in SR1
P15-M0	SR1 +15V-G1	**DC15V ± 0.5V**	(Note 1)
N15-M0	SR1 -15V-G1	**DC-15V ± 0.5V**	(Note 1)

Power	Measuring Location	Standard	Adjustment
P5E-M5E	SR1 +5V-GND	**DC5.4V ± 0.1V**	Volume resistence in SR1 (Note 2)
	Terminal stand for Robot external wiring & Connectors Pin P5E-M5E	**DC5.1V ± 0.1V**	Volume resistence 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-pahse 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)

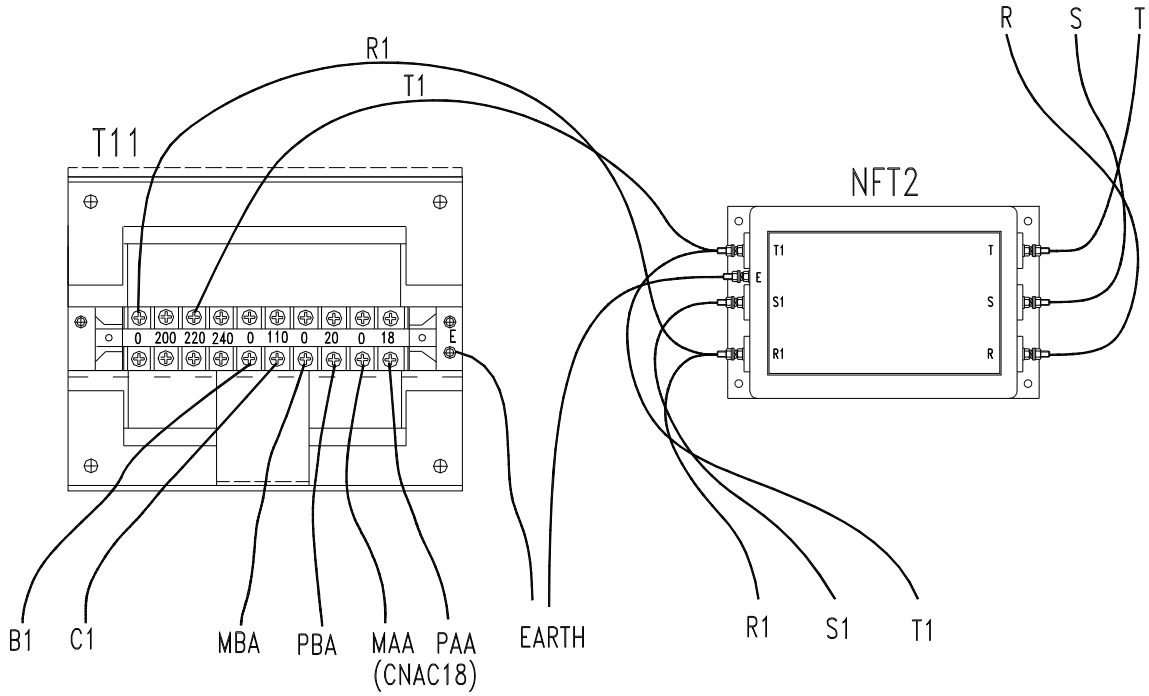


Fig. 5.1 Primary Power(AC220V specification)

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.

Hi4 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
- Details Power failure or CB(Circuit Braker) OFF during Motor ON
- Steps No need to take actions because it is to store the power failure in error records.

- Code E0002 H/W LMT switch on
- Details Limit switch that is installed at the edge of robot axis working envelope is operated
- Steps Refer to『5.1 Troubleshooting cases』.

- Code E0003 Overload relay or CP tripped
- Details With overcurrent in 220V power line in R,S,T 3phase, overload relay(OL) or molded case circuit breaker(CP) is operated.
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0004 Arm interference switch on
- Details Limit switch installed to prevent a robot ARM interference is operated.
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0006 Collision sensor on
- Details Collision sensor is operated.
- Steps Check if the tool of robot end-effector is transformed.
  Remove all the causes of errors before starting an operation.

- Code E0007 Sticking of weld detected
- Details Sticking of weld signal is input when welding sequence ends.
- Steps - Check the sticking of weld detection signal.
  - Remove sticking of weld.

- Code E0008 Motor temperature is risen
- Details Motor temperature is excessively increased.
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0010 Discharge resister overheated(AMP)
- Details When temperature of regeneration discharge resistence is increased above the standard, or when the overheat detecting sensor has errors, this error occurs
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0011 Overvoltage in the drive unit
- Details This error occurs when motor voltage(P-N) standard is exceeded.
- Steps Check the control panel AC input power.(used in the rated power)
  Check the connection of regeneration discharge resistence.

- Code E0012 Brake power error
- Details Brake voltage is dropped.
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0014 PWM error or E/S switch tripped
- Details With safety swtich(emergency stop, safeguard, motor overheating, limit switch, etc.) instant contact or servo board error, PWM instruction is not input to drive unit.
- Steps Check the safety switch.
  Check the CNSG cable of drive unit.
  If errors are found even after taking the above steps , make contact with our company.

- Code E0015 Teaching pendant does not work
- Details T/P error or communication failure.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0016 Servo drive unit error
- Details Motor is ON with servo drive errors.
- Steps Correct the error in case of power input, and then trun the motor ON.

- Code E0017 Conveyor pulse line trouble
- Details Conveyor pulse is not input.
- Steps - Check the conveyor encoder power.
  - Check the connection of conveyor encoder pulse line.
  - Replace the optional BD48X board.

- Code E0018 BD481 interface error
- Details Receiving data from the optional BD48X board is poor.
- Steps Check if the optional BD481X board is correctly mounted on I/O board.
  Check if No. 3 is ON in the DIP switch of I/O board.

- Code E0019 CNVY pulse count changed a lot
- Details The number of conveyor pulses is above the set point of “allowable frequency” in setting menu for system/applied parameter/conveyor/conveyor parameter
- Steps Check the “allowable frequency” set point.
  (menu : system/applied parameter/conveyor/conveyor parameter setting)
  Check if noise signal is input to the pulse line.

- Code E0021 Conveyor speed is too high
- Details “conveyor allowable speed ” is high.
- Steps Check the “conveyor allowable speed”.
  (menu : system/applied parameter/conveyor/conveyor parameter setting)
  Check if noise signal is input to the pulse line.

- Code E0022 Check up I/O board communi. cable
- Details Normal communication data from I/O board is not input to main board for 20msec.
- Steps Refer to『5.1 Troubleshooting cases』

- Code E0023 Fieldbus power is not supplied
- Details Power is not normally supplied to field bus.
- Steps Check the field bus supply line.

- Code E0024 Fieldbus network connection error
- Details Field bus cable is not correctly connected.
- Steps Check the connection of field bus connector.

- Code E0025 Fieldbus IDLE state
- Details PLC scanner, the field bus master, is not operating.
- Steps If PLC is in a program condition, change it to RUN condition.

- Code E0026 Fieldbus adapter response error
- Details Field bus function of I/O board is not normally operating.
- Steps Check the communication cable CNIO between I/O board and main board.
  Check the communication setting in system/control parameter/ serial port/I/) board (57600,8,1,nothing,nothing).
  Refer to『Maintenance Manual I/O Board』 to check the DIP switch setting.
  If not using the field bus, turn the “whether or not to use field bus” OFF.
  (menu : system/control parameter/inpu &output signal property/field bus setting)

- Code E0027 UCS module is not detected
- Details UCS module is not perceived.
- Steps Check if UCS module is correctly mounted on I/O board.
  If not using the field bus, turn the “whether or not to use field bus” OFF.
  (menu : system/control parameter/inpu &output signal property/field bus setting)

- Code E0028 In Jog-ON mode, Be changed to auto
- Details It is an error occurring when selecting an automatic mode from a manual mode during manual operation. It turns motor OFF to secure the operator’s safety in the fence.
- Steps Be sure to light out the jog-ON LED when selecting an automatic mode from manual mode.
  Light up the jog-ON LED to turn motor ON again.

- Code E0029 Fieldbus setting error
- Details For the built-in CC-Link module(Bd471), this error indicates a wrong setting of dip s/w which sets a speed and station number.
- Steps Set the dip s/w correctrly to have the value set to master setting, within the correct range of speed and station number.

- Code E0030 Mismatched AMP type & robot type!
- Details AMP type is not identical with the selected robot.
- Steps (1) Check the AMP type exclusive signal.
  (2) Check the selected robot type.
  (3) Check the PDLY of current loop gain.

- Code E0031 The mode switch is failure
- Details OP panel manual/automatic mode switch is broken or its connection has an error.
- Steps Check the mode switch or line connections.

- Code E0101 Need more DSP Boards
- Details Total number of axes is set to more than the controllable number of axes of servo board.
- Steps Check the total number of control axes.
  (menu : service/system diagnostic/system version) Add a servo board.

- Code E0102 Different arm type!
- Details It is an unsupportable robot type.
- Steps Check the set robot type.
  (menu : service/system diagnostic/system version)

- Code E0103 (axis ○) Enc Err:Process time over
- Details Encoder data is not received within communication processing time.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0104 (axis ○) Enc Err:Imperfect data frame
- Details Data is received but it is not a specified form.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0105 (axis ○) Enc Err:Cable not connected
- Details Communication is impossible because of encoder disconnection.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0106 (axis ○) Enc Err:Bad input data
- Details Data is received but it is not a specified form.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0107 (axis ○) Enc Err:Bad bit sequence
- Details Data is received but it is not a specified form.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0108 (axis ○) Enc Err:Encoder reset needed
- Details Encoder data is out of the offset function application range.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0112 (axis ○) Fuse blown or IPM fault(6Amp)
- Details - Fuse of corresponding axis in Drive unit is cut.
  - FAULT signal occurs in the IPM of corresponding axis.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0113 (axis ○) Overcurrent
- Details Motor or drive unit has a current over the allowable current value.
- Steps Refer to 『5.1 Troubleshooting cases』 .

- Code E0114 Control voltage drop(AMP)
- Details Control power +15V dropping, SMPS for regeneration contal in drive unit is unusual.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0115 (axis ○) Command Error
- Details The instruction code that servo board received from main board is wrong.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0117 (axis ○) Too large position drift
- Details Offset distance is larger than the set value.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0118 (axis ○) Too large speed drift
- Details Speed distance is larger than the set value( ).
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0119 (axis ○) Overload
- Details Motor is operting beyond its setting.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0121 Divided by zero
- Details If it is divided by 0 during calculation
- Steps Make contact with our company.

- Code E0122 Cannot make servo on
- Details Servo is not ON within the limit time when operating the servo ON or canceling the power saving mode.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0123 Cannot make servo off
- Details Servo is not OFF withing the limit time when operating the servo OFF or starting the power saving mode.
- Steps - Repalce the servo board.
  - Make contact with our company.

- Code E0124 Cannot clear servo error
- Details Motor cannot be ON because of servo error.
- Steps Take necessary action to the servo error in problem.

- Code E0125 Accuracy not satisfied
- Details Even after 10 seconds, the current value is not reached the target location.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0126 Trial to go out of workspace
- Details It is the case that the attempted work is out of working envelope.
- Steps Check if robot is reachable to the target location of work.

- Code E0127 MSHP not work
- Details MSHP is not working.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0131 (axis ○) Bit jump error (high level)
- Details Current speed is in excess of high speed detection level(BJH) during a normal speed operation.
- Steps - Check the CNEC connector of servo board.
  - Check the CNR4.
  - Check if the BJH setting is 1.5 times as the maximum speed.

- Code E0132 (axis ○) Bit jump error (low level)
- Details Current speed is in excess of low speed detection level(BJL) during oow speed operation(Jog, step forward/backward, low-speed instruction signal input that is set for the assignment of input signal)
- Steps - Check the CNEC connector of servo board.
  - Check the CNR4.
  - Check if the BJH setting is 1.5 times as the maximum speed.

