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HEAVY INDUSTRIES CO.,LTD.

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Hi5 Troubleshooting Manual

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1
Troubleshooting

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It is designed to facilitate troubleshooting when troubles occur. Please be fully aware of this MANUAL for troubleshooting.

1.1. Troubleshooting Solution

This describes individual troubleshooting methods for the error codes that are generated from the Hi5a controller.

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1.1.1. E0002 Hardware limit switch in operation

1.1.1.1. Outline

Limit switch that is installed at the end of operation area of Robot's each axis has been activated. The Robot will be immobilized immediately for a safety reason and will not be operational until it is moved to a safe operation area by an appropriate method.

1.1.1.2. Causes and checking methods

(1) Please confirm if the Robot actually went out of operation area.
- Actions to be taken when a Robot went out of operation area

(2) If an error occurs though a Robot is in the operation area.
- Checking method from a System Board Connector (CNLS)
- Checking method from a Wire Harness (CER1 or CEC1)
- Checking method by examining a limit switch and internal wiring of main frame

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

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

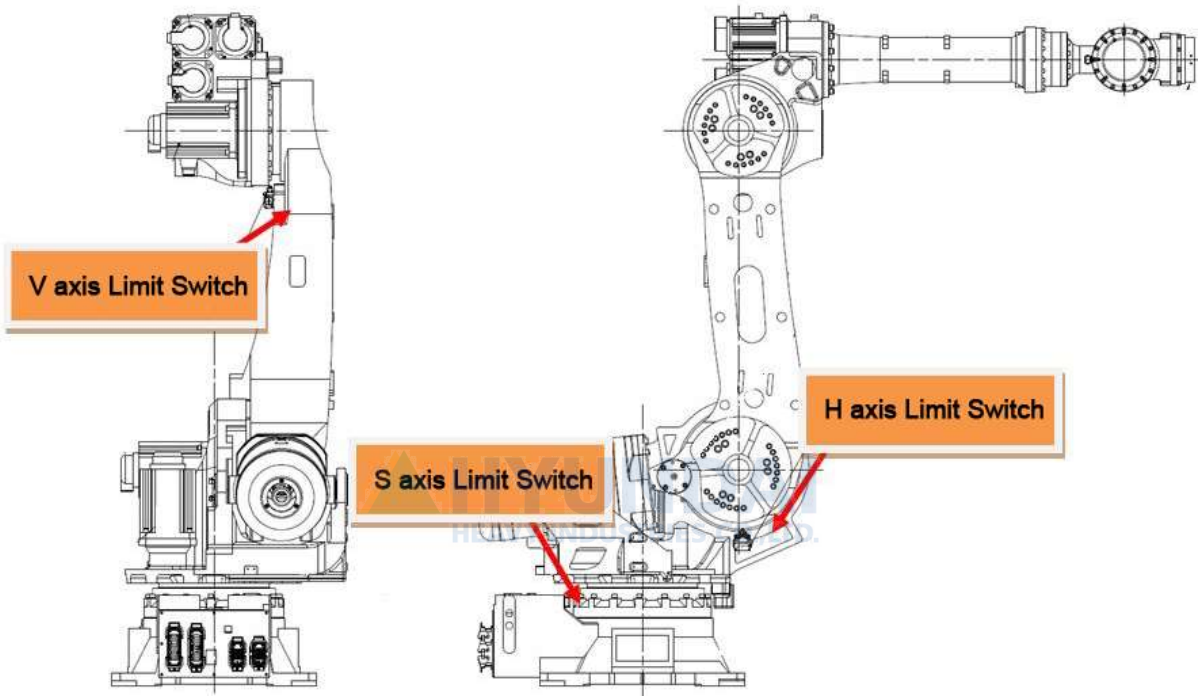

Figure 1.1 Installed Locations of Hardware Limit Switches for HS165/HS200 Robot

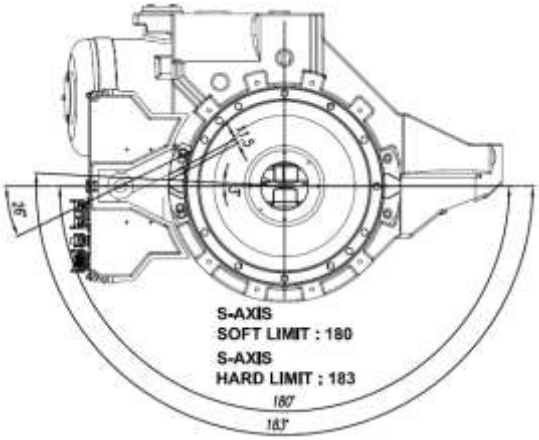

Figure 1.2 Operation Area for S-axis Limit Switch of HS165/HS200 Robot

■ **Actions to be taken when a Robot went out of operation area**

Please take following actions in order to move a Robot while a hardware limit switch is on. Firstly, enter the system with a manual mode and turn on the enabling switch of Teach Pendant.

From this stage, execute the Motor On command and move the Robot back into the operation area by using a jog key.

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(2) If an error occurs though a Robot is in the operation area

Firstly, check if the limit (Over-Travel) is being entered consecutively from the Private input signal window of Teach Pendant.

This window can be accessed by selecting "『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/output Signal』 → 『1: Private input signal』"

A yellow color status on limit (Over-travel) indicates an error status

- Cautions:
  On manual mode, a monitoring is enabled only when a Teach Pendant's enabling switch is on. On automatic mode, a monitoring is enabled regardless of a status of enabling switch.

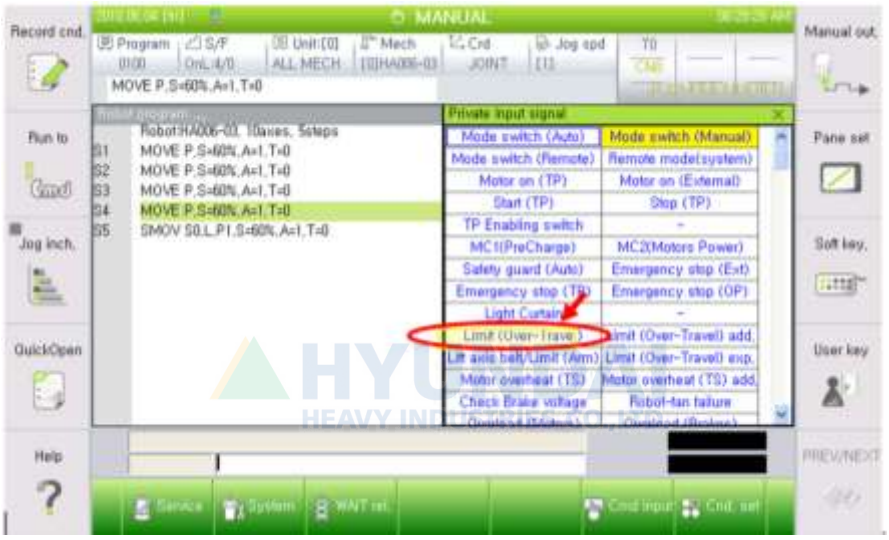


Figure 1.3 Limit (Over-Travel) Monitoring is Displayed from the Private input signal Window

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

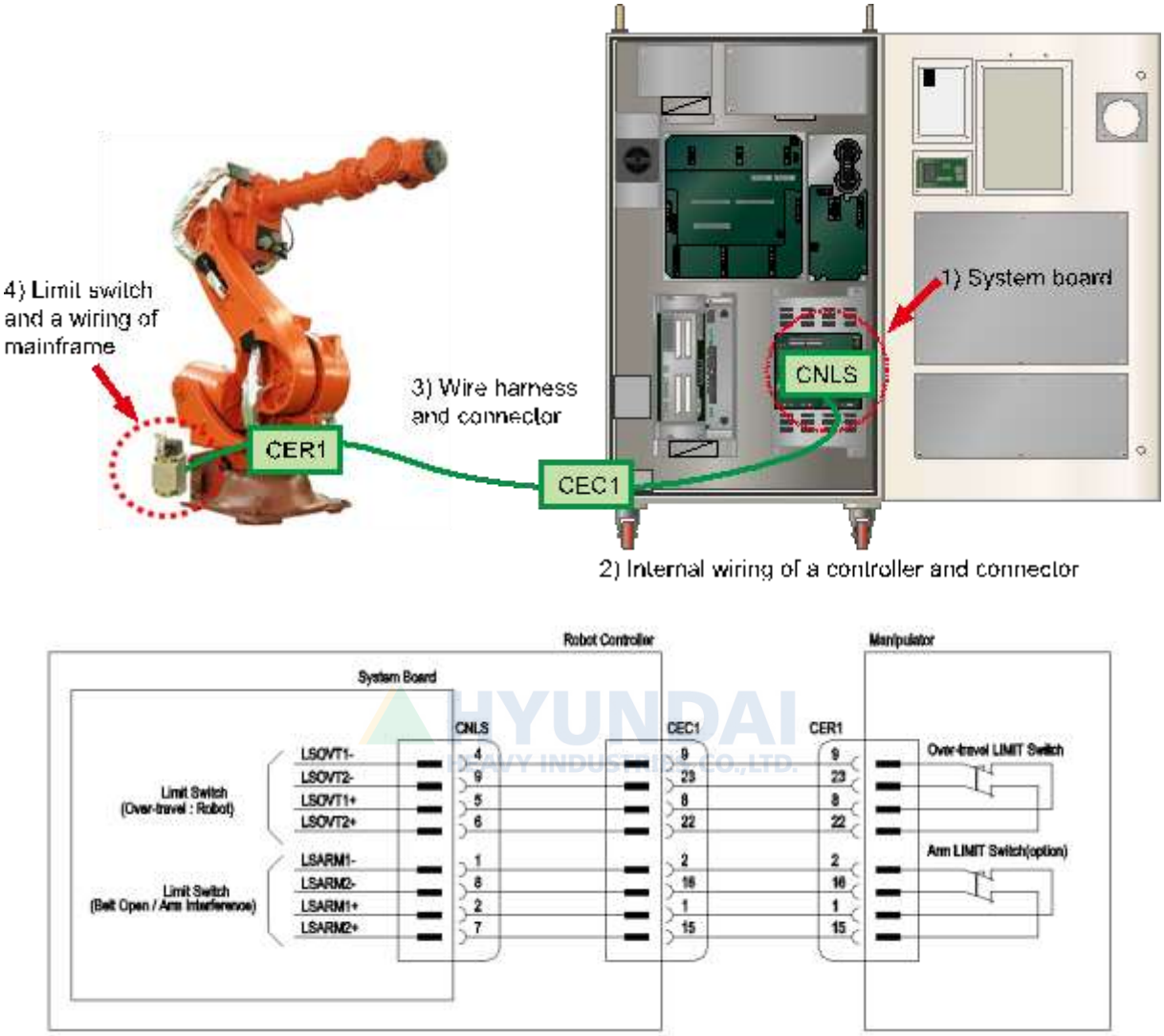


Figure 1.4 Wirings that are related to a Limit Switch Status Input

Main check points and their orders are

① System Board
② Internal wiring of a controller and connector
③ Wire harness and connector
④ Limit switch and a wiring of mainframe

And please jump the input line of limit switch at an appropriate point in order to check if a limit (Over-Travel) from monitoring windows turns to white color.

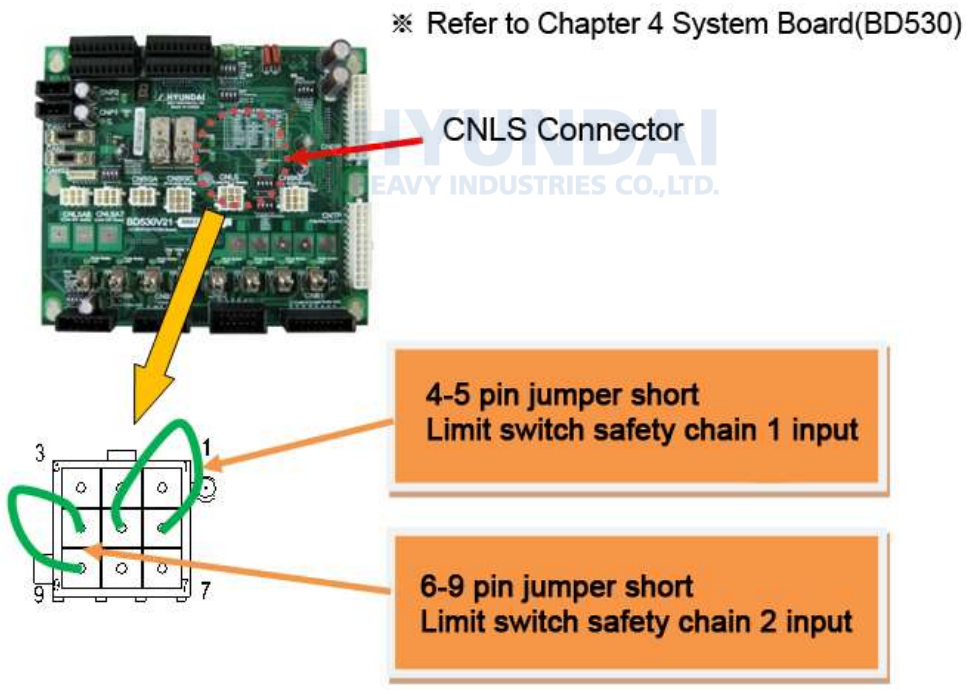
Please proceed as follows.

■ **Checking method from a System Board Connector (CNLS)**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages

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

① If it turned to a white color, System Board malfunction caused this error. Please replace the board.
② If it is still yellow which indicates that the error persists.



■ **Checking method from a wire harness (CER1 or CEC1)**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages

This method uses a Wire Harness connector (CER1 or CEC1) to judge if the cable malfunction caused this error.
Please remove CEC1 Wire Harness, and jumper short the pins that are related to the limit switch from a CEC1 connector which is attached to a controller. At this stage, please check the limit (Over-Travel) from the Private input signal monitoring windows.

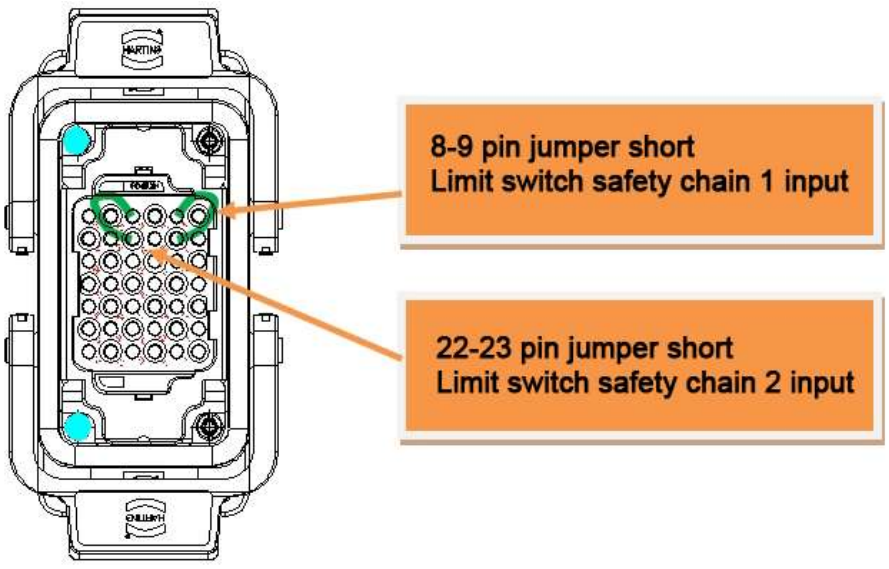
① If it turned to a white color, internal CEC1 Connector (of a controller) - System Board cable or a connector malfunction caused this error. Please examine them or replace them.

② If it is still yellow which indicates that the error persists, please search a problem that caused this error in an area between the CEC1 connector and the limit switch of main frame.

Please reconnect CEC1 Wire Harness, and remove the CER1 Wire Harness from a main frame. After that, please jumper short the pins that are related to a limit switch from a CER1 connector.
At this stage, please check a limit (Over-Travel) from the Private input signal monitoring windows.

① If it turned to a white color, Wire Harness cable between CER1 Connector-CEC1 Connector or a connector malfunction caused this error. Please examine them or replace them.

② If it is still yellow which indicates that the error persists, please search a problem that caused this error in an area between the mainframe sides's CER1 connector and the limit switch.



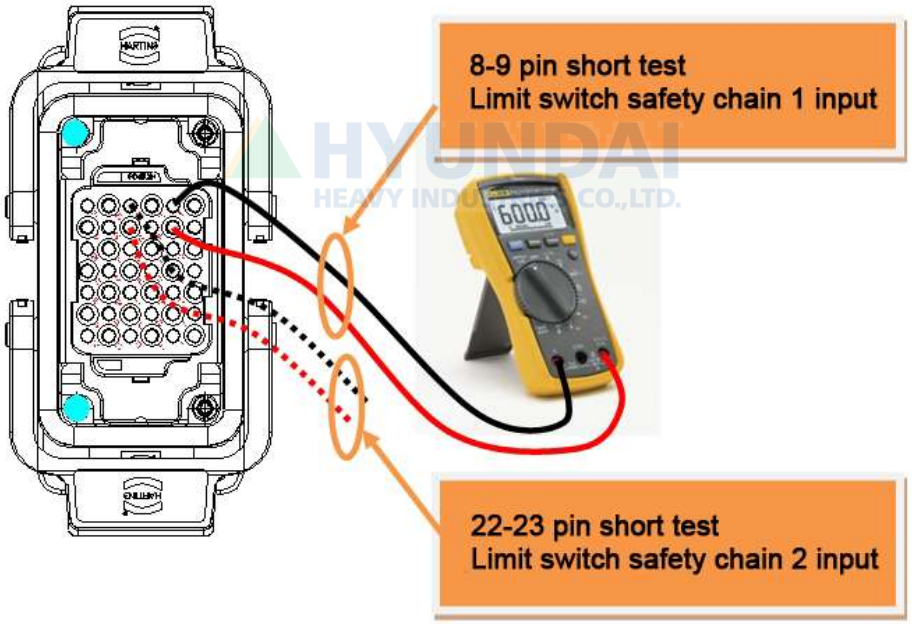
■ **Checking method by examining a limit switch and internal wiring of main frame**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages.

Please remove the CER1 Wire Harness from a main frame, and use a multi meter to run a short (shortage) test to examine the lines that are related to the limit switch from a main frame's CER1 connector.

① If resistance is measures as open status, limit switch or a limit switch – CER1 connector or a connector malfunction is suspected. Please examine or replace them.

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



1.1.2. E0010 AMP recovery discharge resistance overheating

1.1.2.1. Outline

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

1.1.2.2. Causes and checking methods

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

(1) Please examine the components that are related to the overheat error detection
- Please examine the resistor of CNTR cable
- Please replace CNSGC cable and examine it
- Please replace BD530/BD531 board and examine it
- Replace the servo drive unit and then check it.

<Case: Error always occurs at the moment when the motor turns on>

(2) Please examine the components that are related to the power
- Please examine the resistance value of CNDR cable
- Replace the servo drive unit and then check it.
- Please examine the 3-phase voltage from the inside of controller
- Please examine the controller's 3-phase input voltage

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

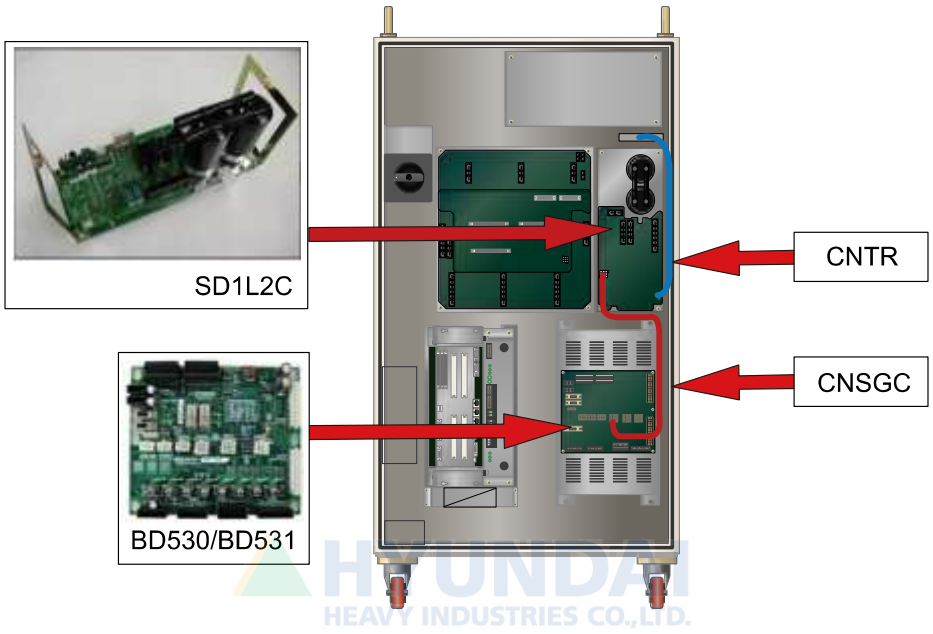
(3) Please make changes on a speed of Robot's operation in order to confirm the error
- Please reduce the speed of Robot's operation in order to confirm the error
- Please examine the recovery discharge resistance value

<Case: Error occurs after 5 minutes from the startup of Robot's operation>

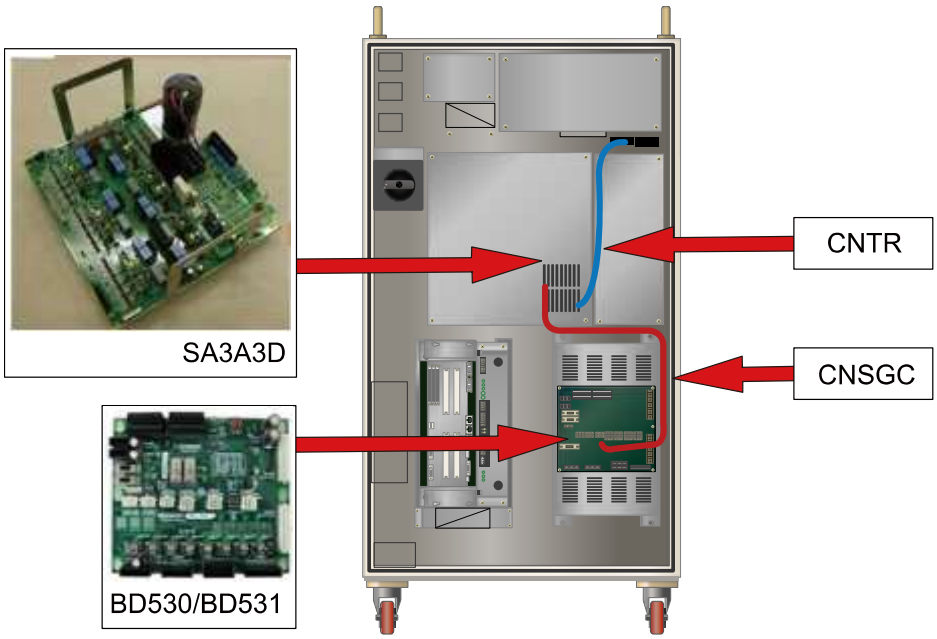
(4) Please examine the controller's cooling system and recovery electric power level
- Please examine the operational status of each fan
- Please examine the power voltage of each fan
- Please reduce the speed of Robot's operation in order to confirm the error

(1) Please examine the components that are related to the overheat error detection

Recovery resistance overheat error is detected by Servo Drive Unit. Each end's On/Off status of overheat sensor that are attached to a recovery resistor is being monitored by CNTR connector. Detected error will be sent through CNSGC cable to be handled by software at the BD530/BD531 board.



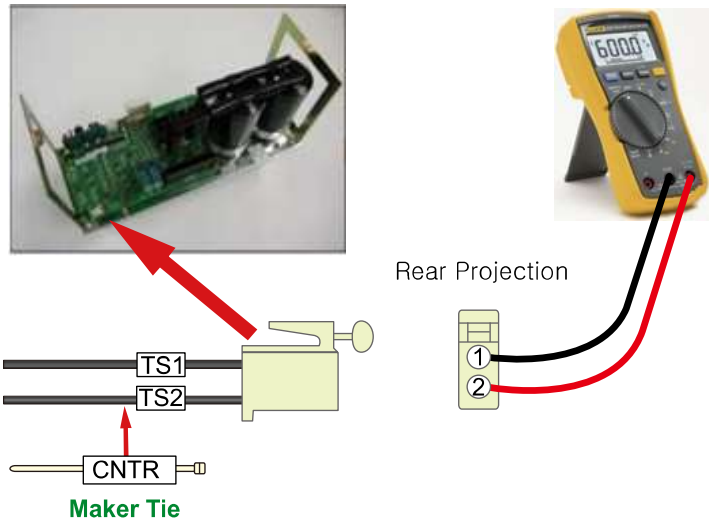
(a) Hi5-N00 controller



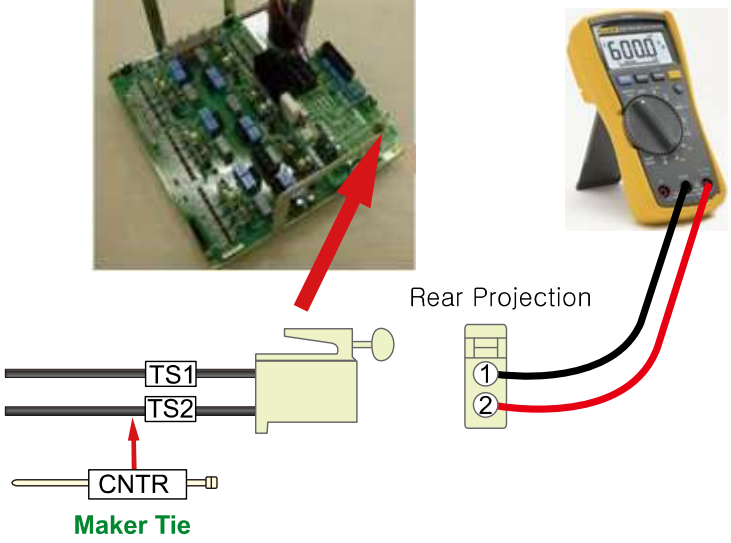
(b) Hi5-N30 controller

Figure 1.5 Arranging the parts related to the regenerative resistor overheating error

■ Examining the CNTR cable
Please examine the sensor from a CNTR connector that connects the overhear detection sensors.
In a normal status, sensor must be measured less or than 0.1 ohm



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.6 Measuring the resistance value at CNTR

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

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

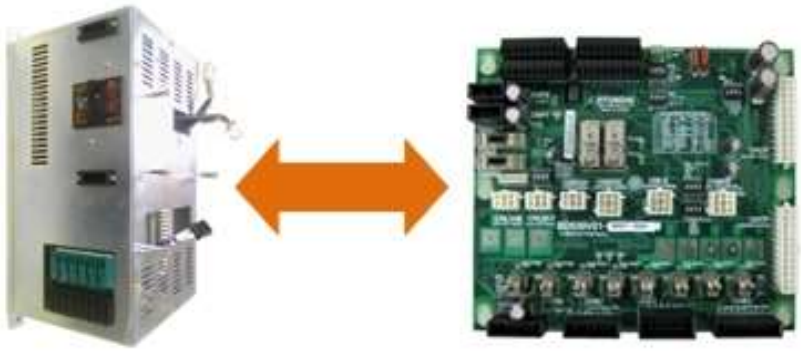


Figure 1.7 Replacement of BD530/BD531

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- Replacement and inspection of servo drive unit
  The regenerative resistor overheating error detection module is as shown below.
  - Hi5-N controller : Medium size SD1L2C, Small size SA3A3D

  Please check the components in the controller that you are currently using and examine it. Please replace it with new one and see if the error persists.

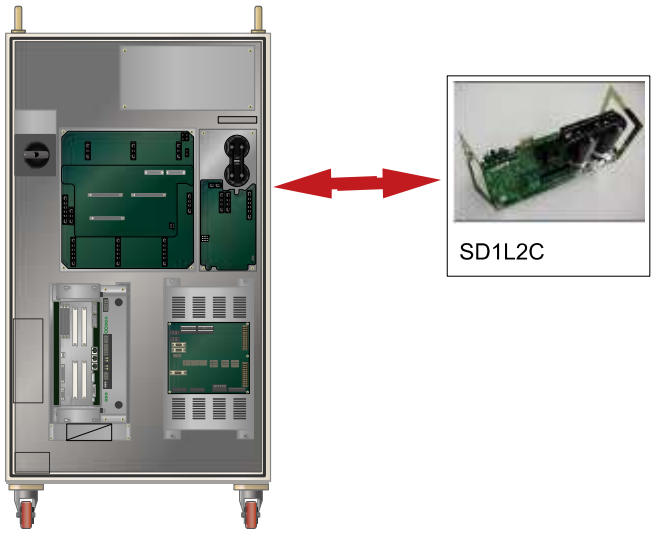
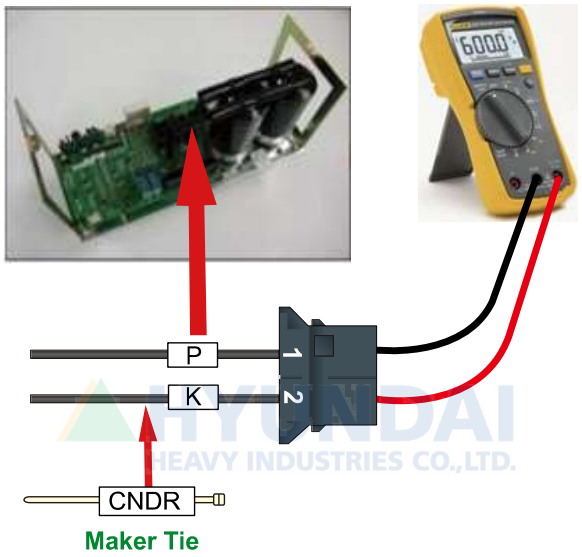


Figure 1.8 Replacing the module when the regenerative discharge resistor overheating error occurs

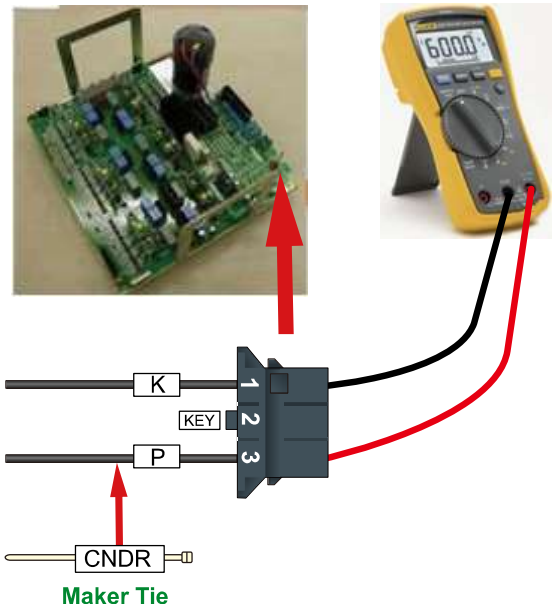
(2) Please examine the components that are related to the power

Overhear error may occurs in a case when resistor has disconnection or discharge control malfunction. It also can occur when recovery discharge resistance value and a 3-phase voltage increases.

- Examining recovery discharge resistor's disconnection
  If measured resistance value at the end of CNDR cable is many M ohm, the resistor's disconnection or connection problem of internal wiring caused this error. Please replace the recovery resistor with new one or repair the wiring.



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.9 Measuring the resistance value at CNDR

- Replacement and inspection of drive unit
  Replace the regenerative discharge resistor overheating error detection module and then check if the error occurs again. An error may occur continuously due to a module's internal circuit malfunction.

  - Hi5-N controller
    - Medium size Robot's diode module : SD1L2C
    - Small size Robot's Servo Drive Unit: SA3A3D

- Examine the 3-phase voltage (inside of the controller)
  Recovery discharge operation activates from approximately DC 375V
  If a voltage over AC242 V enters to the Servo Drive Unit, a recovery discharge resistance overheat error may occur when the motor turns on.
  If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's 3-phase internal voltage examination procedures.

  - Servo Drive Unit input voltage specification: 3-phase AC 220V
  - Allowed range when motor turns on: 198 V ~ 242 V

(3) Please make changes on a speed of Robot's operation in order to confirm the error

In case when a Robot's speed is reducing, or moving toward to gravity direction, direct current voltage of a Servo Drive Unit increases, and the voltage will be discharged with a recovery discharge resistance in order to prevent damages on components that may caused by voltage increase.
If a Robot reduces its speed rapidly, or make a high speed movement toward to gravity direction, it may cause this error. Please confirm if this error occurs according to the speed of Robot's operation.

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

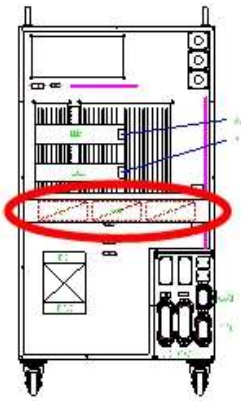
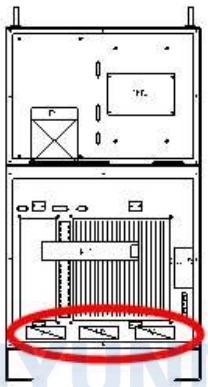
- Examining recovery discharge resistance value
  If a measured resistance value at the end of CNDR cable exceeds over 10% of the value described in the manual, the resistor malfunction is the cause of this error. Please replace the resistor. Please refer to the previous page for the measuring method.

  - Hi5-N controller
    - Medium size (SD1L2C) recovery discharge resistance value: 5 ohm
    - Small size (SA3A3D) recovery discharge resistance value: 15 ohm

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

If recovery resistance overheats error occurs after 5 minutes from the startup of Robot's activation, the cause would be either the controller's cooling system malfunction or a speed of Robot's operation exceeded the designed specification of the controller.
Fans are being used at rear of the controller in order to cool down the Servo Drive Unit's heat sink and the recovery discharge resistor.

Table 1-1 Position for installing the controller pan (Hi5)

Hi5-N**	Hi5a-C1*	Hi5a-C0*
		

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- Examining the operational status of each fan
  Please replace a fan if it does not spin, or the speed is abnormally slow. Lifetime of a fan may vary according to an operating environment or an amount of operated hours.

- Examining fan's power voltage
  Please check the input voltage of fans if all of them do not operate. Input voltage of a fan is set to AC220V and the allowed range is within 10% of the standard voltage. If voltage is lower than 10% of the standard voltage, the cooling effect will be reduced due to slow spinning speed of a fan. In case when the voltage is low, please check the input voltage for fan's power supply connector (CNFN2) and a controller.

- Please confirm an occurrence of an error according to the speed of Robot's operation
  If an overheat error occurs during a continuous operation over 5 minutes, it is because of the consecutive operation of Robot exceeded the cooling capacity of a controller. Please reduce the speed of Robot's operation and check if the error persists. In order to resolve this error, if you had to reduce the operation speed too much just to resolve this error, please enquire at our office.

1.1.3. E0011 AMP overvoltage (P-N)

1.1.3.1. Outline

Direct current voltage (P-N) of Servo Drive Unit that drives the motor exceeded the set value.

1.1.3.2. Causes and checking methods

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

(1) Please examine the components that are related to the overvoltage error detection.
- Please replace CNSGC cable and examine it CNSGC.
- Please replace BD530/BD531 board and examine it.
- Replace the servo drive unit and then check it.