- Code E0133 (axis ○) Command error
- Details Location instruction sent to servo board is unusual.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0134 (axis ○) Overspeed
- Details Location instruction sent to servo board is in excess of maximum speed.
- Steps Refer to 『5.1 Troubleshooting cases』

- Code E0137 (axis ○) Encoder pulse setting error
- Details “PULS” value for encoder pulse in servo parameter is an unavailable value.
- Steps Check the “PULS” value in servo parameter .

- Code E0138 Can't return to previous position
- Details Returning time of Previous position value is exceeded.
- Steps - Check the set value of servo loop gain.
  - Cehck the encoder power voltage.
  - Check the encoder wiring.

- Code E0139 Can't clean up DSP Filters
- Details Communication is poor between main board and servo board.
- Steps - Check the connection of main board or servo board.
  - Replace the main board or servo board.

- Code E0140 MSPR does not work
- Details Relay for drive unit primary power supply is not working.
- Steps Check the CNPC cable of drive unit and MSPR relay.

- Code E0151 Improper step command
- Details Robot is unable to work because of incorrect information.
- Steps Make contact with our company.

- Code E0154 Tip consumption exceeded maximum.
- Details Total tip consumption detected by gun search is in excess of the max tip consumption set in the servo gun parameter.
- Steps - Check the max tip consumption of servo gun parameter.
  - Repalce the tip.

- Code E0155 Move-tip consumption exceeded max.
- Details Shift tip consumption detected by gun search is in excess of the masimum shift tip consumption set in the servo gun parameter.
- Steps - Check the max tip consumption of servo gun parameter.
  - Repalce the tip.

- Code E0156 Fix-tip consumption exceeded max..
- Details Fixed tip consumption detected by gun search is in excess of the masimum shift tip consumption set in the servo gun parameter.
- Steps - Check the maxi fixed tip consumption of servo gun parameter.
  - Repalce the tip.

- Code E0157 (axis ○) Too large skew error
- Details It may be occurred in a gantry type robot suppoting the 2-axis function. Torsion in the traverse axis is larger than the set torsion for the 2-axis servo parameter.
- Steps Adjust the torsion deviation level of 2-axis servo parameter.

- Code E0158 Skew error compensation Timeout
- Details When turning motor ON in the gantry type robot supporting the 2-axis function, torsion returning is in excess of its limit time of 5 seconds.
- Steps - Check if there are any obstables in the covering axis.
  - Check the encoder power voltage and wiring.
  - Replace the motor.

- Code E0159 Joint speed CMD over the limit
- Details It is a sudden rotating posture of axis during interpolating operation.
- Steps - Lower the step record speed.
  - Change the corresponding step posture.

- Code E0160 (axis ○) collision detect
- Details Disturbance torque is in excess of collision detecting level.
- Steps 1) For a collision, remove its cause.
  2) Adjust the collision detecting level.

- Code E0161 (axis ○) shock detect
- Details Disturbance torque change rate is in excess of impact detecting level.
- Steps 1) For a collision, remove its cause.
  2) Adjust the impact detecting level.

- Code E0162 (axis ○) current sensor error
- Details Current feedback offset vaule of AMP is too high.
- Steps 1) Check the +/-15V power of complex power unit.
  2) Replace the BD440 board.
  3) Replace the AMP.

- Code E0163 Axis drifted during power saving
- Details Axis position is changed during power saving operation.
- Steps Check the motor brake operation.
  Power saving function may not used if the additional axis without brake is forced in a direction of gravity. Set the power saving function to Disable.

- Code E0170 MotStopWait(5Sec) TimeOut
- Details It took 5 seconds to decelerate and to stop completely when stop is input during operation.
- Steps Make the sum(it is a sum that accelerating time and decelerating rate of accelerate/decelerate parameter) less than 5 seconds.
  Refer to Acclerate/decelerate Parameter in MANUAL.

- Code E0171 Gun open time is over
- Details It took more than 5 seconds for the open time after applying pressure in spot welding and gun search functions.
- Steps - Check if the gun is deposited on weldment or if any interference occurs.
  - Check any deposit or interference of shift gun.

- Code E0172 (axis ○) Improper Endless rotation
- Details Difference between the endless axis encoder value that is backed up and the read value when initializing is more than 0x20000.
- Steps - Calibrate the endless axis encoder offset once again.
  - Reset the endless axis encoder and then Calibrate the encoder.

- Code E0173 Endless rotation overflow
- Details Recorded location of endless step is in excess of encoder using range.
- Steps Reset the endless position manually with R350 code, and then correct the step position.

- Code E0174 1st servo CPU initialize error
- Details DSP1 of the 1st servo board is not responding to the completion of initialization.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0175 2nd servo CPU initialize error
- Details DSP2 of the 1st servo board is not responding to the completion of initialization.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0176 3rd servo CPU initialize error
- Details DSP1 of the 2nd servo board is not responding to the completion of initialization.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0177 4th servo CPU initialize error
- Details DSP2 of the 2nd servo board is not responding to the completion of initialization.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0178 Incorrect 1st servo CPU version
- Details The currently set robot function cannot be used because of low version of ROM in DSP1 of the 1st servo board.
- Steps Make contact with our company.

- Code E0179 Incorrect 2nd servo CPU version
- Details The currently set robot function cannot be used because of low version of ROM in DSP2 of the 1st servo board.
- Steps Make contact with our company.

- Code E0180 Incorrect 3rd servo CPU version
- Details The currently set robot function cannot be used because of low version of ROM in DSP1 of the 2nd servo board.
- Steps Make contact with our company.

- Code E0181 Incorrect 4th servo CPU version
- Details The currently set robot function cannot be used because of low version of ROM in DSP2 of the 2nd servo board.
- Steps Make contact with our company.

- Code E0182 1st servo CPU communication error
- Details Communication is poor between main CPU and the DSP1 of the 1st servo board.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0183 2nd servo CPU communication error
- Details Communication is poor between main CPU and the DSP2 of the 1st servo board.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0184 3rd servo CPU communication error
- Details Communication is poor between main CPU and the DSP1 of the 2nd servo board.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0185 4th servo CPU communication error
- Details Communication is poor between main CPU and the DSP2 of the 2nd servo board.
- Steps - Check the mounting condition of servo board.
  - Replace the servo board.

- Code E0186 1st servo CPU found main CPU error
- Details DSP1 of the 1st servo board detected a watchdog error in MAIN.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0187 2nd servo CPU found main CPU error
- Details DSP1 of the 2nd servo board detected a watchdog error in MAIN.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0188 3rd servo CPU found main CPU error
- Details DSP1 of the 2nd servo board detected a watchdog error in MAIN.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0189 4th servo CPU found main CPU error
- Details DSP2 of the 2nd servo board detected a watchdog error in MAIN.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0190 Improper encoder reception
- Details Undefined error code is received from servo board when receiving the initial absolute position data of encoder.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0191 Not defined servo error found
- Details Undefined error code is received from servo board during operation.
- Steps - Check the mounting condition of servo board or main board.
  - Replace the servo board or main board.

- Code E0192 AUX amp number error
- Details Additional axis drive unit numbers are numbered repeatedly.
- Steps Check if BD, DSP, AXIS numbers are numbered repeatedly in a constant setting of additional axis.

- Code E0193 (axis ○) Improper Encoder for Endless
- Details Pulses per rotation is incorrectly set in the first time of endless axis encoder type.
- Steps Check if PULS value is 1024, 2048, 4096, 8192 for the servo parameter/motor, encoder type in the menu.

- Code E0194 Load weight is too heavy
- Details Load capacity is in excess of 120% of rated robot.
- Steps 1) Check the weight in tool data.
  2) Lighten the tool weight.

- Code E0195 Sync Axes must use only 1 DSP
- Details To execute the robot control, 2 of robot axes should be all controllable in one of DSP.
- Steps Change the system so that one of DSP can control all the two of robot axes. If adding an axis to 5-axis or less robot, it is possible to make a system that robot is controlled by one of DSP. However, if adding an axis to 6-axis or more robot, one more servo board is required because two of axes cannot be assigned to one of DSP.

- Code E0200 (axis 0) Speed over while cooperating
- Details An instruction in excesse of robot maximum speed is input during cowork operation.
- Steps Change the robot posture, cowork record position, or lower the record speed in a standard position of Slave which has the cowork operation.

- Code E0201 Start time mismatch
- Details There is an error in receiving/sending signals between cowork robots. It was playedback in different modes.
- Steps Check the communication condition. Match the modes between cowork robot before operating.

- Code E0202 Partener robot is error stoped
- Details Partner robot stops in an unsupporting status during cowork operation. It is impossible to assist, and thus stops.
- Steps Check if the operating modes are indetical between robots. If restarting after the stop in cowork operation, start the Slave first before starting the Master.

- Code E0203 Partner robot is Emergency
- Details Partner robot motor is OFF during cowork operation. It turns motor OFF to stop.
- Steps Take necessary actions to the cause of partner robot. Turn motor ON and re-start it.

- Code E0204 Rbt#1 Communication is not working
- Details Communciation with the corresponding robot is disconnected during cowork, jog, and play.
- Steps Check if the connection between communication line and communication card is good. Error can be detected by Hint diagnostic.

- Code E0205 HiNet is not working
- Details Hinet communication for cowork is not working.
- Steps Check if connection between communicatin line and communication card. Error can be detected by Hinet diagnostic.

- Code E0206 Jog Prohibited - Master overlaped
- Details Jog is operated while setting more than two Master robots.
- Steps Set only one Master robot to operate, and change the other robot setting as Slave or individual operation.

- Code E0207 Jog Prohibited - No slave selected
- Details Jog is operated while slave robot is not selected or cowork is not ready.
- Steps Specify the cowork-required robot as Slave, and operate the robot with motor ON, manual mode, and jog OFF.

- Code E0208 Duplicated robot number is set
- Details Cowork is impossibile because of overlapping robot numbers.
- Steps Check to see if the overlapping robot numbers connecting to Hinet, and change them, if any, and then apply power again.

- Code E0209 Slave jog status are changed-Stop
- Details Slave setting is changed during cowork jog operation.
- Steps Make the Salve you intend to operate in a possible condition of cowork, and operate the jog. Be sure not to change the condition of Slave during jog operation.

- Code E0210 Fail of Init. of SVG Connection
- Details Initializing the servo gun connection failured as GUNCHNG ON is instructiond or manual welding gun connection is instructioned.
- Steps Check the DSP version is higher than 4.13. In case of lower version, make contact with our company to upgrade. Check if ATC connection is poor or if encoder power is not applied.

- Code E0211 SVG Servo On fail in time limit
- Details Servo of servo gun is not ON within the limit time.
- Steps It is because ATC does not normally process encoder signal due to its poor connection. Remove any foreign matters from ATC, and try again.

- Code E0212 SVG's Servo filter clear is failed
- Details Filter clear failed during servo gun connection.
- Steps Communication is poor between mainboard and servo board. Check the connection between each board and controller. If no error is found, replace board.

- Code E0213 SVG Servo Off fail in time limit
- Details Servo is not OFF within the limit time while separating the servo gun.
- Steps Check the condition of ATC connection. Replace the servo board.

- Code E0214 SVG Encoder power is not connected
- Details When processing the servo gun connection, the encoder power connection failed.
- Steps Check errors in power control system of servo gun axis encoder, and replay the corresponding part(relay, BD481).

- Code E0215 SVG Encoder power off is failed
- Details When separating the servo gun axis, encoder power separation failed.
- Steps Check errors in power control system of servo gun axis encoder, and replay the corresponding part(relay, BD481).

- Code E0216 SVG Encoder data error
- Details The result of encoder receiving is abnormal in the processing of servo gun axis connection.
- Steps Check the followings on the connected servo gun.
  Check if encoder battery is discharged, and replace it if so.
  After replacing battery, reset encoder first before retry.(Be aware that encoder offset reset is required after encoder reset.)