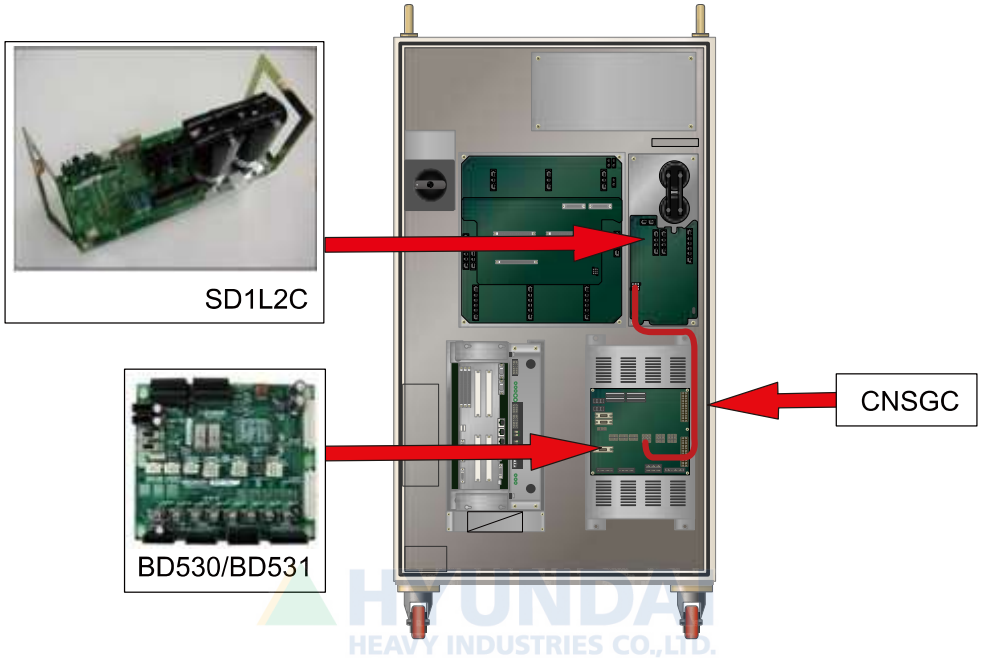
<Case: Error always occurs at the moment when the motor turns on>

(2) Please examine the components that are related to the power.
- Replace the servo drive unit and then check it.
- Please examine the 3-phase voltage from the inside of controller.
- Please examine the controller's 3-phase input voltage.

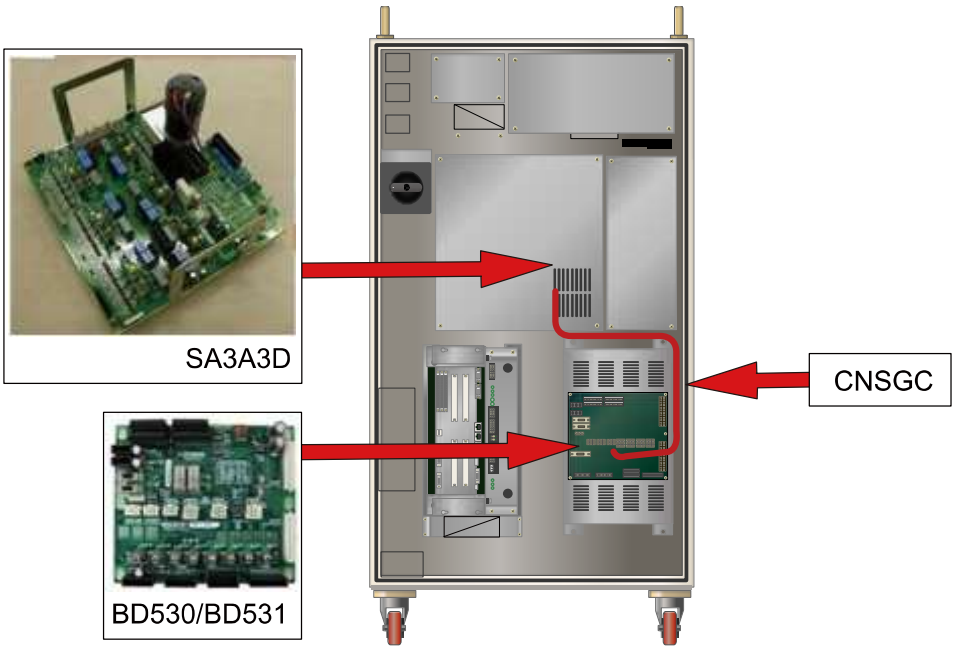
<Case: Error occurs at a certain step according to the Robot's operation speed>

(3) Make changes on a speed of Robot's operation in order to confirm the error.
- Please reduce the speed of Robot's operation in order to confirm the error.
- Please examine the recovery discharge resistance value.

(1) Please examine the components that are related to the overheat error detection.
AMP overvoltage error is detected by the servo drive unit when the DC power (P-N) to the servo drive unit exceeds the set level. Detected error will be sent through CNSGC cable to be handled by BD530/BD531 board.



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.10 Arranging the parts related to the overvoltage error

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

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

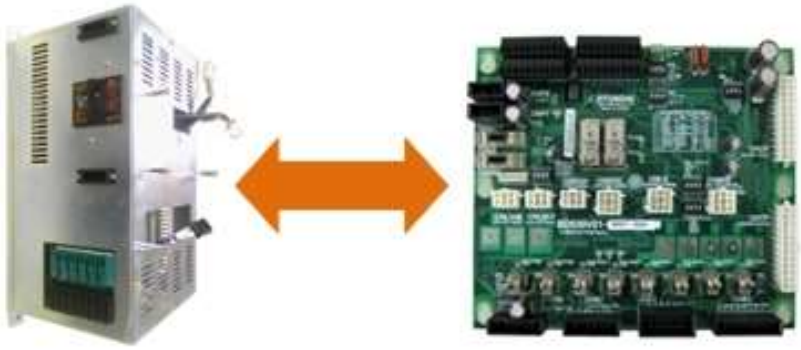


Figure 1.11 Replacement of BD530/BD531

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- Replacement and inspection of servo drive unit
  The AMP overvoltage error detection module is as shown below.
  - Hi5-N controller : Medium size SD1L2C, Small size SA3A3D

  Please check the components in the controller that you are currently using and examine it. Please replace it with new one and see if the error persists.

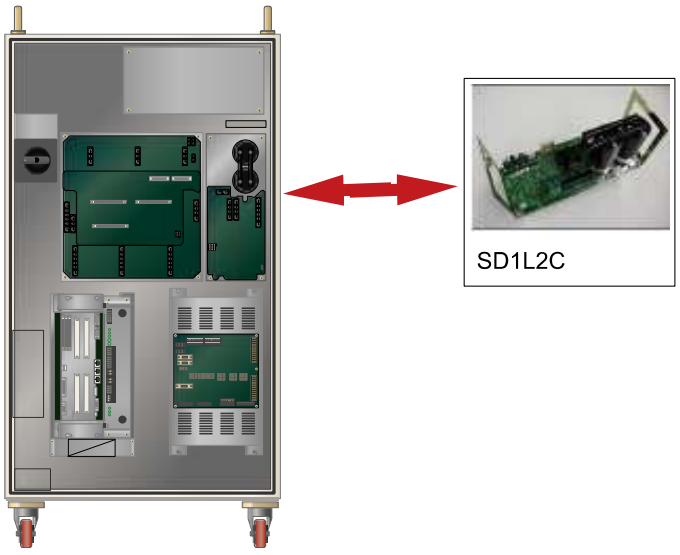


Figure 1.12 Replacing the module when the overvoltage error occurs

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

Overvoltage error occurs when direct current voltage that exceeds DC395V due to 3-phase input voltage over AC 220V enters to the Servo Drive Unit.

- Replacement and inspection of servo drive unit
  Replace the AMP overvoltage error detection module and then check if the error occurs again.
  An error may occur continuously due to module's internal circuit malfunction.

  - Hi5-N controller
    - Medium size Robot's diode module : SD1L2C
    - Small size Robot's Servo Drive Unit: SA3A3D

- Examine the 3-phase voltage
  AMP overvoltage error is activated from approximately DC 395V
  If voltage over AC242 V enters to the Servo Drive Unit, a recovery discharge resistance overheat error may occur when the motor turns on. If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's 3-phase internal voltage examination procedures.

  - Servo Drive Unit input voltage specification: 3-phase AC 220V
  - Allowed range when motor turns on: 198V ~ 242V

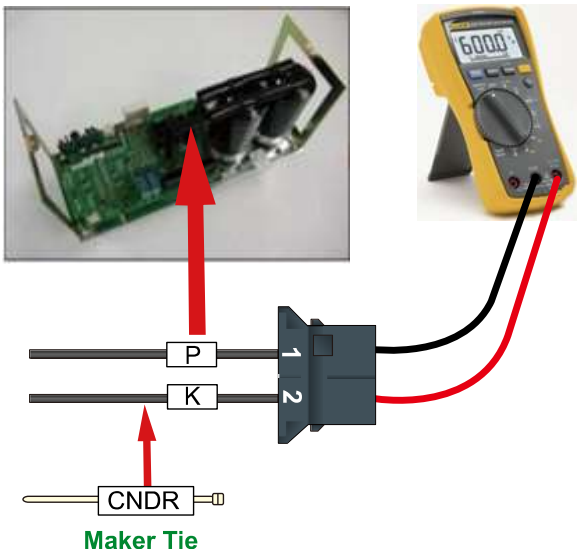
(3) Please confirm the occurrence of error according to the speed of Robot's operation.

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

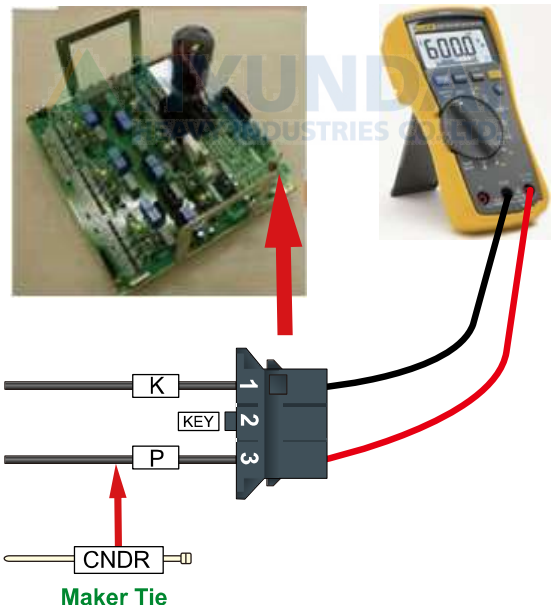
- Make changes on a speed of Robot's operation
  If a recovery electric power that generated by Robot's operation exceeds the controller's designed specification, overvoltage error may occurs. Please reduce the speed of a step that the error occurs and re-operate in order to confirm if the error persists.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

- Examining the recovery discharge resistance value
  If a recovery resistance value is greater than the specification, recovery discharge does not perform well and it will cause the overvoltage error. Recovery resistance specifications are subject to be changed according to the controller's specification. Please refer to a manual and a controller check sheet that provided upon a purchase.
  If the resistance value exceeds 10 % of specification, please replace it.

  - Hi5-N controller
    - Medium size (SD1L2C) recovery discharge resistance value: 5 ohm
    - Small size (SA3A3D) recovery discharge resistance value: 15 ohm



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.13 Measuring the resistance value at CNDR

1.1.4. E0014 Instant contact of safety switch (EM, OTR, TS etc.)

1.1.4.1. Outline

For some reason the motor's power supply to AMP has been shut down. Main examines the safety signals in order find the reason of the motor's power shut down. If no reason is found, this message will be displayed.

Following diagram shows compositions of various safety signals that can shut down the motor's power. Main periodically examines the ON/OFF status of those safety signals. If a momentary contact malfunction occurs between the periods, main will not be able to detect it and displays this message instead.

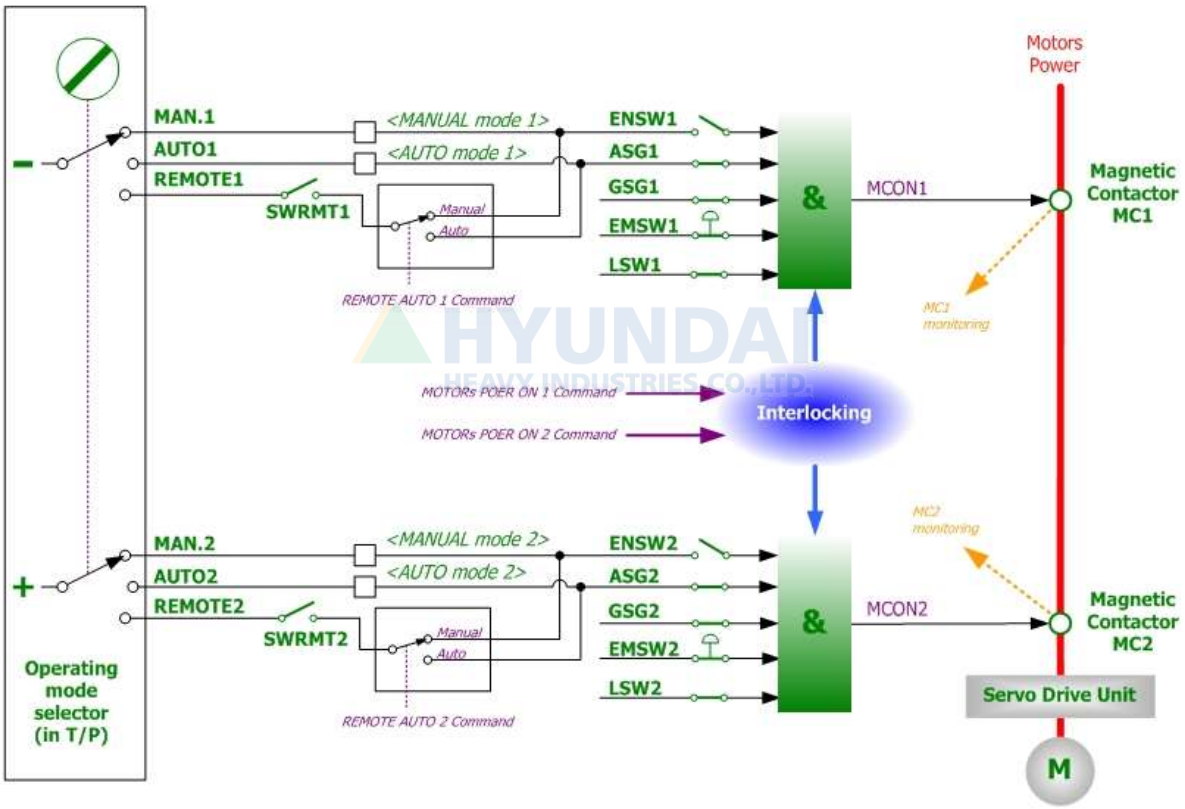


Figure 1.14 Concept Diagram of Safety Circuit for Motor's Power ON/OFF

1.1.4.2. Causes and checking methods

(1) Please check the status of DC 24V (P1-M1) power and cables

(2) Please check if there is a problem with CPUERR, EXOUT signals

(3) Please check the safety switch and signal wirings

(4) Please check the System Board, Electrical Module

(1) Please check the status of DC 24V (P1-M1) power and cables.
Please check if the System Board is being supplied with DC 24V control power (P1, M1) properly. This error can be caused if there is a problem with the power as it will affect the safety sequence of the System Board. Power is to be supplied by SMPS's CN6 Connector-System Board CNP2 Connector. Please check if the power level is varying or is there any problem with the cable.

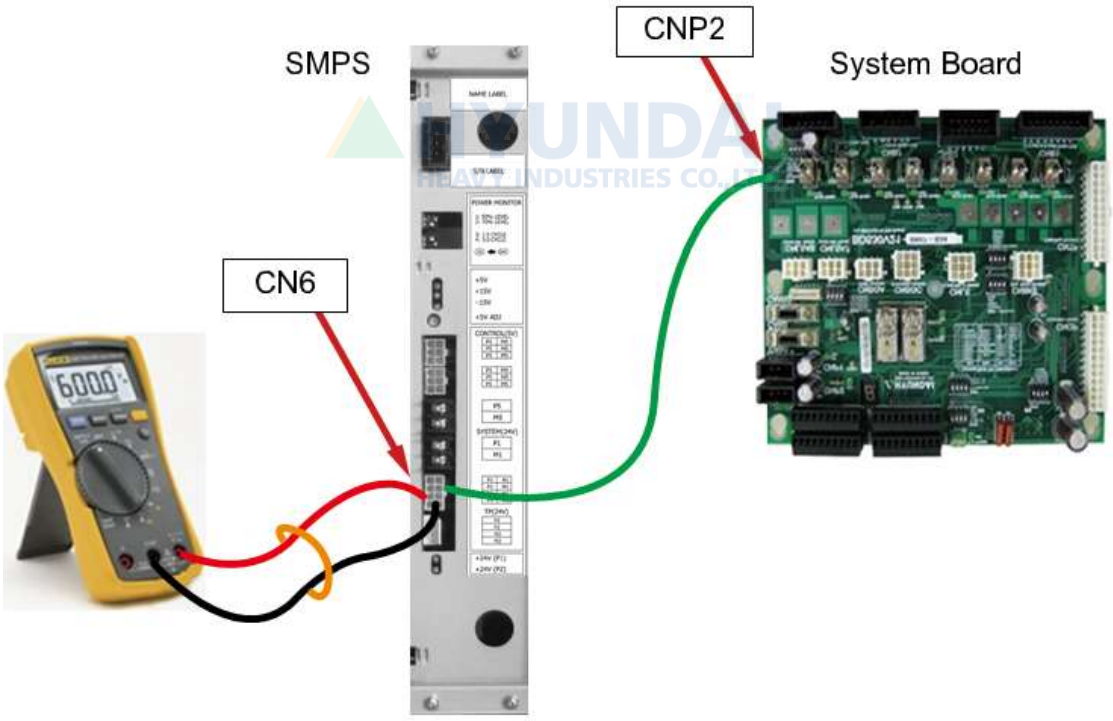


Figure 1.15 Method of Connecting DC24V Power and Measuring Voltage of the System Board (BD530)

(2) Please check if there is a problem with CPUERR, EXOUT signals

Main board generates CPUERR or EXOUT signals in a case when systemic error has occurred (e.g. power shut down, Servo error). This signal will be transferred to the System Board and block the motor on command in terms of hardware. Motor's power will be immediately shut down for a safety reason. However, these signals may be generated abnormally, and it will shut down the motor's power.

- How to judge:
  System Board's 7-segment index may give you an indication of the situation.7-segment displays "H" when CPUERR is being transmitted to the System Board. Also the CPUERR, EXOUT LED which located at the center of the System Board indicate the error situation (figure 6.21) These LED lights will be on if it is a normal status, and the lights will be off if it is not.

  However if the signal appears time to time for a very short moments, 7-segment and LED won't be able to indicate it. In such case, error occurrence must be observed while ignoring the two signals by using DIP switch SW1. Method to ignore the signal is to, as shown in the figure 6.21, turn on the No 1(to ignore CPUERR) and the No 2 (to ignore EXOUT) of the DIP switch SW1. At this point all LED lights will be on.

  If the error no longer persists after the system restart, main board generated these signals or CANS1 Connector/Cable malfunction is suspected.

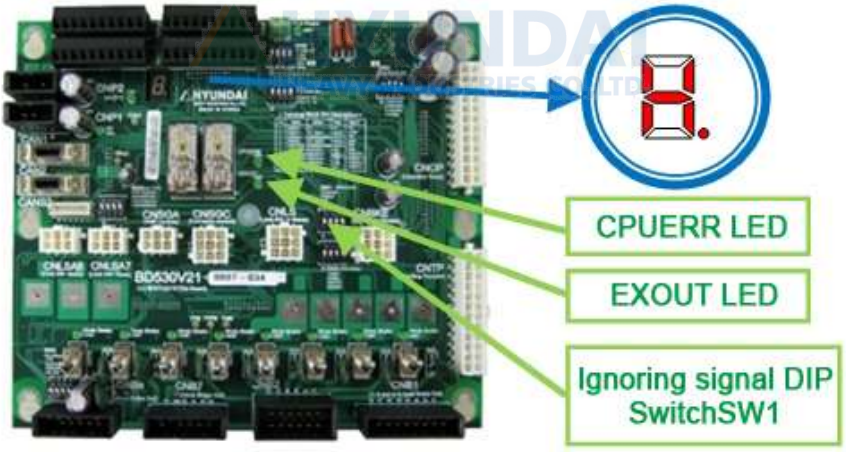


Figure 1.16 Location 7-SEG, LED and DIP Switch (CPUERR error related) on a System Board

- Actions:
  If a Main Board generating this signal without any other indication of errors, please check the PLD version of the Main Board. Over V0.7 is normal. If main board's PLD version is normal, please examine the CANS1 connector and cables.

Cautions: Please use only No 1 (to ignore CPUERR) and No2 (to ignore EXOUT) of the DIP switch SW1 for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

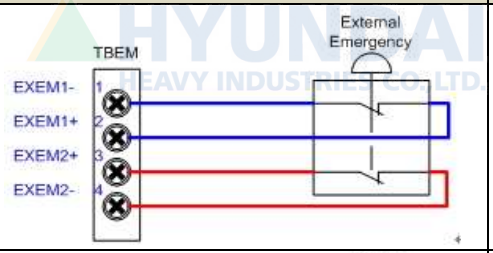
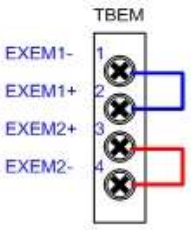
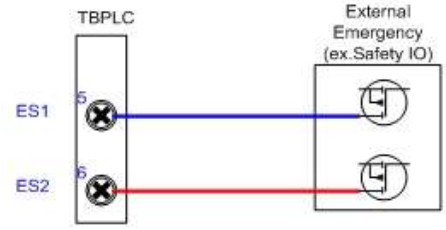
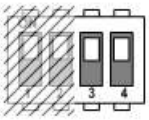
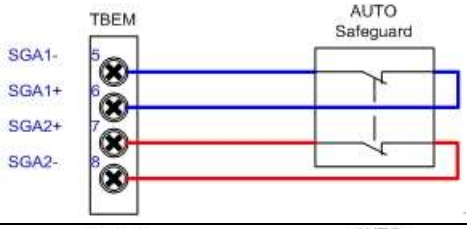
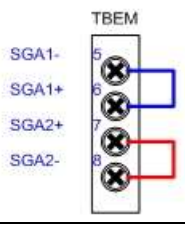
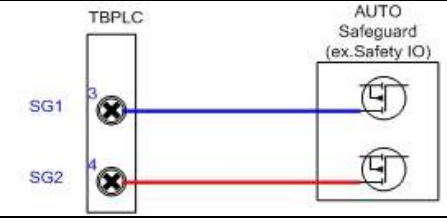
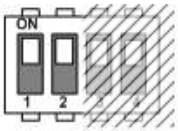
(3) Please check the safety switch and signal wirings.

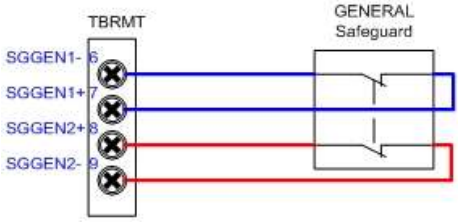
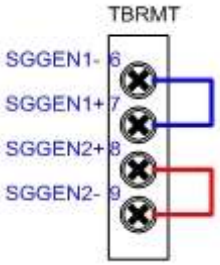
Safety switch input may goes OFF for a short moment which cannot be detected by the Main Board for following reasons.

- Switch malfunction
- Wiring malfunction: Exposure or damage on a cable
- Wirings installation problem:
  Separated distance between power lines, cables that consume a large amount of electric power must be greater than 10CM. Alternatively electrical shielding by using a metal marital plates are required.

Cautions:
Please use only for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

Available safety switches are as below, and they can be connected through a System Board. Please check the above for the safety switches that are being used.

Types	Connecting method	Disabling method
Emergency stop switch(External) –point of contact type		
Emergency stop switch(External)-semiconductor type		No3, No4 of SW6 is ON 
Safety guard (Auto)-point of contact type		
Safety guard (Auto)-semiconductor type		No1, No2 of SW6 is ON 

Types	Connecting method	Disabling method
Safety guard (General)		

Cautions:
Please use only for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

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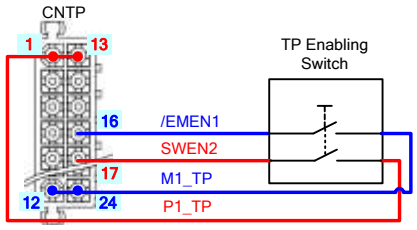
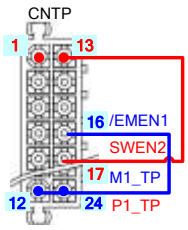
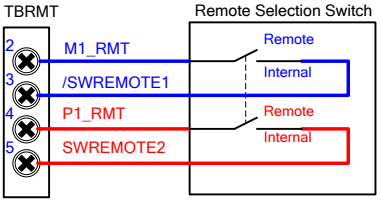
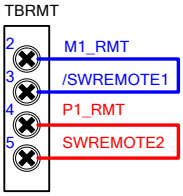
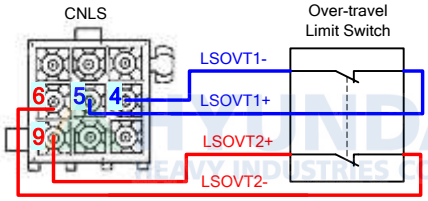
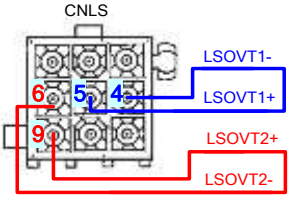
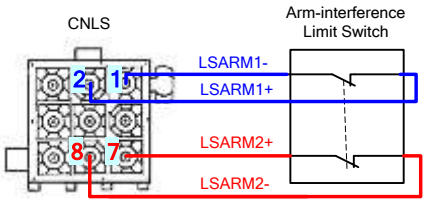
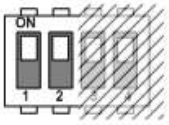
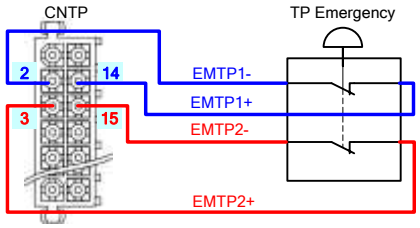
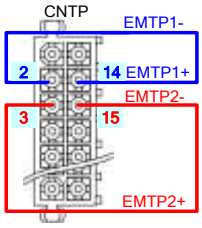
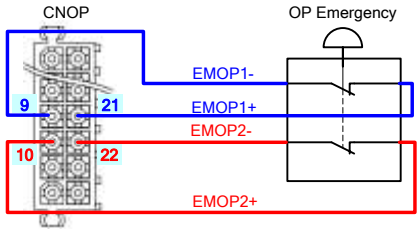
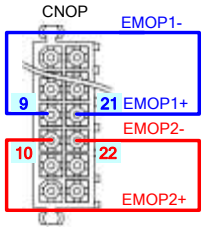
Other switches that are related to a safety and system operation which may effect to this error are as below.

Types	Connecting method	Disabling method
Enabling switch (TP)		
Remote mode input		
Limit switch		
Arm interference switch		**No1,No2 of SW5 is ON** 
Emergency stop switch (TP)	**System Board – Wiring between Teach Pendants** 	
Emergency stop switch (OP)		

(4) Please check the System Board, Electrical Module.

- Cabling (wires, connector etc.) malfunction
  Please check the cabling between the Electrical Module (PSM or PDM) that an electrical connector is installed and the System Board (BD530) that collects monitoring signals.
  The cable name is CNMS and it enters to the Electrical Module through the top rear of the System Board (figure 1.17). Please check the connection status of this cable's connector.

Figure 1.17 CNMC Cable on the Electrical Module

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- System Board malfunction
  Input signal processing unit malfunction from the inside of System Board can be a cause of this error. Please replace the System Board and examine it.

- Electrical Module malfunction
  Internal electrical module malfunction can be categorized as a electrical board (BD5C2 or BD5C0), Electrical connector (MC1, MC2), and wirings between the electrical board and the electrical connector. However it is difficult to examine the inside of Electrical Module in a field where a Robot has already been installed, so alternatively please replace the Electrical Module.

Figure 1.18 Inner Structure of Electrical Module

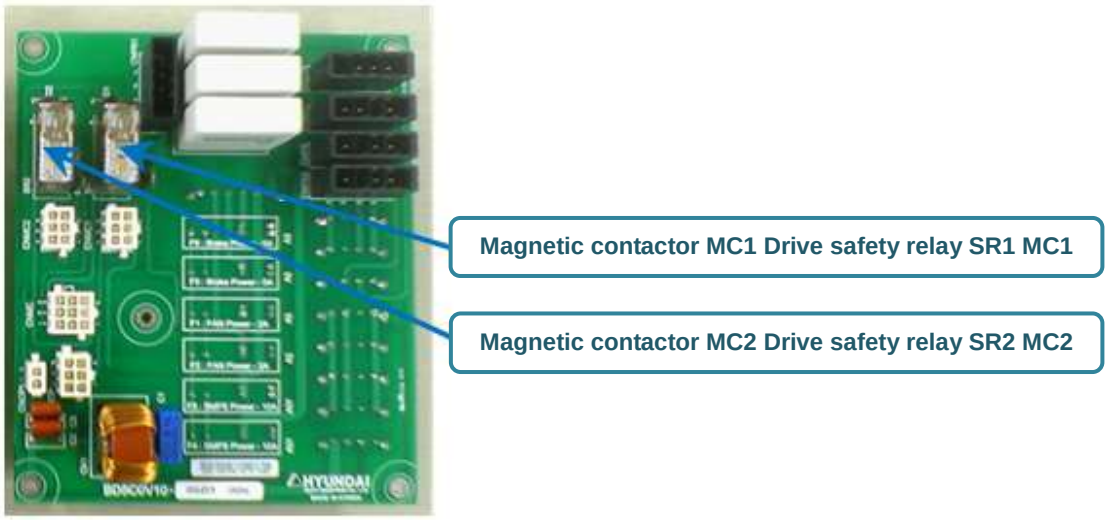

Figure 1.19 Electrical board

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1.1.5. E0015 Teaching pendant operation error

1.1.5.1. Outline

This error occurs when communication between a Main Board (BD510) and a Teach Pendant (TP520) has been disconnected due to a bad communication status. If this error occurring during an operation (AUTO mode), a robot will be immobilized.

1.1.5.2. Causes and examine methods

(1) Please check if the Main Board inside of a controller is in a normal status.

(2) Case: Status of 7-Segment from a Main Board is "." (normal)
- Case: TP communication status indicator icon is white
- Case: TP communication status indicator icon is x

(3) Case: Status of 7-Segment from a Main Board is "u."
- TP communication status indicator icon will be x

(4) Case: Status of 7-Segment from a Main Board is abnormal
- TP communication status indicator icon will be x

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(1) Please check if the Main Board inside of a controller is in a normal status

Communication can be disconnected if a Main Board or a Teach Pendant is in an abnormal status for any reasons. Please see the 7-Segment from a Main Board to confirm if a Main Board's status is normal or abnormal.

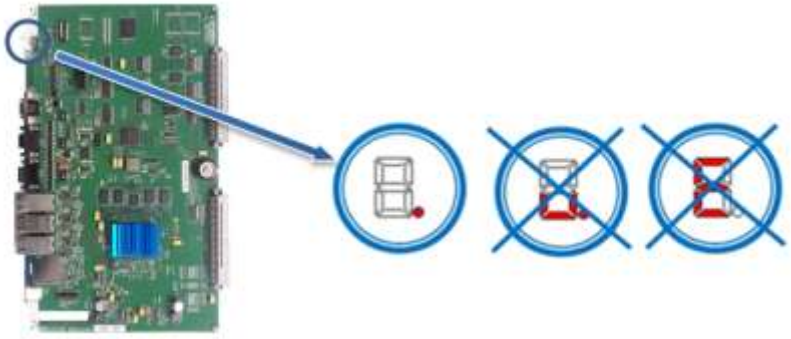
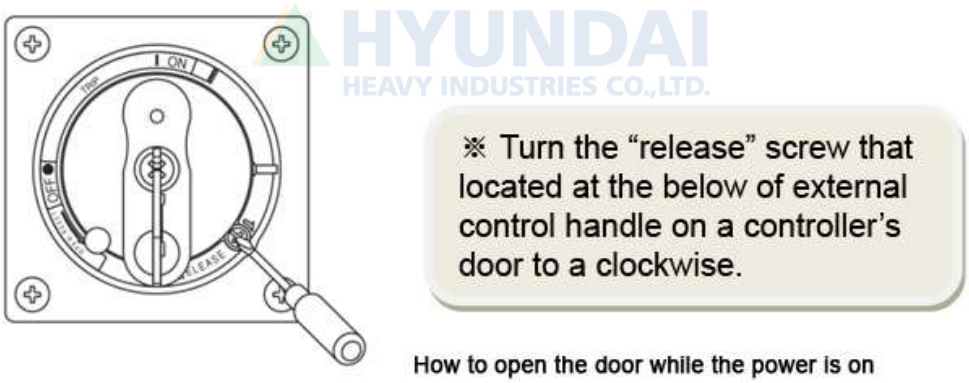
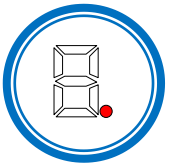


Figure 1.20 7-Segment is in a Normal Status. Others are Abnormal (see the above diagram)

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



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



(2) Case: Status of 7-Segment from a Main Board is "." (normal)

Please check the status of "TP communication indicator icon" that located on a left side of "Titles" from TP511.

- If a TP communication status indicator icon is blue, it is a normal status.

- If a TP communication status indicator icon is white,

  - LAN cable between a Main Board and TP has a problem (not open) or an abnormal status of Teach Pendant is suspected.

    ① Please download Main Board's application program as same version as a TP.
    ② Please replace TP510 and test it.
    ③ Please replace a LAN cable between TP connector and Main Board in a controller and test it.
    ④ If a same status persists, please contact to our AS department.

- If a TP communication status indicator icon is x,

  - Disconnection (open) of LAN cable between a Main Board and TP is suspected.

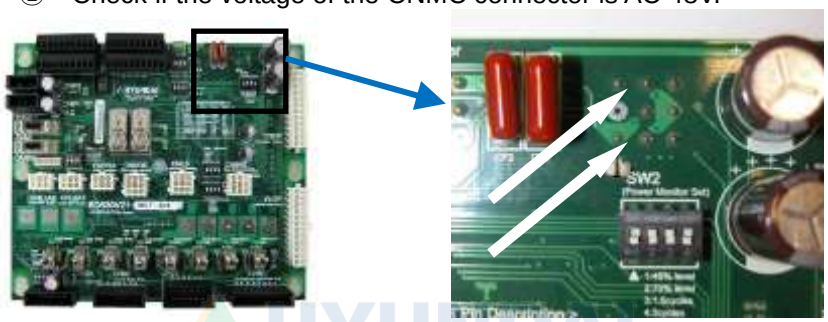
    ① Please replace TP and test it.
    ② Please replace a LAN cable between TP connector and Main Board in a controller and test it.
    ③ If a same status persists, please contact to our AS department.

(3) Case: Status of 7-Segment from a Main Board is “u.”

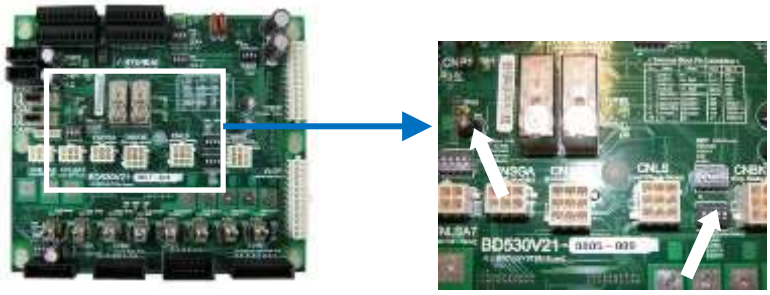
■ TP communication status indicator icon will be x.

➢ The cable between the main board and the system board, or the system board is suspicious.