- Code E0217 Acc/Decel parameters are not sync
- Details Maximum speed, accelerating time, and decelerate rate should be all identical among 2 of robot axes, but in this case, the above parameters have different values.
- Steps Check the accelerate/decelerate parameter of robot, and make the robot axis accelerate/decelarte parameters identical with those of robot.

- Code E0218 axis (0) is overload.
- Details Overload occurs in the corresponding axis. Much more current than the rated current(Ir) for servo parameter was applied.
- Steps Check any errors in overload detecting level for the servo gun. Check if servo gun has any mechanical errors. Do not continue to apply pressure with excessive current than the rated current.

- Code E0219 Couldn't execute SMOV W/O SELSTN
- Details Positioner robot instruction(SMOV) may not be executed for the station that is not selected by SELSTN instruction(positioner individual operation instruction)
- Steps Select correctly the station to use in SELSTN instruction. Make the station numbers in SMOV instruction identical with the numbers selected in SELST N.

- Code E0220 Encoder noise
- Details Robot's current position is not identical with the position re-read in encoder. Noise flows in the encoder.
- Steps Check the encoder voltage, cable connection, and grounding of controller and robot.

- Code E0221 failed to receive encoder
- Details The attemption to receive the absolute value of encoder data from encoder in instruction to check the encoder noise inflow is failed.
- Steps Check the encoder voltage, cable connection, and grounding of controller and robot.

- Code E0222 Coincident enterence to same cube
- Details The location where robot TCP is currently entered is the cube area of other robot. The simultaneously entering robot to the same cube is a deadlock, so play back cannot be proceeded.
- Steps Move the robot out of cube envelope by using a jog in a manual mode. Adjust the program to avoid a deadlock during playback.

- Code E0223 encoder line cut or comm. err
- Details Errors occur while receiving position data from serial encoder.
- Steps Check the encoder voltage, cable connection, and grounding of controller and robot.

- Code E0224 encoder status error occured
- Details Errors are received from encoder such as Overflow, overspeeding, intenal condenser voltage, LED error, etc.
- Steps If errors continue to occur even after error reset in the encoder reset function, replace the encoder(motor).

- Code E0225 Softlimit exceed encoderlimit
- Details The currently set softlimit is in excess of the available range encoder.
- Steps If control constant file (ROBOT.C01) is newly loaded to controller, initialize encoder offset calibration, axis constant set-up, and softlimit set-up in sequence after encoder reset for the corresponding axis. Or otherwise, check the limit and set it to an adequate position.

- Code E0226 exceed encoder limit
- Details It is impossible to move to the instruction position that exceeds the allowable encoder range.
- Steps Convert it to the axis coordinate system in a manual mode, and make the jog operation to the origin direction in a system setting mode. If the allowable encoder range is abnoramel, reset the encoder and then initialize the corresponding axis again.

- Code E0227 Seq. error of Cooperative control
- Details There is a difference in instruction sequence between master robot and slave robot during cowork control.
- Steps Check the connection of network for cowork control. Check if slave is excecuting power saving function. Set the power saving function of slave robot as Disable.

5.4.2. Operation Error

- Code E1001 Program not found
- Details The corresponding program does not exist in controller.
- Steps Check the program number before selecting.

- Code E1002 Step not found
- Details Step number is selected bigger than the total step of current program.
- Steps Check the step number before selecting.

- Code E1003 Too many files(It's more than 255)
- Details Maximum number of files is limited to 255 in controller.
- Steps Delete unnecessary files before programming.

- Code E1004 The number of axis not match.
- Details Selected program has different number of robot axis from the registered one in machine constant.
- Steps It seems that it is other robot's program or that other robot program which has different is selected. Please check it up.

- Code E1005 Check CNVY Sync: program, C01 file
- Details Conveyor program is selected while machine constant file does not support the conveyor or vice versa.
- Steps Select other program or renew the program.

- Code E1006 Memory full
- Details It is programmed with insufficient capacity in program storage.
- Steps Delete unnecessary files before programming.

- Code E1007 Brake slipped!(Excess of 50mm)
- Details Brake slip is in excess of 50mm during stud welding pressurizing.
- Steps Check the pressure.
  Check the motor slip of all axes, and replace a motor that has bigger slip than the other axis motors.

- Code E1008 Excessive brake slip count!
- Details The frequency of exceeded brake slip by stud welding pressure is in excess of “frequency of aberrant error detection” that is set in parameters system/applied parameter/spot & stud/welding.
- Steps Check the pressure.
  Check the motor slip of all axes, and replace a motor that has bigger slip than the other axis motors.

- Code E1009 Simultaneous file access confined
- Details For the same file, such operations as controller external-> internal copying and internal ->external copying cannot be done at the same time. (RS-232C, ethernet, SRAM card)
- Steps Wait for a while until other copying is done, and try again.

- Code E1010 More teach points required
- Details The number of steps in recording program for setting the User coordinate system or automatic setting for conveyor degree.
- Steps - Automatic setting for conveyor degree : 2 of steps(straight line), 3 of steps(round shape) required
  - Setting for User coordinate system : 3 of steps required

- Code E1011 Points too close to one another
- Details Step positions of recorded program for automatic setting for conveyor degree is too close each other so that conveyor degree cannot be obtained.
- Steps For straight line conveyor, record 2 points at intervals of approximately 1m.

- Code E1012 Recorded points are linear
- Details In a program for User coordinate system setting, coordinate system data cannot be obtained because 3 of steps exist in a straight line.
- Steps Refer to Operation Manual, and position the 3 points in the same plane but in a straight line.

- Code E1013 Function not found
- Details Corresponding plane to the number does not exist.
- Steps Check the step's plane number.

- Code E1014 Failed in allocating file handle
- Details Throughout several routes, more than 4 copying work was attempted. (RS-232C, ethernet, SRAM card)
- Steps Wait for a while until other copying is done, and try again.

- Code E1015 Protected program
- Details Protected program is not possible to edit by steps.
- Steps Cancel protect in the corresponding file in service/file management/protect before executing.

- Code E1016 Can't modify (No parameters)
- Details The plane that has no factor to change is selected and attempted to change in individual change of function.
- Steps Check the function to change.

- Code E1017 No contents
- Details Unprogrammed program is attempted to delete or change.
- Steps Check the selected program.

- Code E1018 Program has no step data
- Details Corresponding number of step does not exist.
- Steps Check the step number.

- Code E1021 Unassigned weld condition signal
- Details The number of signals to ouput is more than the number of those to input in welding condition signal.
- Steps Check the assigned welding condition signal in system/control parameter/ input/ouput signal setting.

- Code E1023 Checksum error at the step
- Details Check Sum of teaching step is wrong.
- Steps Delete the selected step, and add it again.

- Code E1024 Palletizing program changed
- Details Program cannot be changed and restarted during palletizing.
- Steps Initialize the palletize counter, and reset the counter value before using.

- Code E1026 More steps than 4 are needed.
- Details The recorded steps in program for automatic constant setting should be at least more than 4 steps.
- Steps When programming the automatic constant setting, recorde more than 6 steps , if possible, and program to have several postures.

- Code E1027 Program damaged.
- Details Backup memory is damaged, so program for automatic constant setting is damaged.
- Steps Initialize the memory with support of our A/S staff.

- Code E1028 It is not the same tool.
- Details There is a difference in number between tool for automatic constant setting and recorded tool in setting program.
- Steps Make the tool numbers equivalent.

- Code E1029 Robot type not applicable.
- Details It supports automatic constant setting only for 6-axis multi-articulated robot.
- Steps - Doublecheck the system/initialization/robot type setting.
  - Directly measure and input the set value.

- Code E1030 Auxiliary axes not applicable.
- Details If recordingthe automatic constant setting program for additional axis robot, do not move the additional axis.
- Steps Move only the robot's basic 6 axes to program for setting.

- Code E1031 Pose data not good.
- Details Automatic constant setting function cannot be executed because the recorded postures in automatic constant setting program are similar each other.
- Steps Record different postures as much as possible. In particular, teach to largely change the wrist axis in each step.

- Code E1032 Too big change of Axis Constant!
- Details Calibration value for axis constant resulted from automatic constant setting function is too large so that it may cause a danger in robot operation.
- Steps Check if robot type is correctly selected.
  Move the robot to standard Pin position to set the axis constant. And then operate the automatic constant setting function again.
  Renew the automatic constant setting program to minimize the distance error between steps.

- Code E1034 Collision sensor on
- Details Collision occurs.
- Steps Check any errors in the shape of tool.
  If there is no cause of error any more, re-operate the robot.
  If collision is not occurred, check the signal logic of system/users environment/collision sensor.

- Code E1035 Works over permitted No. entered.
- Details If Allowable is selected from "multiple workpiece enter=<allowable, error, ignorable" in the system/applied parameter/conveyor/conveyor parameter setting menu, robot allow the multi workpiece to enter during conveyor working. Here, total number of entered workpiece is more than 10 pieces.
- Steps Stop the sytem, and clear the process before restarting the line.

- Code E1036 Welding Interlock time is over.
- Details In case of srvo gun welding operation, welding competion(WI) signal is not input during WI input standby in system/applied parameter/spot & stud/servo gun welding data(condition, sequence)/welding sequence menu.
- Steps Check the connection of current Welding signal /welding condition signal/welding competin signal and relevant peripheral equipment. If errors occur, refer to "Processing without WI input" of system/applied parameter/spot & stud/servo gun welding data(condition, sequence)/common data in instruction to determine whether to standby until welding completion(WI) signal is input or stop the robot.

- Code E1038 Can't record tip consump. position
- Details When calibrating the tip consumption and recording the position, robot is postured not to calibrate the tip consumption.
- Steps Make sure that the robot posture for calibrating as much as the detected tip consumption should not be out of working envelope.

- Code E1039 Tolerance of sync. exceeded range.
- Details Torsion of mechanical position between the two axes is in excess of the allowable value set in the 2-axis robot servo parameter when operating the covering axis robot for 2-axis robot machine.
- Steps - Set the servo gain between the 2 axes to the same.
  - Raise the Kp gain of delayed axis.

- Code E1040 In this robot type, can't provide.
- Details Interpolation ON(straight line, circular arc) cannot be used in the covering axis robot for 2-axis robot machine.
- Steps Adjust the step to interpolation OFF before starting robot.

- Code E1041 Axes over at this positioner Group
- Details The number of axis for positioner group is in excess of 2.
- Steps Set the value less than 2 for the corresponding group in system/initialization/positioner group setting.

- Code E1042 Not support REFP step for calibr.
- Details In the positioner calibration program, reference point(REFP) cannot be recorded.
- Steps Record Step instead of the reference point(REFP) in steps of calibration program.

- Code E1043 Cannot calculated (Modify Steps)
- Details Floating-point arithmetic error occurs during calibration operation.
- Steps Adjust the step record position of calibration program. For the correct calibration, teach the degrees between points more than 30 degree.

- Code E1044 Can't motor ON without Enc. Compen
- Details Motor cannot be ON without encoder offset calibration after selecting system/initialization/robot type .
- Steps Be sure to calibrate the encoder offset after selecting system/initialization/robot type in instruction to turn motor ON.

- Code E1045 Not input freq/palletize count
- Details The counter value to set before 800ms after selecting register is not input when setting the frequency by external signal input or palletize counter.
- Steps Input the counter value before 800ms after register is selected.

- Code E1046 Gun is openning by external signal
- Details Automatic operation signal is input during manual operation of servo gun by external signal.
- Steps Complete the manual operation of servo gun before execution.

- Code E1047 FIFO Registers number is over 20
- Details More than 20 programs would be reserved while FIFO function (1) applicable register is set to <20> in a system/users environment menu.
- Steps Enter the service/register/FIFO register, and check the number of reserved programs.

- Code E1048 Gun connection number signal error
- Details Gun connection number values are incorrectly selected in a welding gun manual/automatic connection by external input signal.
- Steps Check the input value of gun connection number.

- Code E1049 Spot gun was already connected
- Details Welding gun is not possible to operate with re-connection(GUNCHNG ON or manual connection) because welding gun has been already attached to system.
- Steps Check the attaching condition of welding gun.

- Code E1050 Spot gun was already separated
- Details Welding gun has been already separated from system, and GUNCHNG OFF instruction or manual separation has been used again.
- Steps Check the attaching condition of welding gun.

- Code E1051 Improper environment to gun change
- Details GUNCHNG instruction or manual gun connection/separation is not operated in an environment for welding gun change.
- Steps Reset the controller to welding gun change environment.

- Code E1052 Gun change time by manual is over
- Details When performing the welding gun connection/separation instruction manually, the corresponding instruction fails to be completed wihin 5 seconds.
- Steps Make contact with our company.

- Code E1101 (axis ○) Soft limit
- Details Encoder data of each robot axis reaches the set soft limit in system/ robot parameter/softlimit during teaching or automatic operation.
- Steps Move the robot between the set range in system/robot parameter/softlimit.

- Code E1102 Motor on under axis operation!
- Details Motor is ON while the axis operating key is pressed.
- Steps When truning motor ON, do not press the axis operating key.

- Code E1105 Step for jump not found
- Details Step number to operate is larger than the final step number of the currently selected program.
- Steps Check the final step number of program.

- Code E1106 Function for jump not found
- Details Function number to operate is larger than the final function number of the currently selected program.
- Steps Check the final function number of program.

- Code E1107 Shelter step not found
- Details Steps to push do not exist in timer conditional shift function, etc.
- Steps Check the final step number of program.

- Code E1108 Jumping to shelter step occurred
- Details It is unreasonable conditions in a conditional function operation.
- Steps Check all kinds of receiving data of program.

- Code E1109 Interpolation impossible
- Details Interpolation is operated in a posture incapable of robot interpolation.
- Steps Change the posture with axis individual adjustment, and operate it.

- Code E1110 Out of workspace!
- Details It was moved to the position where tool's tip of robot cannot reach.
- Steps Doublecheck if the work piece and robot position is adequate.

- Code E1111 Too large angle between arms
- Details Axis H and axis V reach in the state of interference.
- Steps Move the robot in the direction where no interference occurs.

- Code E1112 Too small angle between arms
- Details Axis H and axis V reach in the state of interference.
- Steps Move the robot in the direction where no interference occurs.

- Code E1113 Step for jump not found
- Details Target step of step jump function does not exist in an automatic operation.
- Steps Check the factor of program.

- Code E1114 Step for call not found
- Details Target step of step call function does not exist in an automatic operation.
- Steps Check the factor of program.

- Code E1115 Too many step-calls without return
- Details Step calls were operated more than 9 times without return.
- Steps Do not execute step calls more than 9 times without return.

- Code E1116 Can't return without step call
- Details Step return function exists without step call function.
- Steps Be sure to use step return with step call.

- Code E1117 Can't return to another program!
- Details Program for step return is not identical with the currently operating program number.
- Steps Check if there was a step call prior to a step return of program.

- Code E1118 Step for return not found
- Details Target step of step return does not exist in an automatic operation.
- Steps Check the factor of program.

- Code E1119 Program for jump not found
- Details Target program of program jump function does not exist in an automatic operation.
- Steps Check the existence of program and the factor(인수) of program.

- Code E1120 The number of axes mismatch: Jump
- Details The number of axis in target program of jump function is different from the number of axis in robot.
- Steps Check the program to jump.

- Code E1121 Program for call not found
- Details Target program of call function does not exist in an automatic operation.
- Steps Check the existence of program and the factor of program.

- Code E1122 The number of axes mismatch: Call
- Details The number of axis in target program of call function is different from the number of axis in robot.
- Steps Check the program to call.

- Code E1123 Too many Prog-calls without return
- Details Program calls were operated more than 9 times without return.
- Steps Do not execute program calls more than 9 times without return.

- Code E1124 Program for return not found
- Details Target program of return function does not exist in an automatic operation.
- Steps Check the existence of program and the factor of program.

- Code E1125 The number of axes mismatch:Return
- Details The number of axis in target program of return function is different from the number of axis in robot.
- Steps Check the existence of program and the factor of program.

- Code E1126 A pose unable to take Cir-Interpol
- Details It is impossible to make a circular arc because the recorded step is too close or in a straight line.
- Steps Adjust the position of step to make a circular arc.

- Code E1128 Unusable output(DO) signal
- Details Unavailable DO signal is specified in an automatic operation.
- Steps Check the output signal number.

- Code E1129 Undefined speed unit
- Details It is operated by some unit other than [%], mm/sec.
- Steps Check the current conditions of step.

- Code E1130 END step not found
- Details A program without END instruction is operated.
- Steps Add END instruction to the program.

- Code E1133 Inexecutable function
- Details Unavailble function is specified for an automatic operation.
- Steps Check the existence of program and the factor of program.

- Code E1135 End relay output error
- Details END Relay time is more than 15 seconds. This error is not occurred in a normal situation because END repaly time setting in system/control parameter is less than 10 seconds.
- Steps There is an error in constant parameter. Check the constant file.

- Code E1136 Playback-protected program!
- Details - Automatic operation is not possible from step 0.
  - It prevents forward/backward of step.
- Steps Cancel automatic operation protection of the corresponding program in service/file management/protect.

- Code E1138 Shelter step not found
- Details Steps to shelter do not exist in timer conditional function , etc.
- Steps Check the factor of program , and change it.

- Code E1139 Improper GI signal No
- Details Timer conditional GI signal number is incorrect in an automatic operation.
- Steps Check the factor of program , and change it.

- Code E1140 Improper port number
- Details Port specification of shift data request function is assigned as T/P port .
- Steps Specify the port specification of shift data request function as general port.

- Code E1141 Improper use of serial port #1
- Details Serial port(RS232C) has different uses.
- Steps Check the serial port uses in a system/control parameter/serial port.

- Code E1142 Repeated requests for shift data
- Details Shift data request function is operated again before shift data comes in from the outside after the shift data request function operates.
- Steps Check if the shift data function of program is overlapping.
  Check the connection with external sensor.

- Code E1143 Function M88 needed
- Details It occurs when operating function jump without function termination in an automatic operation.
- Steps Check the factor of program , and change it.

- Code E1144 Function M86 or M87 needed
- Details It occurs when operating a terminating function without function jump in an automatic operation.
- Steps Check the factor of program , and change it.

- Code E1145 Out of range for function jump
- Details It occurs when exceeding the jump range calculated in function jump.
- Steps Check the factor of function jump.

- Code E1146 Use function M78 only 4 times
- Details There are more than 5 palletizing functions in a program to operate.
- Steps Reduce palletizing functions.

- Code E1147 Palletize start was not executed
- Details Palletizing ends without starting.
- Steps Check the details of program.

- Code E1148 Palletizing already executed
- Details Palletize starting instruction is given while palletizing function is already operating.
- Steps Check the details of program.

- Code E1149 Start after palletizing stopped
- Details Palletizing function selects another program in the process of palletizing , and starts from the step 0.
- Steps Reset the palletizing function before starting.

- Code E1150 Can't use during palletizing
- Details P reset instruction is executed in the process of palletizing function.
- Steps End palletizing before the execution.

- Code E1151 Function for jump not found
- Details Function number to jump does not exist in a function jump.
- Steps Check the factor of program , and change it.

- Code E1152 Check search function M59(on/off)
- Details It occurs when search ON is not identical with search OFF.
- Steps Check the factor of program , and change it.

- Code E1153 Set search reference Pt. record on
- Details Search function is operated without standard position setting for search in a search function.
- Steps Turn the record ON for search standard position data of application condition, and record the recorded position by 1 Cycle operation before executing.

- Code E1154 Only in the 1 cycle at AUTO mode
- Details It occurs when violating the fact that data recording of standard search position is possible only in 1Cycle operation of automatic mode.
- Steps Set the automatic mode of condition setting to 1Cycle before executing.

- Code E1155 Out of the search range
- Details Robot interrupt did not occur even in excess of searching range.
- Steps Check the searching range setting of searching subject or applicationg conditions.

- Code E1156 3 points are on the same line
- Details Convert calculation is not possible because three points are in the same straignt line in coordinate system converting function.
- Steps Check the teaching point.

- Code E1157 No data in the shift register
- Details Function is executed while data is not input to RS232C port in On-Line XYZ shift,On-Line coordinate system conversion.
- Steps Adjust the program to input data to RS232C port before the On-Line XYZ shift,On-Line coordinate system conversion.

- Code E1158 Transfer reference step not found
- Details It is the step without the standard step number in coordinate conversion parameters.
- Steps Check the coordinate converting function parameters of the program.

- Code E1159 Can't take transferred pose
- Details The result of coordinate conversion is out of the robot working range.
- Steps Adjust the recorded step position.

- Code E1160 Improper welding condition
- Details It is specified in excess of welding conditions output data range.
- Steps Check the welding conditions output type of its parameters and set data of welding conditions in the syste/applied parameters/spot & stud.

- Code E1161 Interpolation impossible
- Details Robot was operated in a posture that is impposible to process interpolation.
- Steps Change the robot posture for teaching.

- Code E1162 Three points too close
- Details Convert calculation is not possible because three points are too close each other in coordinate system converting function.
- Steps Check the teaching point.

- Code E1163 Shift makes robot leave workspace
- Details The position to shift is out of robot working envelope.
- Steps Check the shift, and inspect the working process to work within the working envelope.

- Code E1164 Improper coordinate frame:XYZshift
- Details The standard coordinate system setting of XYZ shift function is incorrect.
- Steps Check the XYZ shift function parameters of the program.

- Code E1165 Improper coordinate frame :Search
- Details The standard coordinate system setting of search function is incorrect.
- Steps Check the search function parameters in the program.

- Code E1166 Improper coordinate frame :Pallet
- Details The standard coordinate system setting of palletizing function is incorrect.
- Steps Check the palletizing function parameters in the program.

- Code E1167 Search target is out of workspace
- Details Searching range is out of robot working envelope.
- Steps Reduce the searching range value in the conditions setting.

- Code E1168 Search available in linear INPLTN
- Details Searching step is not in a straight line interpolation.
- Steps Adjust the step to a straight line interpolation.

- Code E1169 Playback errors in fetching steps
- Details Step data that has been read for program execution has an error.
- Steps Delete the corresponding step, and record again.

- Code E1171 Transfer makes robot leave WRKSPC
- Details When executing On/Off line coordinate converting function, the result is out of robot working envelope.
- Steps Try again by changing the robot posture or changing the position of workpiece and robot installation.

- Code E1189 Not inputs WCR at arc start.
- Details When starting welding, Arc did not occur. (in excess of the frequency of retry)
- Steps Check the welding power system.

- Code E1192 Arc sensing error([A] range over)
- Details The detected welding current is in excess of the range. Namely, the frequency in excess of End point judging margin is more than the items of judgment.
- Steps 1. Inspect the welding current detecting circuit.
  2. In case of end point, set the end point detecting function as Enable.
  3. In case of no end point, adjust the end point judging margin or items.

- Code E1193 Arc sens'g error(Too unstable [A])
- Details The detected welding current is in excess of the range. Namely, the frequency in excess of End point judging margin is more than the items of judgment.
- Steps 1. Inspect the welding current detecting circuit.
  2. In case of end point, set the end point detecting function as Enable.
  3. In case of no end point, adjust the end point judging margin or items.

- Code E1194 Arc sens'g error(Side range over)
- Details It occurs when the calculated left/right follow-up is not available for a certain cycle.
- Steps Adjust the left/right current or maximum distance of interpolation per sample.

- Code E1195 Arc sens'g error(Height range ov.)
- Details It occurs when the calculated up/down follow-up is not available for a certain cycle.
- Steps Adjust the up/down current or maximum distance of interpolation per sample.