① Make sure that the connectors (CANIO↔CAN1) are properly connected on both ends of the cable.
② Check if the voltage of the CNMC connector is AC 48V.

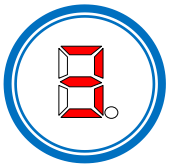


③ Check if the VE (3-pin) of SW1 is DC 0V.



④ Replace the CANIO↔CAN1 cable and then retest it.
⑤ Replace the system board and then retest it.
⑥ If a same status persists, please contact to our AS department.

(4) Case: Status of 7-Segment from a Main Board is abnormal



■ TP communication status indicator icon will be x.

➢ The cause for this case is a Main Board malfunction.
① Please replace a Main Board and test it.
② If a same status persists, please contact to our AS department.

1.1.6. E0022 Communication error between internal modules

1.1.6.1. Outline

Internal modules of controller use CAN communication in order to transfer data. E0022 is an error code that indicates the Main Board has detected an error in a CAN communication between internal module System Boards. E0032 error code will be used for users board (BD58x) that uses a same CAN communication channel.

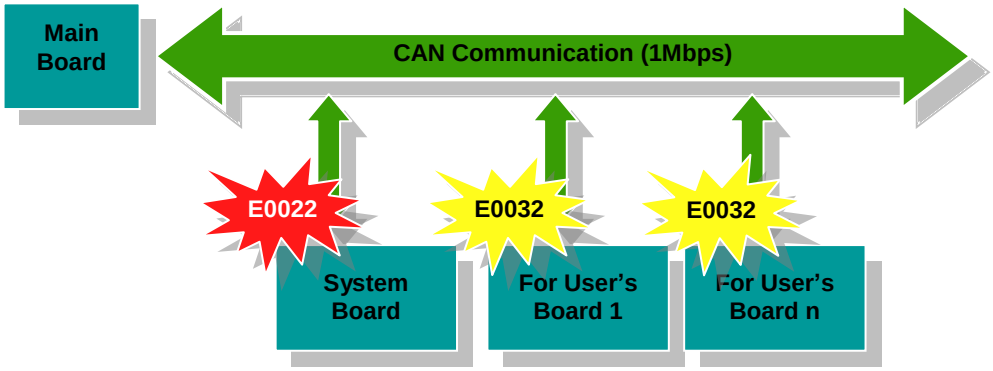


Figure 1.21 CAN Communication Structure of Hi5 Controller

System Board is a module that controls an input/output of controller's power sequence. Once this error occurs, all functions related to this will be stopped and main stops CAN communication. In order to re active all the functions, a controller must be restarted.

1.1.6.2. Causes and examine methods

(1) General examine
- Please check the connection status of CAN communication cable.
- Please check the power status. (power voltage or connection status of cable)

(2) If an error persists even after a restart of controller
- Please check a System Board malfunction.
- Please replace a malfunction parts and test it (Main Board, System Board, cables)

(3) If an error occurs while a controller is normally operating
- Please observe changes in surrounding environment.
- Please examine the CAN communication line.
  - Please examine the CAN communication connector for user's module.
  - Please examine the connection of termination resistor.
  - Please examine the wiring structures.
  - Please examine if a communication cable uses a twist line.

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(1) General examine

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

Reference

Once "E0022 Communication error among inner modules" occurs, mainboard will not establish a communication with system board even if a system board initiates communication. Controller must be restarted in order to reestablish a communication.

- Please check the connection status of CAN communication cable

  Please check if a CAN cable between Main Board and System Boards are well connected. Please remove and reconnect the CAN connectors of Main Board and System Board and check if an error persists, in order to check connector's connection status.

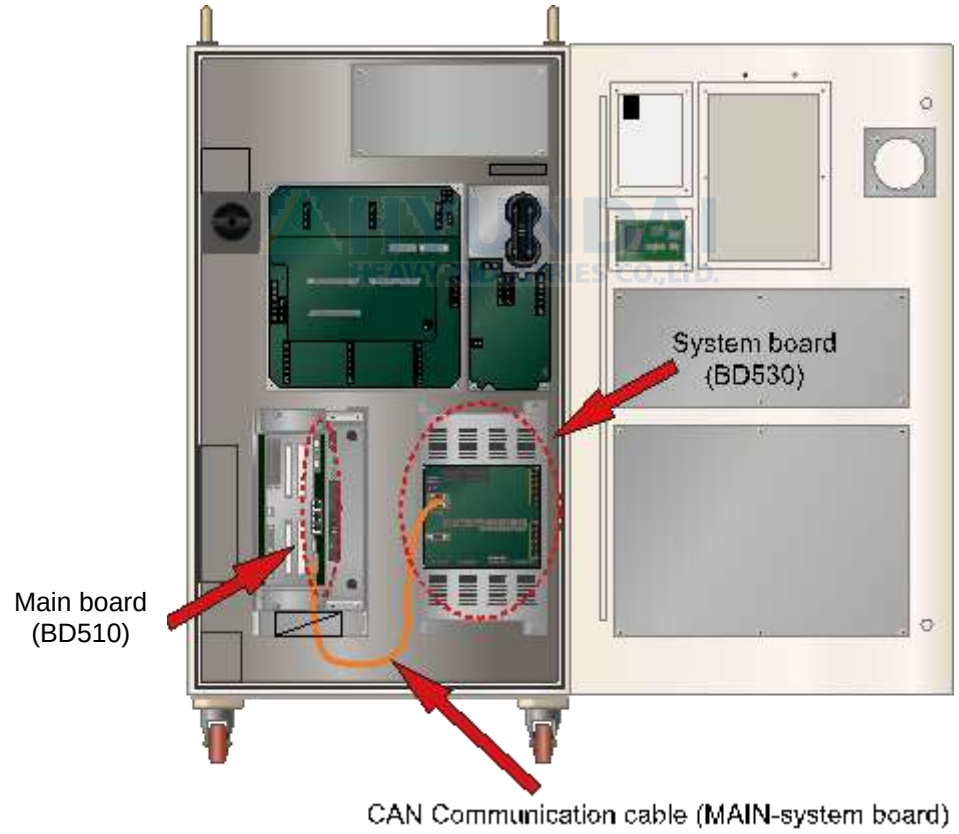

Figure 1.22 CAN communication cable connection between a main board (BD510) and a system board (BD530)

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

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

  Please check if a power is being supplied or not by using a simple method. As a below diagram, there are LED CNP1 that indicates DC 5V voltage and 7-segment that indicates the board operating status on an upper right side of System Board.

Table 1-2 Method to Check the whether the Rated Voltage on System Board is Normal or Not

Category	LED CNP1	7- Segment	Result
1	Off	Off	Power on a System Board is has not been authorized properly. Please examine the power related parts such as SMPS, Cable, Connector connections etc.
2	On	Off	Power of IO related board (BD531) that located at the rear of system is not authorized or malfunction.
3	On	On	Please check the power voltage.

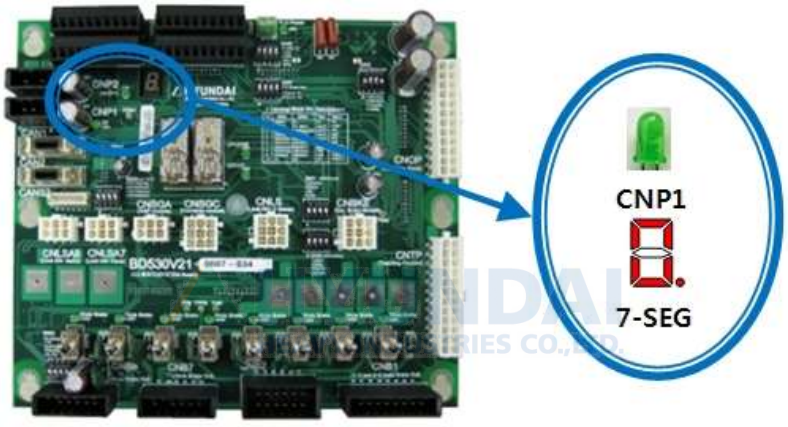

Figure 1.23 LED CNP1 for a power purpose DC5V of a system board (BD530)

If the lights of LED CNP1 and 7-segment DC are all on as above table, please check if the DC 5V control power that authorized on a board is in a range of 5.0V~5.3V.
If the voltage is out of this range, it may effect to the communication. Check points are as below diagram and it the voltage is out of range, please configure it to a range of 5.0V~5.3V from a SMPS.

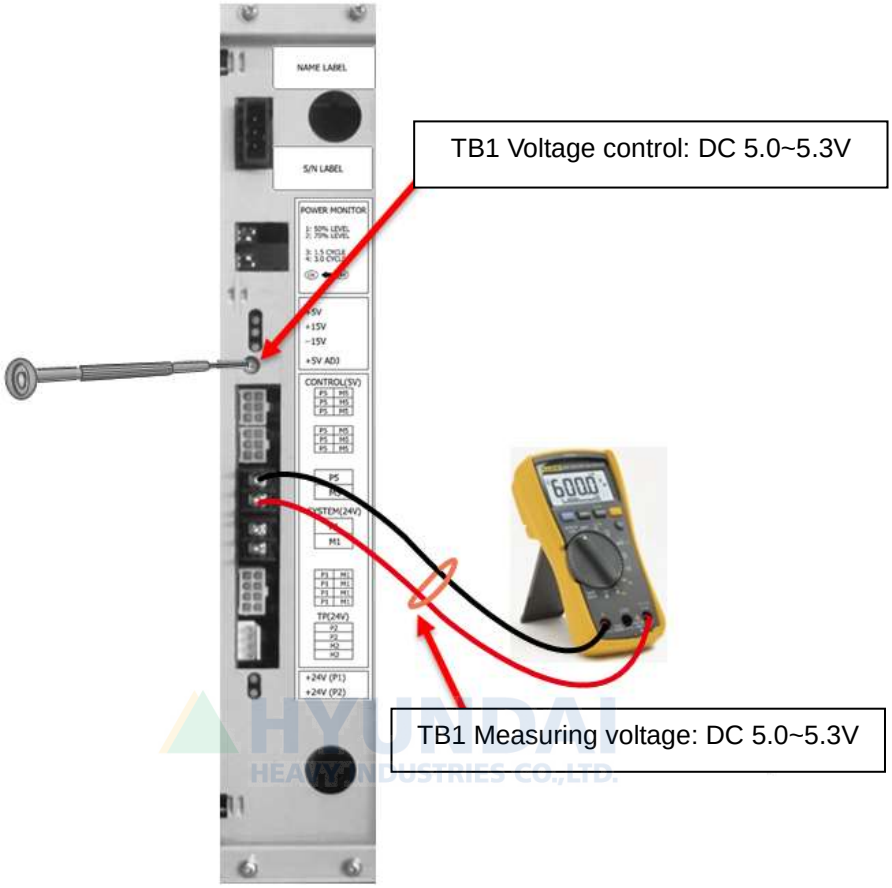

Figure 1.24 Measuring a voltage of DC 5V and controlling method

(2) If an error persists even after a restart of controller

If an error message displayed because the error is already occurring even after the controller has been restarted, the faulty area can be identified by performing a series of examines.

Reference

If you are using's a user's module (BD58x), please remove a CAN cable that connected to this module before you perform this test. It is to eliminate possible elements that will effect to the test. If this error does not persists after a restart of a controller followed by a removal of user's module cable, the cause of an error is related to a user's module. Please refer to the following paragraph.

In order to remove a user's module CAN communication from a controller, please unplug the CAN2 and CANS2 connectors from a System Board as below diagram. If you restart the controller, only a Main Board and System Board will keep the CAN communication.

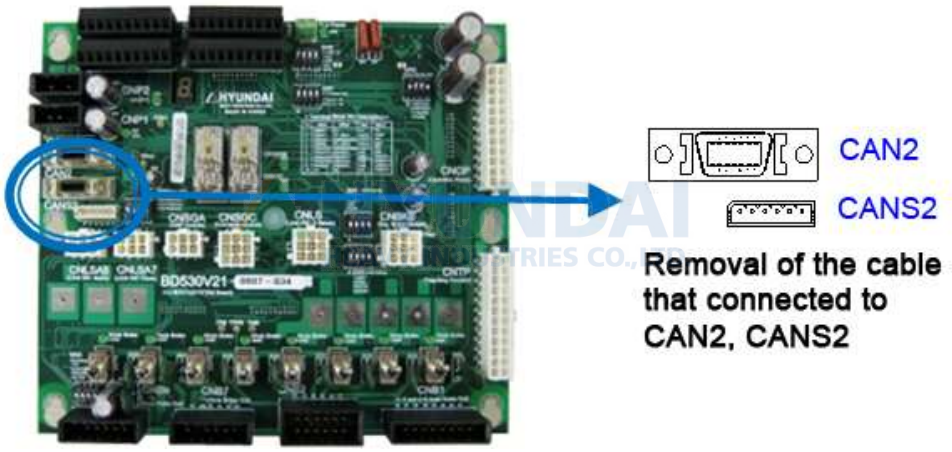

Figure 1.25 Method to remove CAN communication connection from user's module (BD58x)

- Please check the malfunction status of System Board
  System Board has a 7-segment that indicates a various status. By examining it, you may determine if a System Board is malfunctioning or not. After a controller has been restarted, if the indicator does not display the content in a rotation as below, System Board malfunction is suspected. Please replace it.

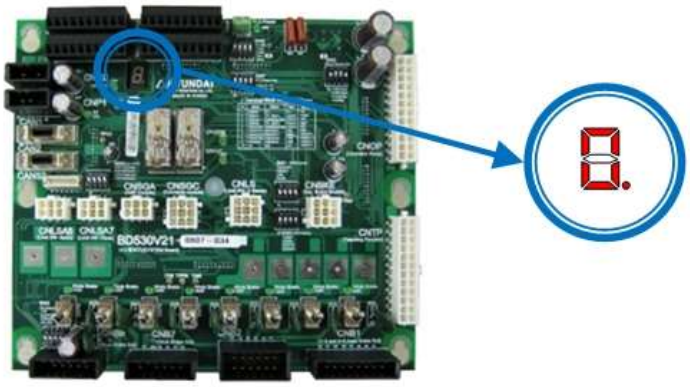

Figure 1.26 Location of 7-segment on a System Board (BD530)

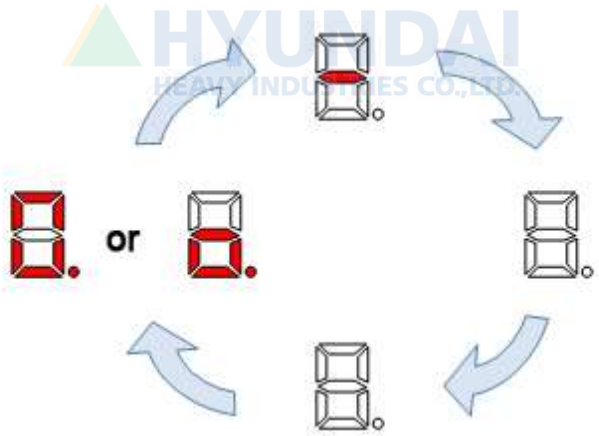

Figure 1.27 Normal display of 7-segment on a system board when restarted

- Please replace a malfunction part and test it.
  If above examines do not resolve an error, you will have to replace the parts that related to this error and test them. The cause might be a circuit malfunction that related to CAN communication inside of the board and it is difficult to be identified from an outside.
  There are 3 parts as below diagram – System Board (BD530), Main Board (BD510), Cable. (If a Main Board and other option module (BD58x) were having a CAN communication, the cause of an error is not likely from Main Board or cable. Please replace a System Board and test it).

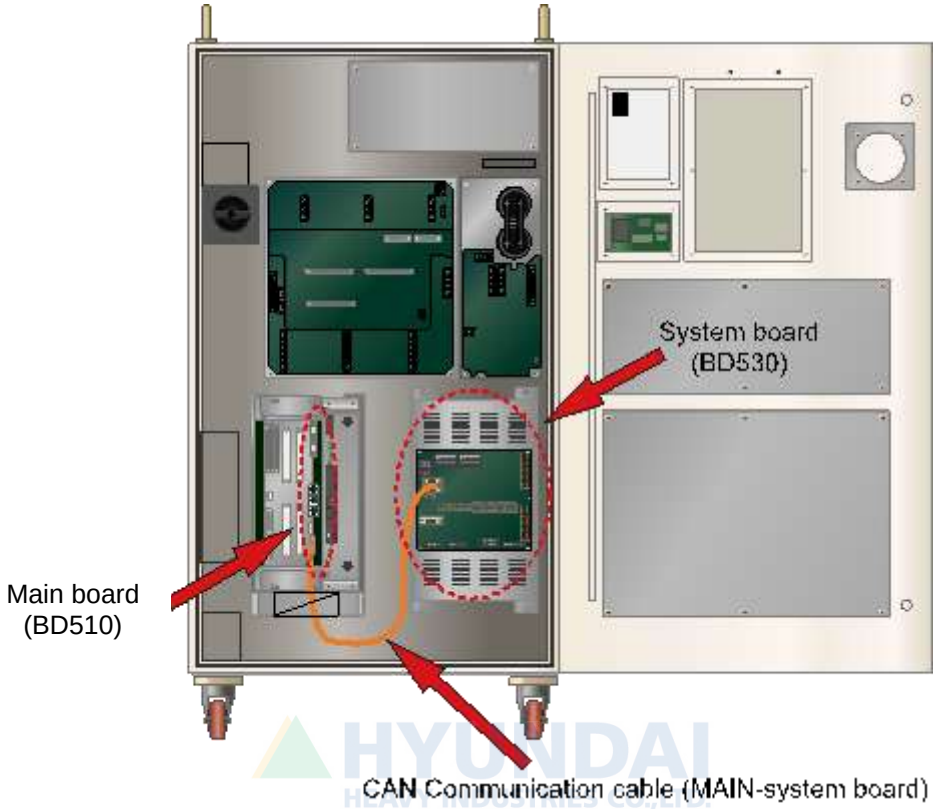

Figure 1.28 Location of CAN communication cable and a main board (BD510)

(3) Error occurring while a controller is operating normally

- Please observe changes in surrounding environment.
  Please observe if there have been any changes in the surrounding field. Check if a new large capacity electric power device has been installed. Quality of electric power and a shortage may effect to the communication and cause this error.