- Code E1196 Shift limit over
- Details Shift volume is in excess of shift limt value of system/shift limit item
- Steps Reduce the shift volume or readjust the limit value.

- Code E1197 Disable step for Cir-Interpolation
- Details To operate a circular arc interpolation, at least more than 2 steps are required.
- Steps Add steps.

- Code E1198 Not exist approach step.
- Details Weaving has been tried without access step or REFP 2.
- Steps Input access step of REFP 2.

- Code E1199 Read error of current step.
- Details Calculating the position for robot movement fails in retry function or restart function.
- Steps Add one more step after the completion of arc step.

- Code E1200 Read error of preview step.
- Details Calculating the position for robot movement fails in retry function or restart function.
- Steps Add one more step before starting an arc step.

- Code E1202 Syntax error
- Details It is a general grammatical error in robot language.
- Steps Check if the grammar is incorrect in robot language.

- Code E1203 Length of identifier exceeded
- Details The length of lable is longer than 8 digits
- Steps Shorten the length of lable under 8 digits.

- Code E1204 The number of element fault
- Details Component items is not correct in pose constant, shift constant.
- Steps Check the component items in pose constant, shift constant. Shift constant is the number of basic axes + additional axes, and pose constant is the number of basic axes + additional axes + 1(config.)

- Code E1205 Misusage of Parenthesis
- Details There is no parenthesis in a necessary position such as formula, function, or pose/shift constant.
- Steps Check if parenthesis in pairs is correctly used.

- Code E1206 Misusage of type postposition
- Details Variable designator of variable V is incorrectly marked.
- Steps Choose one of '%', '!', '$' as variable designator.

- Code E1207 '[' missed
- Details Number is omitted or '[' from variable.
- Steps Check if number is omitted from variable, and if '[' and ']' in pairs are correctly used.

- Code E1208 ']' missed
- Details There is no ']' where it is needed in variable.
- Steps Check if the variable number , and '[' and ']' in pairs are correctly used.

- Code E1209 Index exceeded its range
- Details The value of variable number is out of the limited range.
- Steps Use the variable number only within the corresponding variable number.

- Code E1210 Misusage of index
- Details The constant or formula used as variable number has incorrect grammar.
- Steps Check if the grammar of variable number is correct.

- Code E1211 Must be separated by space
- Details Put on the instruction statementand parameter together without a gap between the two.
- Steps Separate the instructioning statement from parameter with a blank between them.

- Code E1212 Shift operating fault
- Details Shift operation formula has incorrect grammar, or shift value is not adequate.
- Steps Check if shift operation formula has correct grammar or adequate shift value.

- Code E1213 Interpolation parameter fault
- Details The interpolation specifying grammar of MOVE statement is incorrect.
- Steps For specifying interpolation, choose one of ‘P', 'L', 'C'.

- Code E1214 ',' missed
- Details There is no ’,’ where it is needed in instructioning statement or function.
- Steps Check if the factors are correctly divided by use of ‘,’ .

- Code E1215 Pose expression fault
- Details Pose formula in MOVE statement is not correct.
- Steps Check the grammar of pose formula. In case of hidden pose MOVE, check the speed specifying grammar.

- Code E1216 Speed parameter fault
- Details Specifying a speed in MOVE statement is not adequate.
- Steps Check the speed specifying grammar. S={Speed}

- Code E1217 '=' missed
- Details There is no '=' where it is needed.
- Steps Check if '=' is correctly used to specify factors in assignment statement or general instruction statement .

- Code E1218 Unit fault
- Details Speed unit grammar in MOVE statement is not correct.
- Steps For a speed unit, choose one of "cm/min", "mm/sec", "sec", "%". It should be a minuscule.

- Code E1219 Accuracy parameter fault
- Details Accuracy is incorrectly specified in MOVE statement.
- Steps Check the specified grammar for accuracy. A={0-3}

- Code E1220 Tool no. parameter fault
- Details Tool is incorrectly specified in MOVE statement.
- Steps Check the specified grammar for tool. T={0-3}

- Code E1221 Too many output options
- Details More than 5 output options(MX,MX2,G1,G2,BM) are used in MOVE statement.
- Steps Be sure not to use output options repeatedly.

- Code E1222 Value exceeded its range
- Details Factor values are out of the limited range in all kinds of instruction statements.
- Steps Use the factor values within the limit.

- Code E1223 Input/Output direction fault
- Details Ouput direction of PRINT statement or input direction of INPUT statement is incorrectly specified.
- Steps For a input/output direction, choose one of “#0”, “#1”, “#2”.

- Code E1224 Step number exceeded its range
- Details Values are out of the limited range in step number.
- Steps For a step number, choose values within 0～999.

- Code E1225 Line number exceeded its range
- Details Values of row number is out of the limited range.
- Steps For a row number, choose values withing 1～9999.

- Code E1226 Address parameter fault
- Details Branching is tried for the address that has incorrect grammar, or address that is not existed.
- Steps Check the grammar of address, and check if the address is actually exsting.

- Code E1227 Failed in getting hidden pose
- Details It fails to obtain a hidden pose from step because work file is damaged.
- Steps Delete the correspondint step, and record it again.

- Code E1228 Incorrect element
- Details This error occurs when pose factor or shift factor is incorrectly used.
- Steps Check the grammar of pose factor or shift factor. (Refer to Operation Manual)

- Code E1229 String fault
- Details This error occurs when string constant has incorrect grammar.
- Steps Check the grammar of string constant.

- Code E1230 Program number parameter fault
- Details This error occurs when program number is incorrectly specified.
- Steps Check the grammar of program number. Program number should be specified as constant rather than variable or formula.

- Code E1231 Voltage parameter fault
- Details This error occurs when voltage factor value has incorrect grammar or it is out of the limited range of corresponding instruction statement voltage factor.
- Steps Check if the voltage factor has correct grammar, and if the value is within the range.

- Code E1232 Current parameter fault
- Details This error occurs when current factor value has incorrect grammar or it is out of the limited range of corresponding instruction statement current factor.
- Steps Check if the current factor has correct grammar, and if the value is within the range.

- Code E1233 Time parameter fault
- Details This error occurs when time factor value has incorrect grammar or it is out of the limited range of corresponding instruction statement time factor.
- Steps Check if the time factor has correct grammar, and if the value is within the range.

- Code E1234 File parameter fault
- Details This error occurs when file number factor value has incorrect grammar or it is out of the limited range of corresponding instruction statement file number factor.
- Steps Check if the file number factor has correct grammar, and if the value is within the range.

- Code E1235 Divided by zero
- Details This error occurs when divided by 0 in calculating formula.
- Steps Make sure that the value of formula which is used as a divisor in the division should not be 0.

- Code E1236 Mathmatical Error
- Details This error occurs when calculating formula has an error.
- Steps Check if the formula is enable. Infinite value should not be occurred.

- Code E1237 Checksum Error
- Details Encoder value of corresponding step is not identical with Check Sum.
- Steps Delete the corresponding step, and renew the record.

- Code E1238 Job header fault
- Details Working header string has incorrect grammar.
- Steps As compared with other work files, correct the wrong part of string in working header.

- Code E1239 Job format version is different
- Details It cannot correctly operate LOAD or so because it is a high version of work file.
- Steps Highten the controller version, or change the type of corresponding work file to the previous version.

- Code E1240 Too many addresses
- Details This error occurs when GOTO statement has excessive number of address.
- Steps Specify address less than 10.

- Code E1241 Code number fault
- Details This error occurs when inexistent code number is used in M code or I code instruction statement.
- Steps Use a enable code number. (Refer to Operation Manual)

- Code E1242 Assign. fault(Read only variable)
- Details It is not possible to assign because the left side of assignment statement is read-only variable.
- Steps Check errors in work file, and use an assignable variable.

- Code E1243 Fault of Jig number to sync
- Details Jig number factor has incorrect grammar or range in SMOV statement.
- Steps Input jig number factor ranged 0~3 corresponding to the SMOV statement.

- Code E1244 There is no registered jig
- Details It occurs when jig number is input without registered jig.
- Steps Register the jig first.

- Code E1245 Block stack overflow
- Details Excessive blocks are included such as GOSUB - RETURN, IF - ENDIF, FOR – NEXT of robot language. Or, GOSUB, IF, FOR is operated repeatedly without RETURN, ENDIF, NEXT by way of an incorrect flow control.
- Steps Reduce the blocks such as GOSUB or IF, FOR included. Or, fix the wrong flow control.

- Code E1246 Coordinate no. fault
- Details Coordinate system specification of pose or shift constant has incorrect grammar.
- Steps Correct the wrong part of grammar.

- Code E1260 Disable position move conditions.
- Details It occurs when calculating the position for working movement in retry and restart function.
- Steps Arc welding section and access step should be an interpolating step.

- Code E1261 Incorrect number of REFP
- Details It occurs when reference number is out of the range 1~4.
- Steps Correct the reference number. (Refer to Operation Manual)

- Code E1262 Detected wire stick.
- Details It occurs when welding wire is deposited in the parent metal(in excess of automatic removal frequency of deposit).
- Steps 1) Inspect the welding power unit.
  2) Remove the stick of weld.

- Code E1263 Cannot read WEAV CONDITIONS.
- Details It occurs when there is no weaving condition file(ROBOT.WEV).
- Steps Position the cursor to WEAVON instruction, and press the QuickOPen key to make a weaving condition file.

- Code E1264 Cannot read ARC START CONDITIONS.
- Details It occurs when there is no welding starting condition file (ROBOT.ASF).
- Steps Position the cursor to ARCON instruction, and press the QuickOPen key to make a weaving condition file.

- Code E1265 Cannot read ARC END CONDITIONS.
- Details It occurs when there is no welding ending condition file (ROBOT.AEF).
- Steps Position the cursor to ARCOF instruction, and press the QuickOPen key to make a weaving condition file.

- Code E1266 Cannot read ARC AUX CONDITIONS.
- Details It occurs when there is no welding cowork condition file (ROBOT.AUX).
- Steps Position the cursor to ARCON(or ARCOF) instruction, press the QuickOPen key, and then press PF key to press cowork conditions and make a weaving condition file.

- Code E1267 Cannot read ARC START CONDITIONS.
- Details It occurs when there is no welding special condition file (ROBOT.WLD)
- Steps Position the cursor to ARCON(or ARCOF) instruction, press the QuickOPen key, and select PF2(welder) to make a weaving condition file.

- Code E1268 Incorrect refernce pose(REFP 3).
- Details It occurs when there is no reference point(REFP 3) in case of reposed weaving, or the directions of reference point and target point are identical in a normal weaving.
- Steps 1. In case of reposed weaving
  1) Record the reference point(REFP 3).
  2) Starting step is not identical with target step.
  (copy the step for use)
  2. In case of non-reposed weaving
  Adjust the reference point(REFP3) position.

- Code E1269 Incorrect refernce pose(REFP 1).
- Details It occurs when the distance from welding line to auxiliary point(REFP 1) is less than 0.1mm.
- Steps Adjust the auxiliary point(REFP 1) position.

- Code E1270 Wall and target pose are linear.
- Details It occurs when weaving proceeding direction and wall direction are in a straight line(if no REFP 1, Z axis of rectangular coordinate).
- Steps Add the auxiliary point (REFP 1) with [shift]+[auxiliary point] key, or adjust a position.

- Code E1271 Incorrect refernce pose(REFP 2).
- Details It occurs when weaving wall direction and access point(previous step or REFP2) are in a straight line.
- Steps Add the auxiliary point (REFP 2) with [shift]+[auxiliary point] key, or adjust the position of previous step.

- Code E1272 Too small weaving width.
- Details It occurs when the distance of weaving amplitude is less than 0.1mm.
- Steps Position the cursor in WEAVON instruction, press QuickOpen key to set the weaving amplitude as high.

- Code E1273 Too small number of weaving seq.
- Details It occurs when the number of sequence is less than 1 in case of the use of weaving pattern defined by users.
- Steps Input more than 2 for the number of weaving Sequence.