- Please examine a CAN communication line CAN.
  Property of matter CAN communication line may be connected with a user's module (BD58x) as well as a System Board and this may cause an error due to a effect caused by a property of line's material. So, if a user's module is being used, please run the following examines.

  - Please examine a CAN communication connector for user's module.
    Data communication with a Main Board uses a half-duplex CAN. Sub modules of controllers are consists of a Daisy chain that uses CAN data communication. So the board has 2 CAN connectors that indicated as CANS1, CANS2. Please check if those connections are valid.

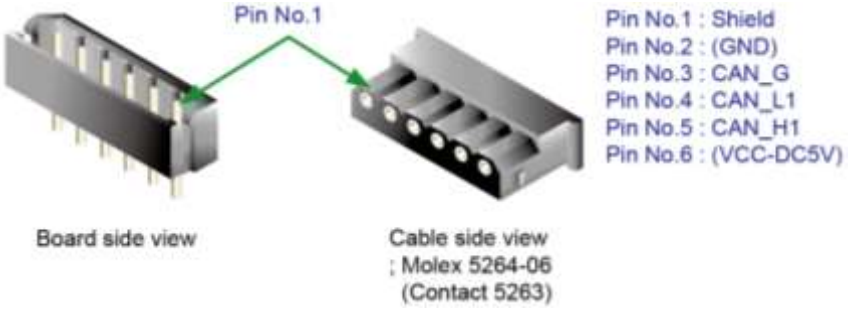

Figure 1.29 CAN connector CANS1, CANS2 of user's module

Table 1-3 Pin Locations for CAN Connector of User's Module

Number	Title	Use
1	Shield	To connect the electric shield line of CAN cable
2	(DC5V GND)	To connect board power DC5V ground (Connection with CNP1 is recommended)
3	CAN_G	To connect a ground for CAN communication
4	CAN_L1	To connect L signal of CAN communication
5	CAN_H1	To connect H signal of CAN communication
6	(DC5V)	To connect board power DC 5V (Connection with CNP1 is recommended)

- Please examine the connection of terminal resistor.
  If numbers of boards are connected to each other, a terminal resistor must be handled clearly. CAN data communication uses daisy chain method. So the terminal resistor only should be connected to the last CAN communication cable and the terminal resistor must not be connected to any boards in between. Terminal resistor's connection uses a JP1 jumper that located next to the CANS1 and CANS2 connector on a board. If JP1 has been shorted it means that the terminal resistor is connected, and if JP1 has been opened, it eliminates the terminal resistor connection. Please refer to the following Figure.

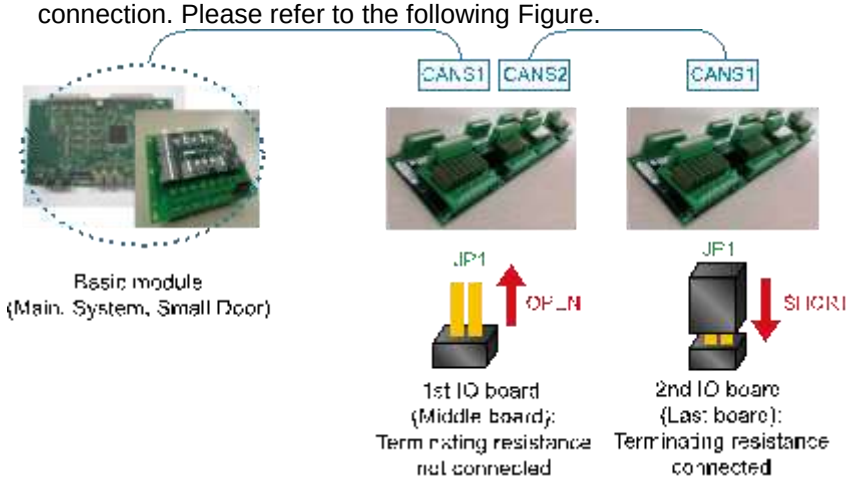

Figure 1.30 Connecting Method of Terminal Resistor on a CAN Communication Line

- Please examine if a communication cable uses a twist line.
  CAN communication uses twist pair wiring in order to ensure a high quality of communication against external noise. CAN_H1 and CAN_L1 signal line must be twisted to each other (please refer to figure 1.31).

Figure 1.31 Example of Twist pair

- Check the wiring structure in case of a controller that uses a small door
  CAN communication wiring must not have a branch wiring. All connections must have a series connection from one module to the next module. Following diagram describes a wrong wiring structure.

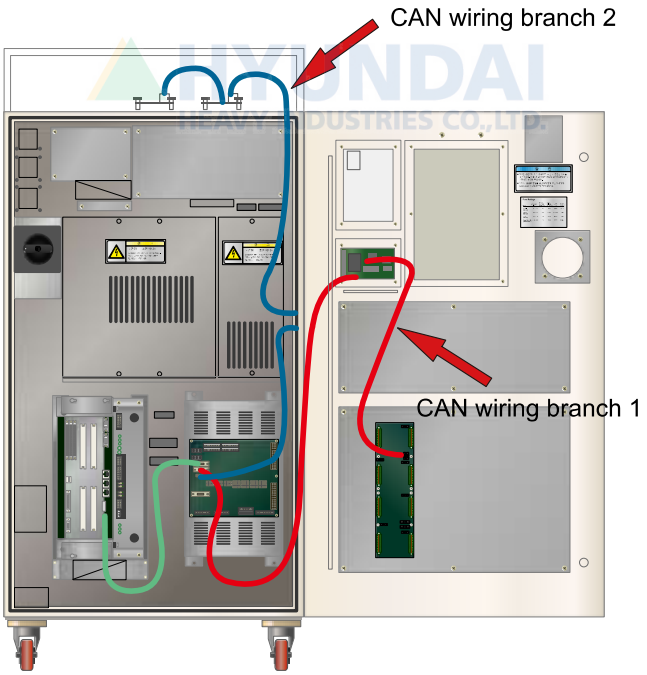

Figure 1.32 Bad example of CAN Communication Wiring Structure (in case of a Hi5-N controller that uses a small door)

In a diagram, CAN communication line that starts from a System Board has two branches.

- Branch 1:
  System Board CAN 2 Connector → Small Door Board → Controller door DIO board
- Branch 2:
  System Board CNAS2 Connector → Analog board on Controller's side → DIO boards on a controller

These can have a negative effect on a quality of communication, so please change the wiring structure as below.

- Branch 1:
  System Board CAN 2 Connector → Small Door Board → Controller door DIO board → Analog board on Controller's side → DIO boards on a controller
- Branch 2: Eliminated

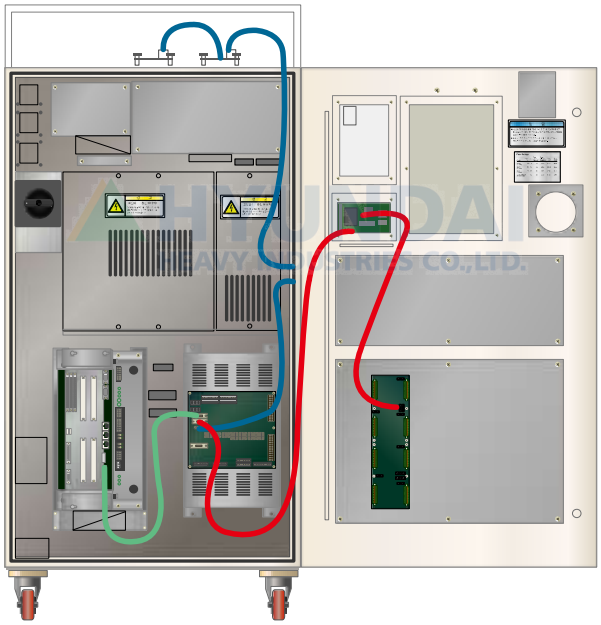

Figure 1.33 Good example of CAN communication wiring structure (in case of a Hi5-N controller that uses a small door)

If user module that used for a controller's door is not available, please remove the CAN cable that connects a System Board to a small door board as shown in a below diagram. Also making a wiring in order to keep the cable between modules at a minimum distance can increase a quality of communication

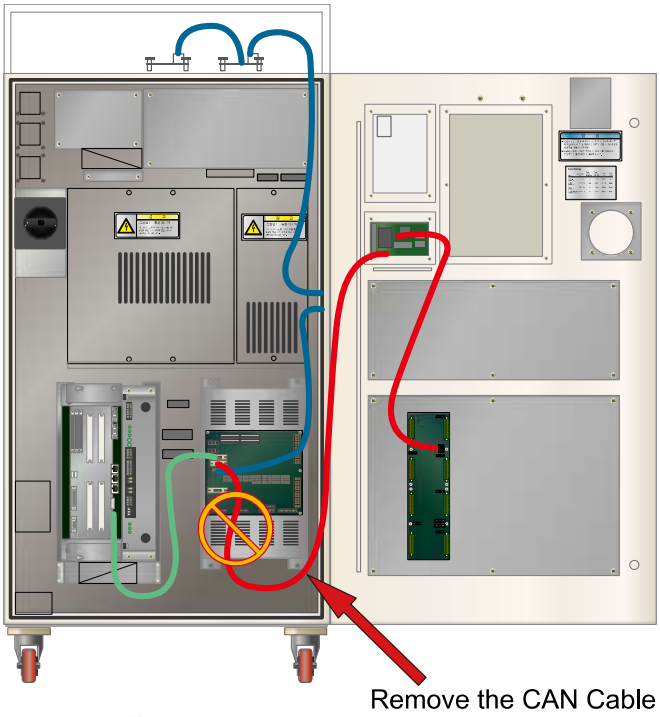

Figure 1.34 Remove the CAN Communication Cable that is Not in Use (in case of a Hi5-N controller that uses a small door)

1.1.7. E0033 AMP under-voltage error

1.1.7.1. Outline

Direct current voltage (P-N) that activates a motor in a Servo activation device has been measured under the under-voltage set value.

1.1.7.2. Causes and examine methods

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

(1) Please examine the parts that related to under-voltage error detection.
- Please replace CNSGC cable and test it.
- Please replace BD530/BD531 board and test it.
- Replace the servo drive unit and then check it.

.

<Case: Error always at the moment when motor turns on>

(2) Please examine power related parts.
- Replace the servo drive unit and then check it.
- Please examine a 3-phase voltage inside of a controller.
- Please examine an input 3-phase voltage of a controller.

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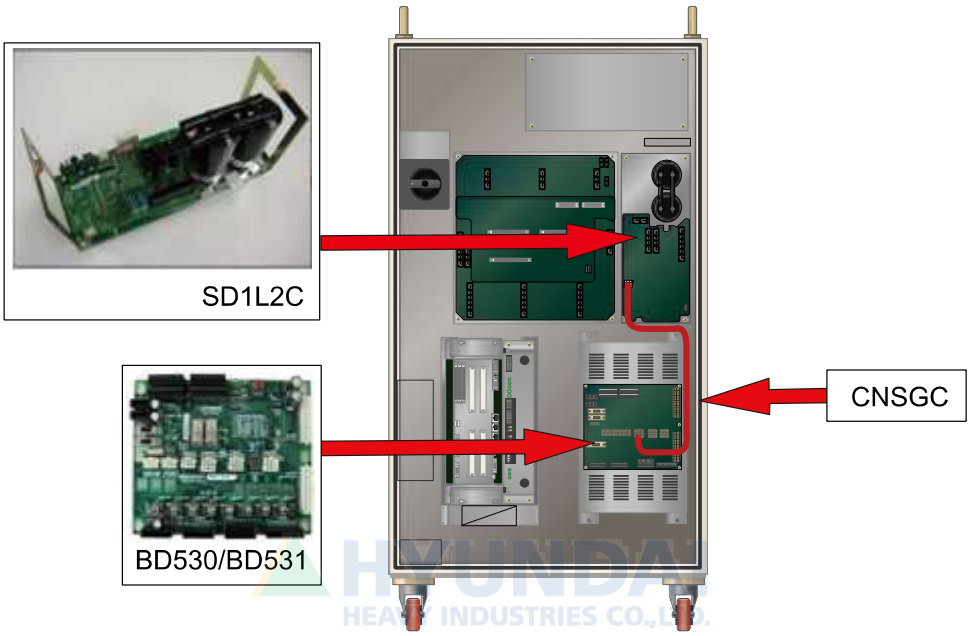
<Case: Error occurs at a certain step according to the robot's operation speed>

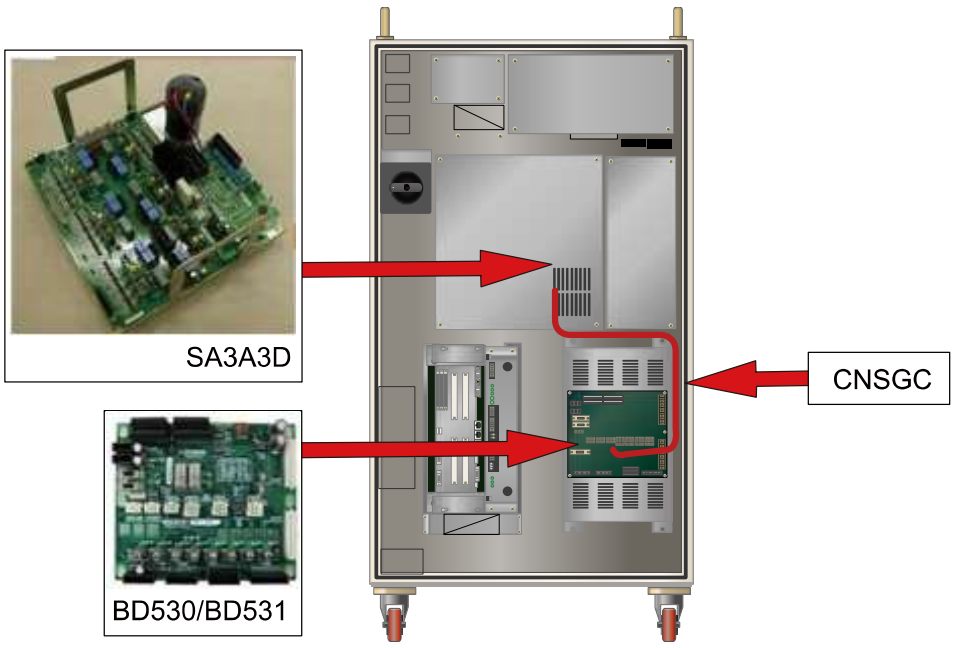
(3) Please make changes on a speed of robot's operation in order to confirm an error.
- Please reduce the speed of robot's operation in order to confirm an error.
- Please examine an input 3-phase voltage of a controller while a robot is in operation.
- Please examine an internal 3-phase voltage if an input voltage is not 220V.

(1) Please examine the parts that related to under-voltage error detection.

AMP low-voltage error is detected by the servo drive unit when the DC power (P-N) to the servo drive unit doesn't reach the set level. Generated error will be handled by software at BD530/BD531 through a CNSGC cable



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.35 Arranging the parts related to the low voltage error

- Replacement of CNGSC and examine CNSGC
  Please replace CNGSC cable with a proper one and if an error does not persist, cable connection fault caused an error. Please replace the CNGSC cable with new one and use.

- Replacement of BD530/BD531 and examine
  Please replace BD530/BD531 with a proper one and if an error does not persist, the board malfunction caused an error. Please replace the BD530/BD531 with new one and use.

Figure 1.36 Replacement of BD530/BD531

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- Replacement and inspection of servo drive unit

  The AMP low voltage error detection module is as shown below.
  ➢ Hi5-N controller : Medium size SD1L2C, Small size SA3A3D

  Please check the parts of a controller that currently used. Please replace it with new one to test the persistence of an error.

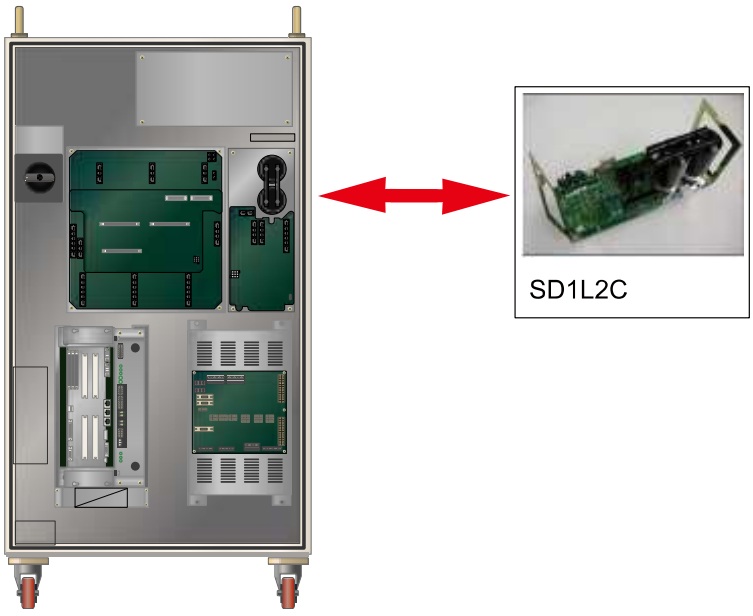


Figure 1.37 Replacing the module when the low voltage error occurs

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

AMP under-voltage occurrence error occurs when the 3-phase AC 220V that enters to the Servo Drive Unit exceeds the allowed range. Also this error may occur when recovery discharge happens at a moment of motor turns on due recovery discharge control circuit malfunction.

- Replacement and inspection of servo drive unit
  Replace the AMP overcurrent error detection module and then check if the error occurs again.
  An error may occur continuously due to module's internal circuit malfunction.

  - Hi5-N controller
    - Medium size Robot's diode module : SD1L2C
    - Small size Robot's Servo Drive Unit: SA3A3D

- Examine the 3-phase voltage
  AMP under-voltage error starts from approximately DC 142V (or 210V)
  If a voltage under AC100V (or 148V) enters to the Servo Drive Unit, under-voltage error may occur when the motor turns on.
  If the input voltage exceeds the allowed range, please examine according to a controller's input 3-phase voltage examination procedures and a controller's 3-phase internal voltage examination procedures.

  - Servo Drive Unit input voltage specification: 3-phase AC 220V
  - Allowed range when motor turns on: 198V ~ 242V

(3) Please confirm the occurrence of error according to the speed of Robot's operation.

If a robot reduce the speed rapidly, or make a high speed movement toward to gravity direction, it can cause AMP under-voltage error. Please confirm if an error occurred, or the changes of input 3-voltage supplied to Servo Drive Unit according to a speed of Robot's operation.

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

- Examine the 3-phase voltage at the error occurrence step
  AMP under-voltage error starts from approximately DC 142V (or 210V)
  If a voltage under AC100V (or 148V) enters to the Servo Drive Unit at the error occurrence step, under-voltage error may occur when the motor turns on.
  If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's 3-phase internal voltage examination procedures.

  - Servo Drive Unit input voltage specification: 3-phase AC 220V
  - Allowed range when motor turns on: 198V ~ 242V

1.1.8. E0034 AMP over-current error

1.1.8.1. Outline

The protection fuse is disconnected because over current flew through the surge protector when the over or surge voltage flew into the 3-phase voltage(R, S, and T) to servo drive unit.

1.1.8.2. Causes and checking methods

(1) Please examine the fuse in the Servo Drive Unit.
- Check the fuse disconnection of servo drive unit.

<Case: Fuse has not been cut-off>

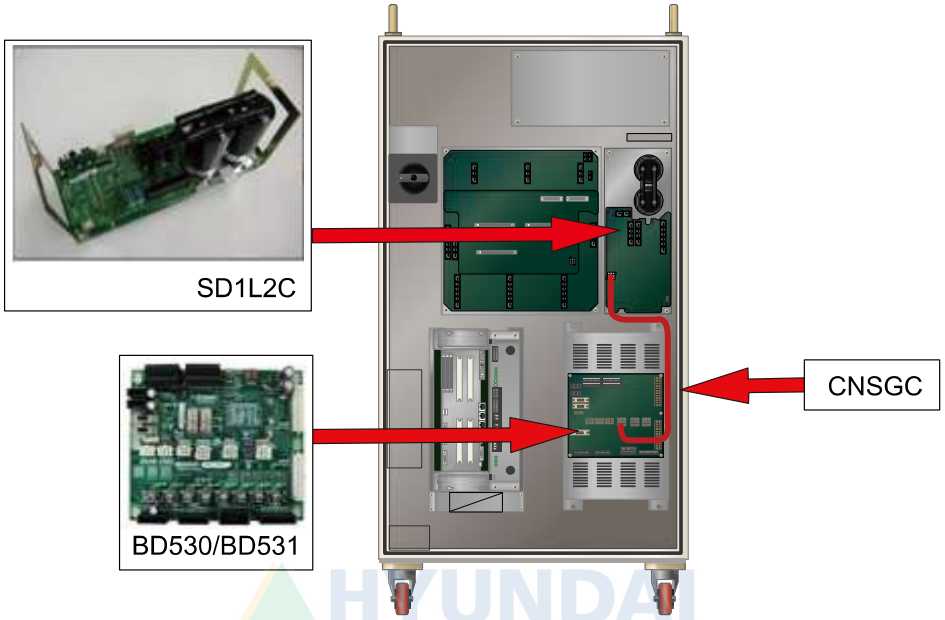
(2) Please examine the components that are related to the over-current error detection error.
- Please replace CNSGC cable and examine it CNSGC.
- Please replace BD530/BD531 and examine it.
- Replace the servo drive unit and then check it.

<Case: Fuse has been cut-off>

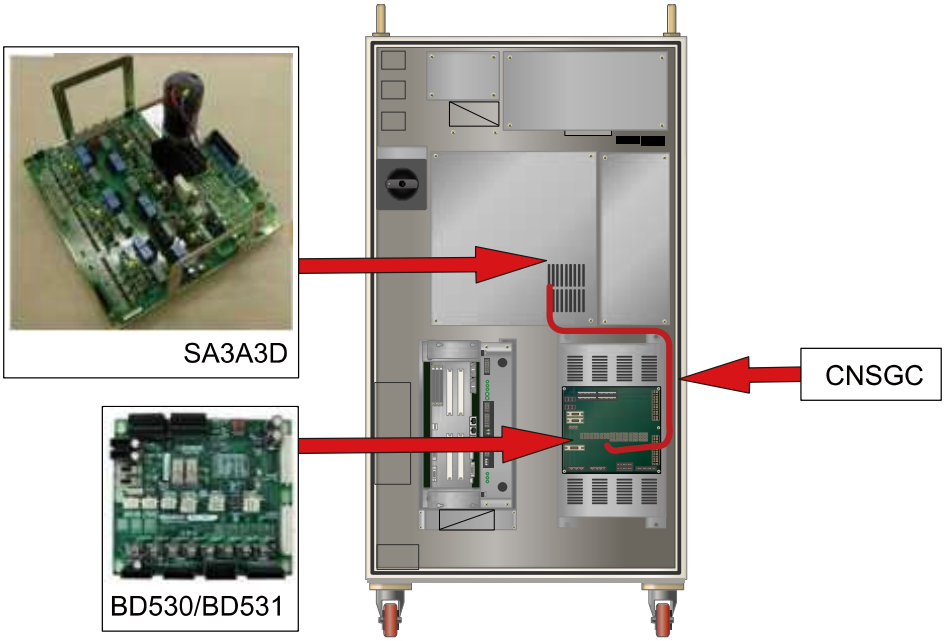
(3) Please examine the components that are related to power.
- Please examine the 3-phase voltage from the inside of controller.
- Please examine the controller's 3-phase input voltage.
- Replace the servo drive unit and then check it.

(1) Please examine the fuse in the Servo Drive Unit

Occurrence of AMP over-current error is detected by a diode module when the input 3-phase voltage exceeds the specification. Generated error will be handled by the BD530/BD531 through a CNSGC cable.

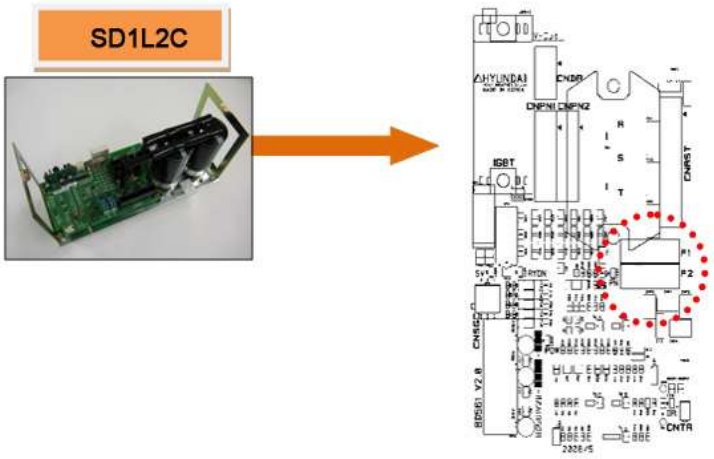


(a) Hi5-N00 controller

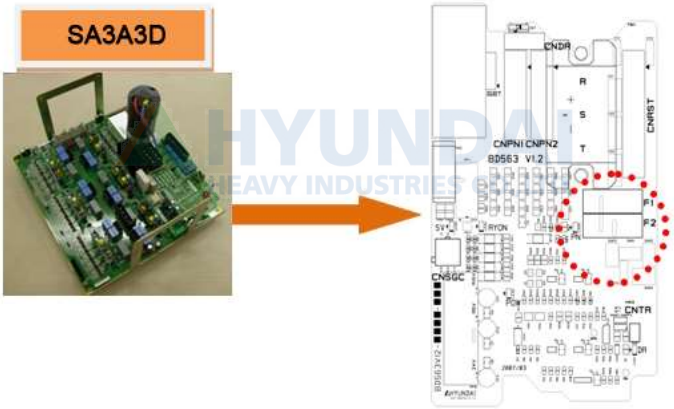


(b) Hi5-N30 controller

Figure 1.38 Arranging the parts related to the AMP overcurrent error



(a) Hi5-N00 controller (SD1L2C)



(b) Hi5-N30 controller (SA3A3D)

Figure 1.39 Position of the AMP overcurrent detection fuse

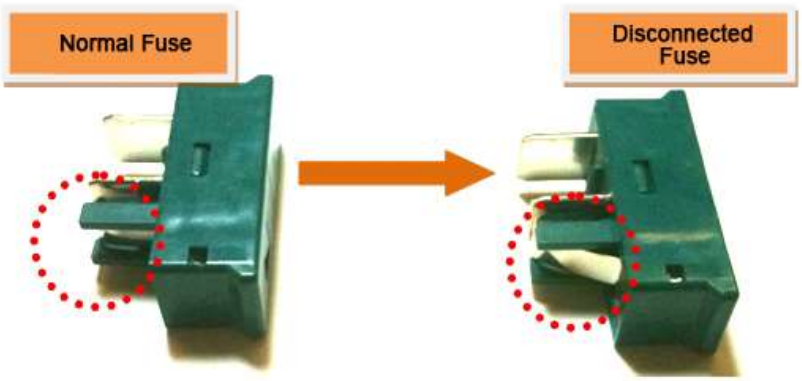


Figure 1.40 Appearance of Disconnected AMP Over-Current Detection Fuse

(2) Please examine the parts that are related to over-current error detection

If AMP over-current error occurs while the fuse has not been cut-off, CNSGC, BD530/BD531 or the Servo Drive Unit is faulty. Please refer to the compositions of controller from the manual and examine the each component.

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

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

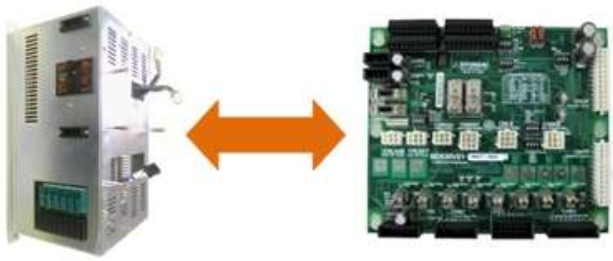


Figure 1.41 Replacement of BD530/BD531

- Replacement and inspection of servo drive unit
  The AMP overcurrent error detection module is as shown below.
  - Hi5-N controller : Medium size SD1L2C, Small size SA3A3D

  Please check the components in the controller that you are currently using and examine it. Please replace it with new one and see if the error persists.

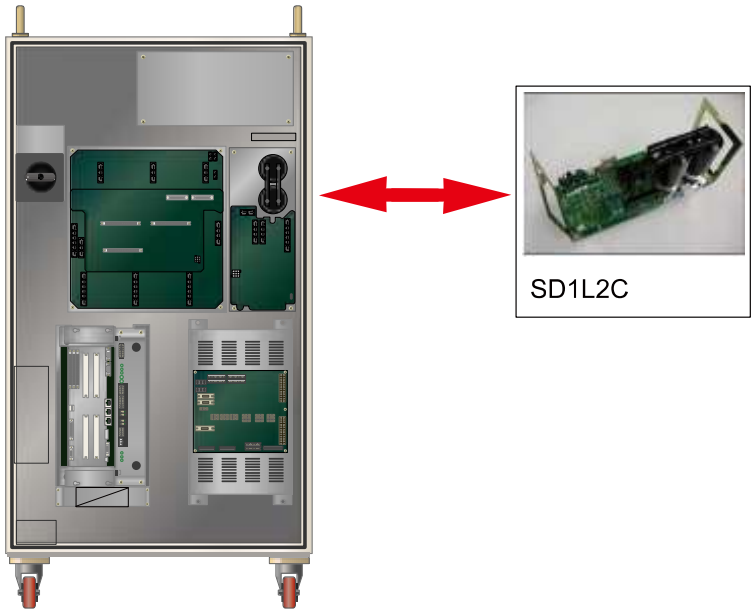


Figure 1.42 Replacing the module when the overcurrent error occurs

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

Over-current error occurs when an over-voltage or surge voltage that exceeds 3-phase AC 220V enters to the Servo Drive Unit. Over-voltage will trigger the surge protector, and the serial connected fuse gets disconnected, so the error will occur.

- Examine the input voltage

  If a voltage over AC242 V enters to the Servo Drive Unit, over-current error may occur when the motor turns on.

  If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's 3-phase internal voltage examination procedures.

  - Servo Drive Unit input voltage specification: 3-phase AC 220V
  - Allowed range when motor turns on: 198V ~ 242V

- Replacement and inspection of servo drive unit

  Replace the AMP overcurrent error detection module and then check if the error occurs again.

  An error may occur continuously due to a module's internal circuit malfunction.

  - Hi5-N controller
    - Medium size Robot's diode module : SD1L2C
    - Small size Robot's Servo Drive Unit: SA3A3D

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1.1.9. E0044 Lift axis belt disconnect sensor is operating

1.1.9.1. Outline

A sensor that is installed on an axis (one of Robot's operating axis) which transfers the power to the belt is determining whether the belt exists or not. This error will occur, if a belt does not exist in the detection range of the sensor as the belt is broken.
This error also can be caused by an abnormal connection between the sensor and the board that is installed on a controller.

1.1.9.2. Causes and examine methods

(1) Please check the status of the error.
- Please check the Private input signal monitoring window.
- Please check the status of BD58B board's relay operation.

<Error status on monitoring window, but replay is normal(ON)>

(2) Please examine the components that are related to the error detection.
- Please replace CNSGC cable and examine it CNSGC.
- Please replace BD530/BD531 board and examine it.

<Error status on monitoring window, and replay is abnormal(OFF)>

(3) Please examine the Robot.
- Please check the status of belt in the Robot's drive unit.
- Please check the operation of the sensor that detects the broken belt.

(1) Please check the status of the error.

- Check the Private input signal from the monitoring window of TP510
  Firstly, check if the Lift axis belt/Limit (Arm) is being input. This window can be accessed from 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/output signal』 → 『1: Private input signal』. If the Lift axis belt/Limit (Arm) is highlighted in yellow, it indicates an error status.

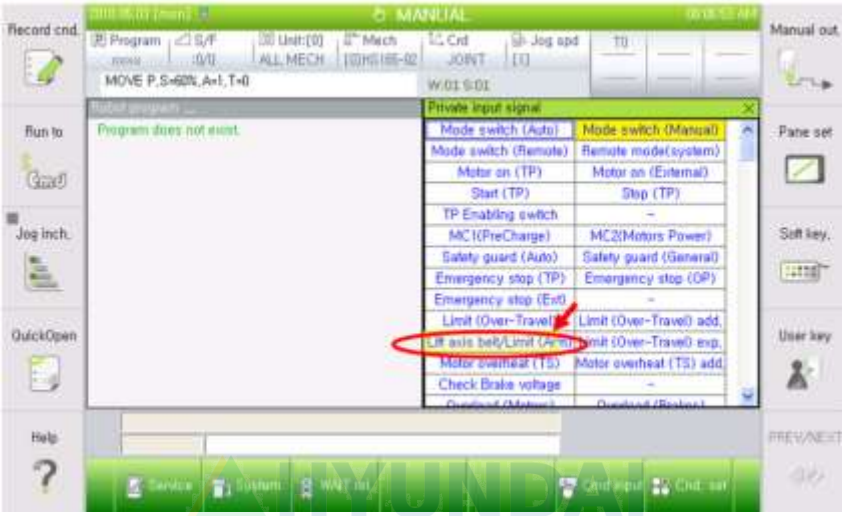


Figure 1.43 Checking the Lift axis belt from Private input signal

- Checking the status of BD58B board's relay operation
  Proximity sensor that attached at the Robot's operation part detects a break based on the light reflection from surface of the belt and transmits the ON/OFF signal to the controller. The received signal will be transferred to BD58B board for the fall prevention brake system and as well as to the BD530 (the System Board). Please check the sensor's operation status based on the relay operation status of BD58B board.

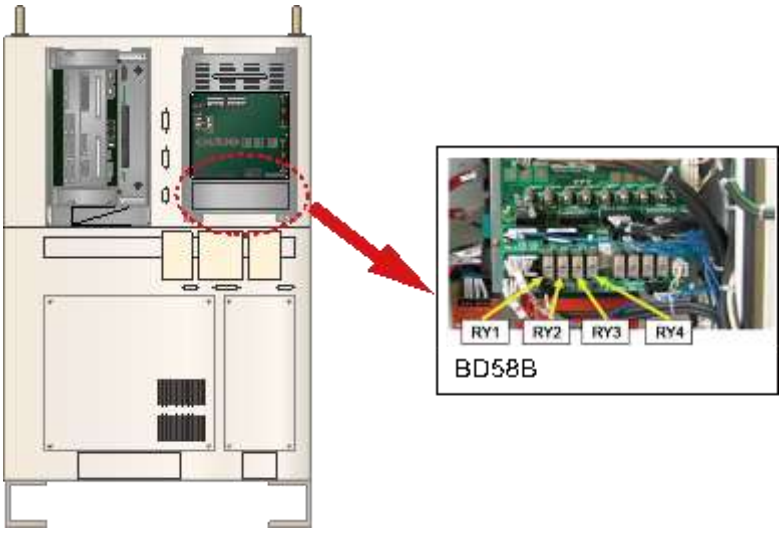


Figure 1.44 Checking the Relay Status of BD58B Board

Relay operation status of BD58B board can be checked as below diagram. Normal status relay operates the coil and can see the empty space at the center.

Figure 1.45 Comparing the Normal and Error Status of BD58B Board's Relay

You may confirm which (in the Robot) axis's detection sensor is operating based on the status of BD58B board's relay operation.