- Code E1274 Out of restart number on weld line
- Details It occurs when the restarting frequency by Arc OFF within the same welding section is larger than the set value.
- Steps 1) Inspect the welding power unit.
  2) Adjust the Arc OFF detecting time of welder characteristic file.

- Code E1275 An insufficiency of shield gas
- Details It occurs when welding protect gas pressure is insufficient.
- Steps 1) Replenish the welding protecto gas.
  2) If you intend to ignore the signal, set the input of corresponding input signal of Arc application as “Disable”.

- Code E1276 A shortage of weld wire
- Details It occurs when welding wire is insufficient.
- Steps 1) Replace the welding wire.
  2) If you intend to ignore the signal, set the input of corresponding input signal of Arc application as “Disable”.

- Code E1277 Cannot overlap pose of cir-interp.
- Details It is impossible to calculate the overlap position by the restarting condition in circular arc welding section.
- Steps Set the overlap of restarting condition a little bit bigger, or as overlap prohibited before executing.

- Code E1278 Cannot retry pose of cir-interp.
- Details It is impossible to calculate the retry position by retry conditions in circular arc welding section.
- Steps If the same error occurs after one more execution, set the moving distance of retry conditions a little bit bigger , and change the operating mode of welding time condition file by using the QuickOpen key.

- Code E1280 Check VOL CONFIRM of conditions.
- Details It occurs when the output voltage of welding starting condition file or welding ending condition file is not confirmed after changing power(individual/unity) in the welder characteristics.
- Steps Confirm the output voltage of welding starting condition file or welding ending condition file, and then set it to “voltage confirmed=completion”

- Code E1281 Detected welder error signal.
- Details It occurs when welder error signal is input.
- Steps 1) Inspect the welder power unit.
  2) If you intend to ignore the signal, set the input of corresponding input signal of Arc application as “Disable”.

- Code E1283 Inserts ADIO Board for arc welding
- Details This error occurs when there is no option board even it is for arc welding.
- Steps Check if BD48x board is mounted. If option board is mounted, check if DIP3=ON in BD430 board.

- Code E1285 Improper use of serial port #2
- Details It occurs when the uses of serial port is not marked as “Sens” in the system/control parameter/serial port items.
- Steps To use the serial port for Sensor, set the use as “Sens” in the system/control parameter/serial port items.

- Code E1286 Different from Power Control Mode.
- Details It occurs when the power control mode is not identical with the voltage output mode mode of welder characteristic file.

- Steps If the power control mode is individual in welder characteristic file, the voltage output should be selected as “voltage”, and if the mode is unity or pluse, then the voltage output should be “%”

- Code E1287 Undefined Station(PositionerGroup)
- Details It occurs when an undefined station is specified for SMOV execution.
- Steps Specify the station set in the system/initialization/positioner group setting.

- Code E1288 Not executed Calibration of S(?)
- Details It occurs when an unexecuted station is specified for SMOV execution.
- Steps Execute the system/automatic constant setting/ positioner calibration to the station you intend to use.

- Code E1289 Detected Arc Off in arc welding.
- Details It occurs when art Off is detected during arc welding. Arc Off detection is for the case that WCR signal is not input for a certain period of time, and this value can be changed to ard off detection time of welder characteristic file.
- Steps 1) Adjust WCR signal and arc off detection time.
  2) If you intend to ignore the signal, set the arc Off among the welding auxiliary condition file as “Ignore”.

- Code E1290 Don't detect the start point.
- Details There is no starting point when detecting the starting point with laser vision sensor.
- Steps Correct the detection range or record point.

- Code E1291 No responding of LVS.
- Details Laser vision sensor connected to serial does not receive data.
- Steps 1. Check the use setting of serial port.
  2. Inspect the laser vision sensor.
  3. Inspect the communication cable.

■ Code E1292 Do modify search start length.

■ Details It occurs when the search conditions are identical in the search starting point during the detection of starting point with laser vision sensor. Namely, in case of outward access, when there is a starting point shape in the search starting point. Or, in case of inward access, when there is no starting point shape in the search starting point.

■ Steps Change the searching distance or starting point.

■ Code E1293 Error detect at Laser sensor.

■ Details Laser vision sensor received error. Refer to the logging screen for more details.

■ Steps Refer to the sensor error number in the screen and sensor manual to take necessary actions.

1 : PC setting communication error – communication with PC failure

2 : sensor camera error – no video in sensor head

3 : sensor link error – no sensor head communication - . camera cable error?

4 : no sensor conncetion – no video or communication. Is sensor installed?

5 : sensor operating temperature error – too hot or too cold

6 : sensor power error – sensor head power is out of 24v supply range. Camera cable abnormal?

7 : Laser disable – Inspect the Laser enable key and laser warning lamp.

8 :No sensor calibration – Sensor calibration data error. Try other sensor head.

9 : Out of shape range - No strip in the image

10 : No shape is seen for analysis. There is Ddata itself, but analysis failure only in a searching mode.

11 : Unavaible in this connection..

12 : No shape is set. Is the shape number correct?

13 :No shape of image for tracking.

14 : [Esc] key is pressed in tool program while robot is communicating with

sensor.

15 : Memory error in sensor control unit, format again and load the backup data.

16 : Failure in reading system data

17 : Reading shape from FLASH memory error damage?

18 : Reading shape from FLASH memory error damage?

19 : Analog circuit error(POST)

20 : Video collecting hardware error

21 : Timer hardware error

22 : FLASH memory damage – replacement needed.

23 : Insufficient Data FLASH memory

24 : There is a damaged sector in FLASH memory.. warning

25 : error log error

26 :power omission in I/O of SAPEII board

27 : ESTOP operation – inspect ESTOP link or conncetion.

28 : Existing within the temperature limit of 5 degree

- Code E1294 Cannot read LVS CONDITIONS.
- Details It is not possible to read the laser sensor condition file(ROBOT.LVS).
- Steps Position the cursor to LVSON instruction , press [QuickOpen] key to make a file. Or otherwise, back up all files , and initialize the system.

- Code E1295 Set Weav'g mode=single for Track'g
- Details It occurs when weaving type of weaving condtion is not Single.
- Steps Change the weaving type to Single.

- Code E1296 Assign InPORT of weld [A] for TRK.
- Details It occurs when the welding current input port for arc sensing is not set .
- Steps Assign the welding current input port of arc application parameter(system >4:>2:>11).

- Code E1297 Not exist the license for sensing.
- Details Arc sensing function is optional.
- Steps Make a request to our sales department.

- Code E1298 A seam data doesn't exist with LVS
- Details There is no detection data of laser sensor for calculating position.
- Steps If there is no error in Joint shape, adjust the allowable change in laser sensor conditions, or adjust the detection distance of ending point if it is ending point.

- Code E1299 The Search Start supports only LIN
- Details It occurs when the kind of step interpolation for tracking or moving searching function is not a straight line interpolation.
- Steps Change the kind of interpolation to a straight line interpolation.

- Code E1300 Reference position doesn't record.
- Details Standard distance is needed between limit switch and workpeice during teaching when operating theh robot .
- Steps Record the input function of conveyor register value(M37) before using conveyor machine On(M55 [1]) function, and then input CR displayed in monitoring during teaching to register value.

- Code E1301 Not available under CNVY Syncro.
- Details Stud gun cannot be used during conveyor tracking.
- Steps 1) Change the gun type to the one other than stud guni in the system/initialization/uses setting menu.
  2) Delete the (stud) gun function recorded as step condition data.

- Code E1302 Conveyor interpolation error
- Details Only straight line interpolation function is supported for conveyor synchronization operating. An error occurs when interpolation is OFF or circular interpolation step is recorded.
- Steps For conveyor synchronization step, change the type of interpolation to a straight line interpolation

- Code E1303 Available only during CNVY Synchro
- Details "I50, I51 conveyor interlock" function can be used only in the block of conveyor synchronization.
- Steps Program to make "M55 conveyor synchronization playback" enable before the function of "I50 or I51"

- Code E1304 Conveyor running signal is given
- Details If the mode of conveyor operation is "test" or "simulation", conveyor operating signal should not be input.
- Steps Stop the conveyor, or change the mode of conveyor motion to "normal"

- Code E1305 Create Robot.CO1 file for conveyor
- Details The existing ROBOT.C01 file is written as it does not support conveyor synchronization , but "M55 conveyor synchronization playback" function is recorded in the currently selected program.
- Steps Delete "M55 conveyor synchronization playback" function in the existing program.

- Code E1306 Base position data is not recorded
- Details This error occurs when playing a gun search function or spot welding function without an execution of standard position recording for gun search after making a machine constant file.
- Steps Attach a new tip , and execute the standard position recording for gun search.

- Code E1307 Gun search program is abnormal.
- Details This error occurs when executing gun search 2 without an execution of gun search 1, or when playing spot welding function without a normal termination of gun search.
- Steps Execute gun search 1,2 to detect tip wear before starting work.

- Code E1308 Tool No. of selected step is wrong
- Details This error occurs when the tool numbers corresponding to servo gun numbers are incorrectly specified during a step execution in which spot welding & gun search functions are recorded.
- Steps Match the tool numbers of step with gun search & spot function.

- Code E1310 Squeeze force exceeded current LMT
- Details This error occurs when current limit calculated from instruction pressure is in excess of current limit(IP) of servo amp.
- Steps Lower the set pressure, or increase the capacity of servo gun drive unit.

- Code E1311 Squeeze force exceeded overload.
- Details This error occurs when the instruction pressure is in excess of overload detection level.
- Steps Set a lower pressure in expectation of overload error.

- Code E1312 Squeeze target is out of workspace
- Details This error occurs when result of servo gun pressure position(object position) is out of robot working envelope.
- Steps Change the robot posture, and record it.

- Code E1313 Squeeze data out of range in table
- Details This error occurs when the set pressure in welding condition data of spot welding function(M72) is out of the set pressure range in pressure table of servo gun parameter.
- Steps Lower the set pressure

- Code E1314 Squeeze force delay time is over
- Details This error occurs when the detected tip consumption is larger than the maximum tip consumption of servo gun parameter.
- Steps Replace the tip, or if necessary, reset the maximum tip consumption of servo gun parameter to an adequate value.

- Code E1315 Gun number for servo gun is wrong.
- Details This error occurs when the gun to execute is not set to servo gun.
- Steps Check if the gun to execute in additional axis setting is a servo gun.

- Code E1316 A robot search or C/V is operating
- Details This error occurs when robot searching & conveyor functions are ON during an execution of gun searching function.
- Steps Do not use robot searching or conveyor function while executing gun search.

- Code E1317 HRview is going to load program.
- Details This error occurs when program execution(RUN) instruction is input while program is loaded from HRview.
- Steps Execute the program after the competion of working program loading from HRview.

- Code E1318 The result value was overfloor.
- Details This errors occur when the added result is in excess fo 255 while executing addition/subtraction of frequency register.
- Steps Maximum value that frequency register can store is 255. Check the program.

- Code E1319 The result value was underfloor.
- Details This error occurs when the result of subtraction is a negative value after executing additin/subtraction of frequency register.
- Steps Check the program.

- Code E1320 Sensor doesn't search operation.
- Details This error occurs when sensor does not work even after the robot moved to the target position during wear detecting work with a sensor in a servo gun searching function or robot equalizer function for fixed tip consumption searching.
- Steps 1) Check if a sensor is working when tip approaches the sensor.
  2) Check the connection and connector.
  3) Check if the sensor contacting point is correctly specified.

- Code E1321 The pallet entry number is wrong.
- Details When working on palletizing in the same pallete, all the palletizing relevant instructions should be input with the same pallete number between the two instructions including PAL and PALEND. This error occurs when these pallete numbers are not set to be different.
- Steps 1) Check the pallete number for palletizing instructions of TIERST, PALPU, PAL, PALEND, PALRST in the sma palletizing work.
  2) Input the same pallete numbers.

- Code E1322 Check the pattern register!
- Details For palletizing work, information should be set in a palletizing pattern register. This error occurs when an unused pattern register is set out of 16 pattern registers in total.
- Steps 1) Check the set pattern register number
  2) Check the items in use/out of use among palletizing pattern registers.

- Code E1323 Equalizerless environment is wrong
- Details This error occurs when robot equalizer function is not set in an available environment.
- Steps Set the uses as spot in the system/initialization/uses setting, and select EQ'less for pneumatic GUN1, and pneumatic GUN2.

- Code E1324 Palletizing environment is wrong.
- Details This error occurs when this palletizing function is used while GUN2 is not set as palletizing in the system/initialization/uses setting.
- Steps Set the GUN2 as palletizing in the system/initialization.uses setting.

- Code E1325 Palletize pick'g up function fault
- Details This error occurs when PALPU(picking up shift) is not between PAL and PALEND in program. For the use of picking up shift of PALPU, shift generated from PAL is required, so PALPU must be located between PAL and PALEND in program.
- Steps 1) Position the PALPU between PAL and PALEND in program.

- Code E1326 Disable environment of GUN search2
- Details The environment is set to calibrate the gun wear only with gun search 1. In this case, the error occurs when executing gun search 2.
- Steps Set the environment to calibrate the gun wear by using gun search 1,2. Set the move tip consumption rate(%) to be 0 in a servo gun parameter setting.

- Code E1327 Servo hand opening limit is over
- Details The open position of servo hand open step is in excess of the maximum open position in a system/applied parameter/palletizing/servo hand parameter setting menu.
- Steps Shorten the offset distance of servo hand open step, or increase the maximum open position in a servo hand parameter setting menu.

- Code E1328 Servo hand squeezing limit is over
- Details The force position of servo hand force step is smaller than the maximum force position in a system/applied parameter/palletizing/servo hand parameter setting menu.
- Steps Lenghten the offset distance of servo hand force step, or reduce the maximum force position in a servo hand parameter setting menu.

- Code E1329 Servo hand squeezing time is over
- Details Force is not within the set range even after the force error detection delaying time is exceeded in a system/applied parameter/palletizing/servo hand parameter setting menu.
- Steps 1) Adjust the force position of servo hand
  2)Set the force-current table in a system/applied parameter/palletizing/ servo hand parameter.
  3) Adjust the degree of force.
  4) Adjust the delaying time in force error detection.

- Code E1330 Can't load .LD? file while PLC RUN
- Details Ladder file (.LAD) is attempted to load during built-in PLC RUN or Remote-RUN
- Steps Change the built-in PLC to a STOP or Remote-STOP mode, and try it again.

- Code E1331 Confirm external program select
- Details FIFO function in a system/users environment menu.
  In case that (2) program is <external selection>, (1) applicable items are set as <20> or <1>, and in case that external program selection is set as <disable>, start is input.
- Steps Check the external program selection in a system/users environment menu.

- Code E1332 Confirm program strobe signal use
- Details If the FIFO function (2) program is <external selection> in a system/users environment menu, (1) applicable items are <20> or <1>, and if the use of program strobe signal is set to be <Disable>, starting is input.
- Steps Check the use of program strobe signal in a system/users environment menu.

- Code E1333 Cannot found selected program
- Details When executing the reversed program in FIFO register, the program is not existing in the internal memory.
- Steps Check if the corresponding program is existing in the internal memory.

- Code E1334 Free-fall! start after step SETg
- Details This error occurs when robot's falling distance is in excess of previous position returning error detection with motor ON in a enable condition of previous position returning. This error is to warn the users that trace(locus) of suspended step is out of the normal trace(locus) when it is operated again because there is no error.
- Steps 1) If there is no interference even when restarting in the current posture, reset the corresponding step, and operate it.
  2) If interference is anticipated during execution of corresponding step in the current posture, change the executing robot posture in a manual mode before operating.
  3) If error detection distance is not adequate, adjust the error detection distance in a system/ 2: control parameter/5: previous position returning menu.

- Code E1335 Cannot use continue play at FIFO
- Details when executing program by applying the FIFO function, play mode in condition setting menu is input in a sequence.
- Steps When applying FIFO function, select 1 cycle of the play mode in condition setting menu before using.

- Code E1336 Undefined User-coordinate number.
- Details This error occurs when executing without register of user coordinate system.
- Steps Select a random program, and record origin, X direction, and XY plane. And then register a coordinate system in a system>control parameter>coordinate system registration> user coordinate system.
  If you intend to execute it in a teaching program, refer to MKUCRD instruction.

- Code E1337 SOFT Instruction execute fail
- Details This error occurs when there is a difference of 384Bit between instruction and the current encoder values for the specified time(within 5 seconds) during the execution of SOFT instruction.
- Steps Set the Accurracy of previous step in SOFT instruction execution to be 0.

- Code E1338 Soft floating error distance over
- Details Offset distance generated during SOFT instruction execution is in excess of set error values.
- Steps Adjust the error detection distance.

- Code E1340 Disable condition for co-work run
- Details Controller is inadequately set to execute COWORK instruction.
- Steps Check if communication is normal, if partner's common coordinate system is set, and if the manual coworking is identical with COWORK robot's role.

- Code E1341 Cooperation wait time is over
- Details All the coworking robots are not ready to cowork for the set standby time after meeting with COWORK instruction.
- Steps Set the standby time taking the reaching time for all coworking robot to the position into account. If 0 is set, it would continue to standby until all robot could reach.

- Code E1342 Invailded COWORK or common coordi.
- Details COWORK instructions cannot be executed because robot coworking is disable or common coordinate system is not set.
- Steps Set the common coordinate system after setting <enable> in a system setting/control parameter/cowork control parameter.

- Code E1343 COWORK execution mismatch
- Details COWORK instructions are executed repeatedly, or program END is executed without COWORK END
- Steps Program to make COWORK instruction and COWORK END instruction in pairs. Double execution by step change is prohibited.

- Code E1344 COWORK Para.(M/S,robot No.) error
- Details Partner robot's number is incorrectly set, indicating my robot's number in COWORK instruction.
- Steps Change it because the robot's number corresponding to COWORK M(S),S(M)=robot number cannot be set to my robot.

- Code E1345 The slave already executed COWORK.
- Details Slave robot's cowork is already working in the position of COWORK END, or it stops.
- Steps For normal coworking of Master & Slave, do not change step artificially.

- Code E1346 Excess of P* repeat limit (10x)
- Details P* including step cannot be used more than 10 times in a row. (to limit the calculating laod)
- Steps Input a hidden pose MOVE within the prvious 10 steps.

- Code E1347 Coord. system not supporting shift
- Details Base/Robot/Tool/User coordinate shift is addable to Base/Robot/Encoder/Usercoordinate system pose, and other shift calculation in coordinate system is not allowed.
- Steps Check the coordinate system of pose or shift variable/constant, and convert it to the allowable coordinate system. [QuickOpen]

- Code E1348 Time out of connection complete.
- Details Connection of welding gun is not completed within the specified time.
- Steps Make sure to send the confirmation signal of welding gun to controller when completing the connection of automatic tool exchange device. Be sure to program it so as to execute GUNCHNG ON, instruction after welding gun completes connecting to ATC.

- Code E1349 SVG Disconnect error in limit time
- Details Welding gun is not separated in 5 seconds after executing GUNCHNG OFF instruction.
- Steps Make contact with our company.

- Code E1350 Don't set an user-coord. number.
- Details Users coordinate system number is not specified in a condition setting.
- Steps Input T/P for the users coordinate system number in a condition setting, or specify it with SELUCRD instruction.

- Code E1351 Interrupt defined duplicated.
- Details For the previously defined interrupt number, it overrides without deletion of that number.
- Steps Define it as unused interrupt number, or operate an interrupt delete before defining.

- Code E1352 Pre-execute interrupt definition.
- Details Individual interrupt activating instruction is executed while the defined number of interrupt is not executed.
- Steps Execute the interrupt defining instruction first , and then execute the individual interrupt activating instruction.

- Code E1353 Over allowed max. dist. deviation.
- Details Aberrant distance from trace(locus) by tracking is in excess of allowable value.
- Steps Adjust a teaching position, or adjust the allowable averrant distance.

- Code E1354 Over allowed max. angle deviation.
- Details Aberrant degree from trace(locus) by tracking is in excess of allowable value.
- Steps Adjust a teaching position, or adjust the allowable averrant degree.

- Code E1355 Partener robot is error stoped
- Details Partner robot stops during Cowork so that it is impossible to cowork any longer. It stops because cowork is impossible.
- Steps Check if the operation mode is identical between robots. Restart Slave first before restarting Master if restarting after stop during cowork.

- Code E1356 Duplicated robot number is set
- Details Overlapping robot number makes it impossible to control COWORK.
- Steps Check the robo number connected to Hinet to change the overlapping robot number, and apply power again.

- Code E1357 Detected coolant error signal
- Details Error signal in coolant circulation is input.
- Steps Check the cooling water supply unit. If there is no error in the unit, check the input port setting of controller. Restart welding step after the correction of errors.

- Code E1358 Interrupt enable at continue path.
- Details Successive Path function is operating when executing the interrupt defining or activating instruction.
- Steps Interrupt function and successive Path function cannot be used at the same time. Adjust it.

- Code E1359 Set continuous path at Int enable.
- Details When setting the successive Path, interrupt function is operating.
- Steps Interrupt function and successive Path function cannot be used at the same time. Adjust it.

- Code E1360 ROBOT.C00 file is damaged.
- Details ROBOT.C00 file structure is damged.
- Steps Initialize the memory with a support of our A/S staff.

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- Code E1361 ROBOT.C01 file is damaged.
- Details ROBOT.C01 file structure is damged.
- Steps Initialize the memory with a support of our A/S staff.

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- Code E1362 ROBOT.C00 file is read only.
- Details impossible to record a data in ROBOT.C00 file.
- Steps Change the property of ROBOT.C00 file.

- Code E1363 ROBOT.C01 file is read only.
- Details impossible to record a data in ROBOT.C01file.
- Steps Change the protect of ROBOT.C01 file.

- Code E1364 Duplicated setting of master.
- Details More than two controllers are set as master for the manual cowork role in cowork control network.
- Steps Set only one of master by using R351 code or manual cowork converting F key.

- Code E1365 A cooperative status is not ready.
- Details Master robot for manual cowork is not set.
- Steps Set the manual cowork master robot.

- Code E1366 Master number of slave is wrong.
- Details The selected master number in slave is not identical with the set number of slave.
- Steps It is an ready error.

- Code E1367 Can't be Shifted in CMOV
- Details Shift function is applied to CMOV, but it is an unsupportable coordinate system.
- Steps When such functions as online shift, XYZ shift, variable shift are applied to CMOV, apply them into robot coordinate system.

- Code E1368 Not select Master for Crd. trans.
- Details The current step is set to <M> in master end effector coordinate system, but master robot is not specified.
- Steps Set the robot's manual coworking that is suitable for the current step as a MASTER.

- Code E1369 Disableed master number,ID in CMOV
- Details Master number set as COWORK S,M=#1,ID=#2 is not identical with the master number set as CMOV R#1#2.
- Steps Record the CMOV to have the same master with #1#2 set in COWORK.

5.4.3. Warning

- Code W0001 Backup memory damaged
- Details It occurs when damage is found in all kinds of files.
- Steps Initialize the internal memory, and load all kinds of files backed up in a disket. If errors continue to exist, replace the main board.

- Code W0002 Controller temperature risen
- Details It occurs when the controller temperature is above 65.
- Steps Refer to Troubleshooting Manual.

- Code W0003 Damaged program. Delete it
- Details Program to execute is damaged.
- Steps Delete the program , and reload a backup program.

- Code W0004 Emergency stop on
- Details It occurs when [Motor ON] in an emergency.
- Steps Cancel the emergency stop key, and start an execution.

- Code W0005 Backup battery voltage dropped
- Details Backup battery voltage connected to Main board BATCN connector is below the standard.
- Steps Replace the backup battery.

- Code W0006 Step for jump or call
- Details It occurs when the steps for step jump and step call are deleted.
- Steps It may be dangerous to start without checking the program, Thus, check the program before starting.

- Code W0007 Interlocking not good
- Details Input signal is not input while controller is waiting for the signal.
- Steps - Check if the signal is input to service monitor function.
  - Check the interface conncetion of interlock.
  - Check all the connections of interlock machine.

- Code W0008 Welding machine does not work well
- Details It occurs when welding completion signal is not input within re-welding standby time during spot welding.
- Steps Input the welding completion signal.

- Code W0009 Brake slip!(Excess of set value)
- Details 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.
- Steps 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
- Details Field bus power is not supplied.
- Steps 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
- Details Field bus network connection is not normal.
- Steps 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
- Details Master stops I/O operating.
- Steps - If PLC is in a program mode, change it to RUN mode.

- Code W0013 UCS module is not detected
- Details UCS module is not sensed.
- Steps 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
- Details Parameter setting for field bus master is not identical with that of slave.
- Steps Check if parameter setting is correctly done for filed bus master and slave. If any errors, then correct them

- Code W0015 Fieldbus general error
- Details BD420 board field bus has an error.
- Steps 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
- Details The specified values for GE or DE variable are incorrect. The values are out of range.
- Steps - 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
- Details It occurs when CheckSUm values of step position data have an error.
- Steps Delete the step, and teach a new step.

- Code W0103 Something wrong with interlocking
- Details While controller is waiting for input signal, the input signal is not inpu within the time set.
- Steps - 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
- Details Battery voltage is too low in axis (○) encoder.
- Steps 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!
- Details It occurs when total tip consumption detected with gun search is in excess of tip exchange wear set in servo gun parameter.
- Steps Inspect the unfixed tip and fixed tip consumption, and replace the tip.

- Code W0106 Move-tip consumption exceeded LMT.
- Details It occurs when unfixed tip consumption detected with gun search is in excess of unfixed tip exchange wear set in servo gun parameter.
- Steps Inspect the unfixed tip, and replace the tip.

- Code W0107 Fixed-tip consumption exceeded LMT
- Details It occurs when fixed tip consumption detected with gun search is in excess of unfixed tip exchange wear set in servo gun parameter.
- Steps Inspect the fixed tip, and replace the tip.

- Code W0108 In jog moving, Pressure exceeded!
- Details 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.
- Steps 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
- Details The servo gun you intend to operate is different from the selected servo gun number.
- Steps 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
- Details 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].
- Steps 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
- Details 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].
- Steps Set the returning distance setting to be larger than the existing set value.

- Code W0117 Jog will make overspeed CMMD.
- Details Robot is in a posture of high speed while manually operated in rectangular coordinate system or tool coordinate system.
- Steps Change the robot's posture by manipulating with articulation coordinate before operating it manually.

- Code W0118 1st servo CPU version is Old
- Details 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.
- Steps 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
- Details 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.
- Steps 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
- Details 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.
- Steps 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
- Details 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.
- Steps 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
- Details Stop instruction is received from the partner robot during cowork control operation. In this case, the above message is output, and the robot stops.
- Steps Start running a master to resume a program after starting the robot on the part of slave.

- Code W0124 Slave is Impossible to jog
- Details It is set as salve in the condition of manual cowork control. The robot set as slave is impossible to operate separately.
- Steps 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 Disable position of connected SVG
- Details 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.
- Steps 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 overlaped
- Details Among robots connected to HiNet are more than two robots set as Master in their manual cowork.
- Steps Only one Master for manual cowork is possible to set. Change the setting.

- Code W0132 Jog Prohibited - No slave selected
- Details Jog operation is attempted for Master robot without setting the Slave robot to be available to cowork.
- Steps 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
- Details A robot chaged its manual cowork is detected among the coworking Slave robots Master during cowork jog operation with robot.
- Steps Doublecheck the cowork condition of Slave before operating.

- Code W0134 Master Tool Coord. isn't selected
- Details 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.
- Steps 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.

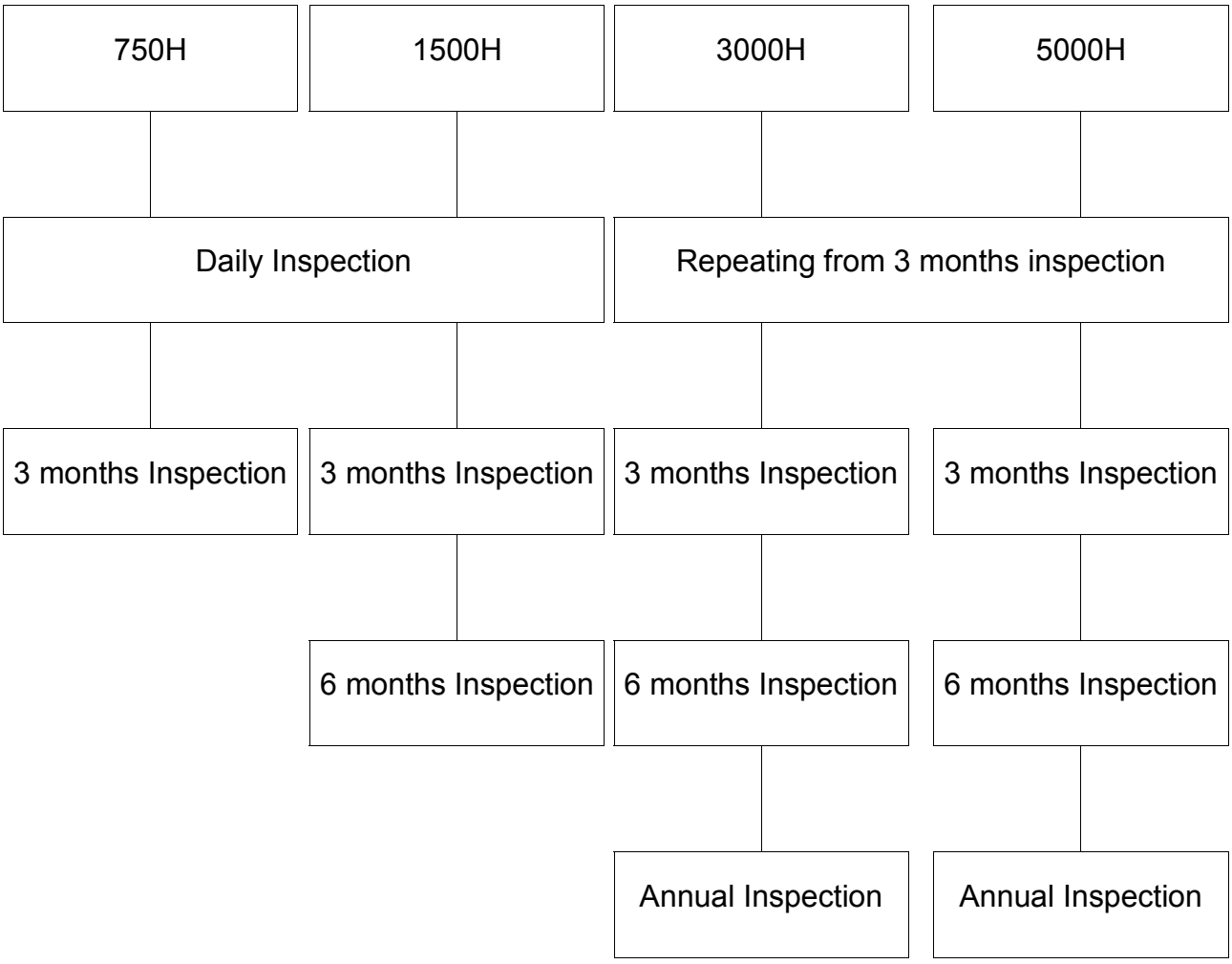

Fig. 6.1 Inspection Schedule

6.2. General Instructions for Regular Inspection

☞ **Instructions**

① Inspection working should be perfomed 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 inpecting 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 Wireharness 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 First Inspection

No.	Inspection Part	Inspection Details	Remarks
1	External, major screws	Unscrewed	Fasten
2	Manipulator wiring connector & Wireharness	Loose connector	Fasten
3	Dog & limit switch screws	Unscrewed	Fasten

6.5. Daily Inspection

Table 6-3 Daily Inspection

No.	Cycle(months)			Inspection Part	Inspection Details	Remarks
	3	6	12			
1		◎	◎	Packing of door	□ Transfored & torn part	
2	◎	◎	◎	Back side	□ Dust & rotation in cooling fan wings of heat exchanger	
					□ Damage & dust in regenerative discharge resistence	
					□ Check a heating of Transformer Room by touch, and clean the room.	
					□Terminal Block(TB1) : Loose & damaged terminal	
3	◎	◎	◎	Wireharness	□ 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 marknet connector (MSHP,MSPB,MSDB)	
14	◎	◎	◎	Safetry 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 BD411 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 6-4 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 6-5 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 Temprature 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 disrcharged. Thus, when keeping the board separately, use an antistatic treated packing materials.

Others

- ◆ No poisonous gas
- ◆ No dust
- ◆ Store without excessive loading

Table 6-6 Maintenance Parts A-1 (Standard accessory parts to prepare)

No.	Product Name	Type	Maker	Qunatity (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, 3A
7	Fuse (HSXY6)	600CF30	HINODE (JAPAN)	6	660V, 30A
8	Fuse (HDAD6)	600CF30	HINODE (JAPAN)	2	660V, 30A

Table 6-7 Maintenance Parts A-2 (Major Backup Parts)

No.	Product Name	Type	Maker	Quantity(EA)	Remarks
1	Servo AMP	HSXY6	HHI (Co.,Ltd.)	1	Hi4-0000, Hi4-0010
		HSXY6-111222	HHI (Co.,Ltd.)	1	Hi4-0008
		HDAD6	HHI (Co.,Ltd.)	1	Hi4-0002, Hi4-0000-CP
2	Complex Power Unit	HD-180	HHI (Co.,Ltd.)	1	SMPS
3	Teach Pendant	TP300	HHI (Co.,Ltd.)	1	
4	Board	BD400	HHI (Co.,Ltd.)	1	Mother Board
		BD412	HHI (Co.,Ltd.)	1	Main CPU Board
		BD430V50	HHI (Co.,Ltd.)	1	I/O Board
		BD540	HHI (Co.,Ltd.)	2	Servo CPU Board (Hi4-0000, Hi4-0008, Hi4-0002, Hi4-0000-CP)
		BD540	HHI (Co.,Ltd.)	2	Servo CPU Board (Hi4-0010)
		BD461V30	HHI (Co.,Ltd.)	1	Sequence/Brake board

Table 6-8 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 6-9 Maintenance Parts B-1 (Parts to purchase from HHI (Co.,Ltd.))

No.	Product Name	Type	Maker	Quantity (EA)	Remarks
1	Wireharness	CNR1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4-0000, Hi4-0010 Hi4-0008
		CNR2	HHI (Co.,Ltd.)	1	
		CNR4	HHI (Co.,Ltd.)	1	
2	Wireharness	CNR1	HHI (Co.,Ltd.)	1	Controller ⇔ Robot Manipulator Hi4-0000-CP, Hi4-0002
		CNR4	HHI (Co.,Ltd.)	1	

Table 6-10 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+ HAC22I	HHI (Co.,Ltd.)	2	For Hi4-0000, Hi4-0010, Hi4-0008
3	Magnetic Contactor (MSHP)	HiMC-40	HHI (Co.,Ltd.)	2	For Hi4-0000, Hi4-0010, Hi4-0008
		HiMC-22	HHI (Co.,Ltd.)	2	For Hi4-0002, Hi4-0000-CP
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	

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