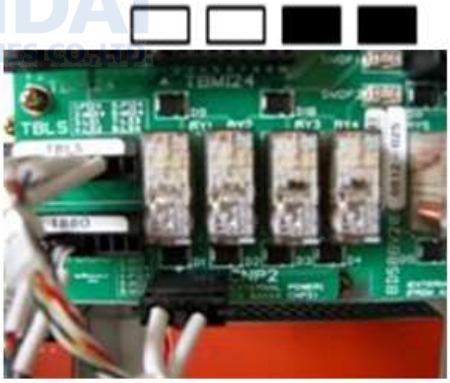
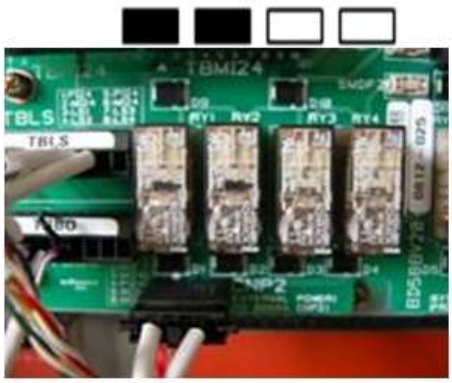
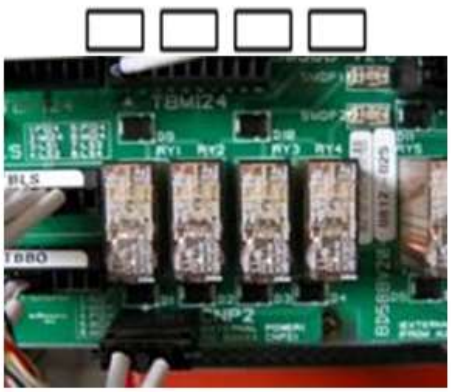
① Normal	② Z1 sensor is off (Z1 axis is broken)
	
③ Z2 sensor is off (Z2 axis is broken)	④ Both Z1/Z2 sensor are off (Z1/Z2 axis are broken)
	

Figure 1.46 Checking the Location of Error Based on BD58B Board's Relay

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

If the Private input signal from the monitoring window and the relay status of BD58B board are different, CNLS cable that connects the BS58B and BD530/BD531, or the BD530/BD531 is faulty. Please refer to the compositions of controller from the manual and examine the each component.

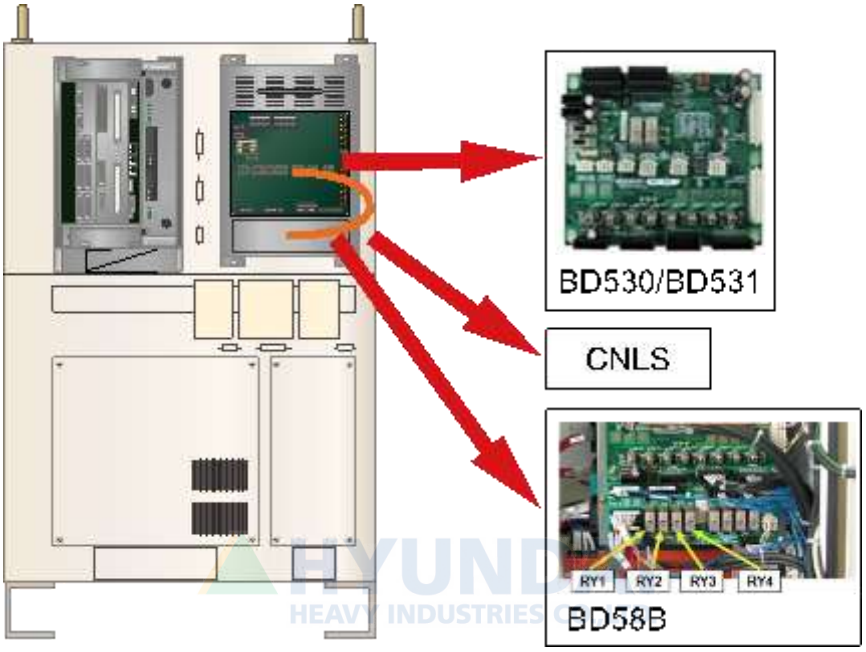


Figure 1.47 Replacing the parts related to the error detection

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

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

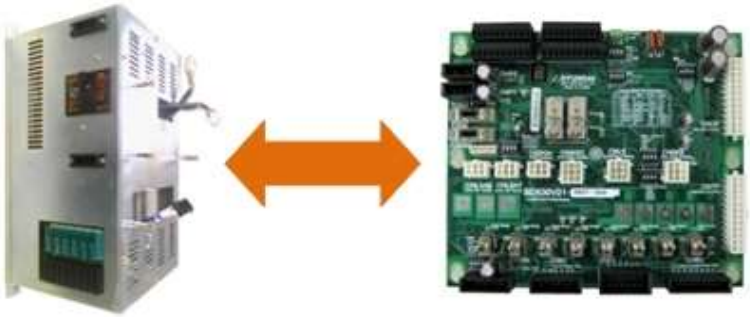


Figure 1.48 Replacement of BD530/BD531

(3) Please examine the Robot

If the Private input signal from the monitoring window and the status of BD58B board's relay, BD58B actually acknowledged the error operation of the sensor. Robot's belt and detection sensor must to be checked. Please remove the CNZB1 and CNBZ2 connector of BB58B board in order to prevent a fall of lift axis that may caused by sensor malfunction during the examination of Robot.

Warning

Make sure the CNZB1 and CNBZ2 connectors of BD58B are removed while examining the Robot's belt and break detection sensors in order to prevent the fall of list axis.

- Check the belt's status of Robot's operation part

  Please check the belt of the axis that confirmed by a status of BD58B relay from the Robot. Applicability and location of the belt may be different to each Robot's model. Please check the status of belt according to the Robot's specification and maintenance manual.

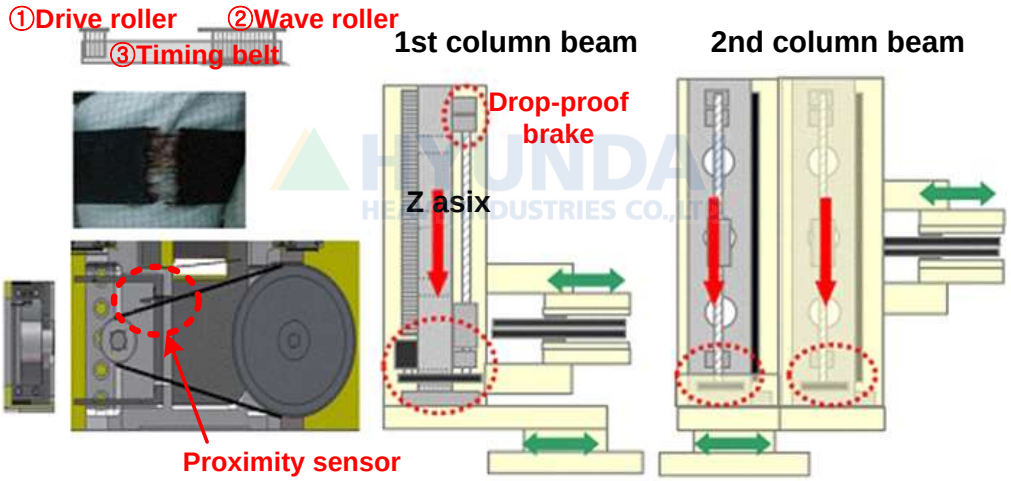


Figure 1.49 Lift Axis Belt and the Break Detection Sensor

- Checking the operation of belt break detection sensor

  Detection sensor is an optical type and it can only detect when the object is within a certain distance. If the object if out of the distance, it will process an error. Please change the distance to the object at the front of detection sensor and check the status of TP510's Private input signal. If the sensor's operation and the result of monitoring do not match, please check the connection of signal line between the sensor and the TBBO terminal block (inside of BD58B board) in the Robot. Sensor's LED green indicates normal status and red indicates error status.

1.1.10. E0108 (○ Axis) Encoder error: Encoder reset required

1.1.10.1. Outline

Power must be supplied to the encoder at all time for it to be able to store the motor's location data.
Encoder's power will be supplied when the controller's power is on or from the encoder's back up battery. This error will occur, if the controller's power goes off while the encoder's back up battery is discharged. (as it will cause the encoder to lose the location data)
The same error will also occur when the motor is being replaced, because the new motor's encoder is not supplied with power.
Please move the Robot to reference position by using an axis coordinate manual control to re-adjust the axis's encoder as encoder reset will change the reference position data of the axis.

1.1.10.2. Causes and examine methods

(1) Please check the voltage of encoder's battery.

(2) Please examine the Encoder's battery connection status.

(3) Please replace the motor and test it.

(4) Re-adjustment of the encoder from Robot's reference position must be done after the encoder reset

(1) Please check the voltage of encoder's battery.

Encoder's batter uses 3.6V. If the voltage decreases to 3.0V~3.2V, a message of "W0104 (○ Axis) Encoder battery voltage is low" will be displayed. Please replace the encoder's battery if this warning occurs. Replacement of encoder's battery must be done while the controller's power is on. If the encoder battery is replaced at this stage, Robot's operation will not be interrupted.

If you miss the time to replace the encoder's battery, and the battery voltage reaches to 2.5V~3.0V, and error of "E0108 ○ Axis) Encoder error: Encoder reset required" will occur.
At the point of this error occurs, the encoder already lost the location data.
Please move the Robot to reference position by using an axis coordinate manual control to re-adjust the axis's encoder followed by a replacement of encoder's battery and the reset of encoder.

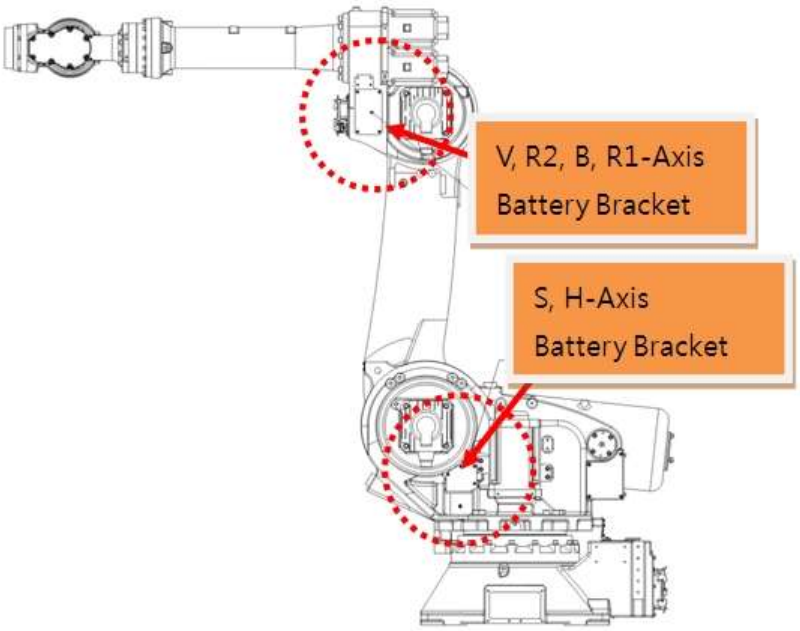


Figure 1.50 Location of Encoder's Battery Replacement

Encoder reset can be executed from the below menu.

- System
- 5. Initialize
- 4. Serial encoder reset

(2) Please examine the Encoder's battery connection status.
Please examine the connection status from encoder's battery to the motor.

(3) Please replace the motor and test it.
If the above do not solve the problem, there is a high possibility that the encoder itself is the cause. Please replace the motor and test it.

1.1.11. E0112 (○ Axis) IPM fault signal detection

1.1.11.1. Outline

A fault output has occurred from an IPM (Intelligent Power Module) – a switch device inside of Servo Drive Unit that drives the motor. IPM fault may occur due to an increased temperature of heat sink, IPM's control voltage reduction or an over-current output.

1.1.11.2. Causes and examine methods

<Error occurs non periodically when the motor turns on>

(1) Please examine the motor drive components.
- Please examine the output cable that connects to the Servo Drive Unit.
- Please examine the terminal (socket) of switching device in the Servo Drive Unit.
- Please replace CNBS1, 2, 3 cables and confirm the error.
- Please replace the Servo Board (BD542) and confirm the error.
- Please replace the Servo Drive Unit and confirm the error.
- Please replace the Servo motor and confirm the error.

<Error occurs at a certain step>

(2) Please examine the Robot at the step that an error occurs.
- Please examine the Robot's wiring at the location where the error occurs.
- Please reduce the speed of robot's operation in order to confirm the error.
- Please make changes on teached step's interpolation and confirm the error.

<Case: Error occurs after 5 minutes from the startup of Robot's operation>

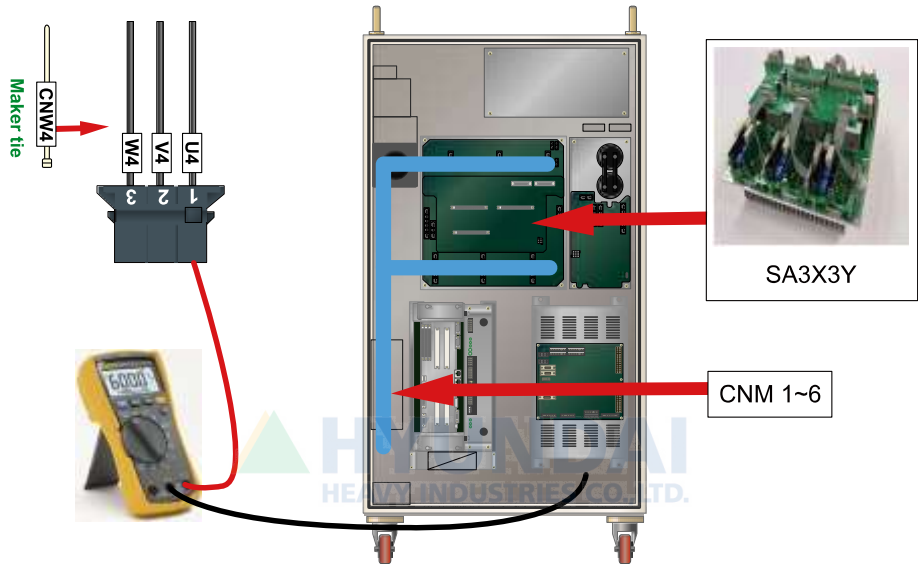
(3) Check the controller's cooling fan
- Please examine the operational status of each fan
- Please examine the power voltage of each fan

(1) Please examine the components that are related to the motor drive.

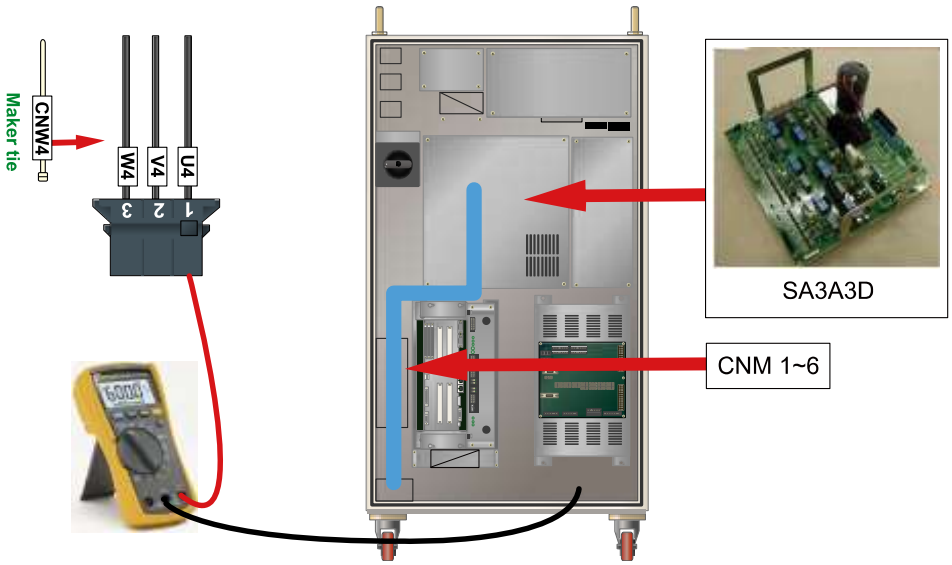
Servo Drive Unit that drives the motor receives a command from the Servo Board (BD542) through CNBS cable, and the current output of internal amplification circuit will be transferred to the motor through wirings that connected to each connectors of axis.

■ Examine the output cable that connects to the Servo Drive Unit

Examine the wirings that connect the Servo Drive Unit to the motor. Please turn off the power of controller, and remove the connector from the Servo Drive Unit and measure the resistance value between grounds to inspect the occurrence of short circuit.



(a) Hi5-N00 controller

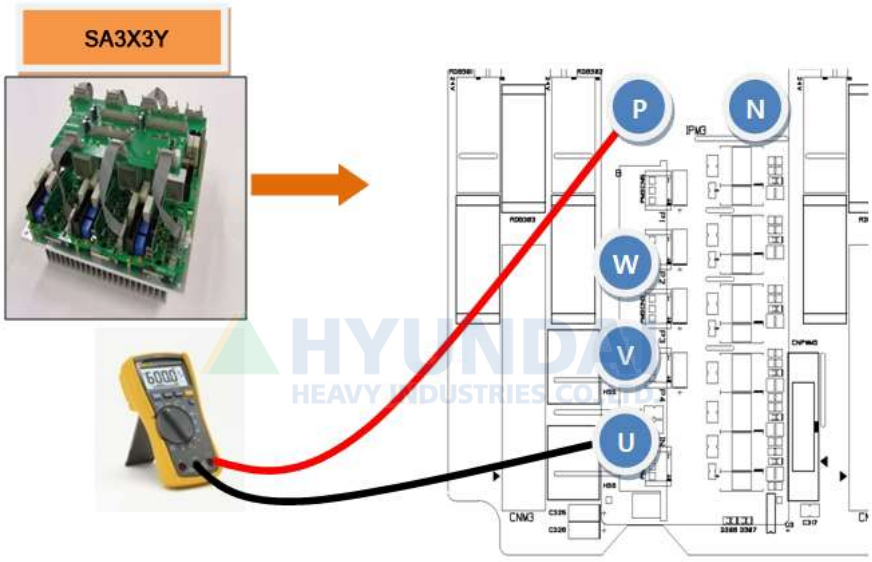


(b) Hi5-N30 controller

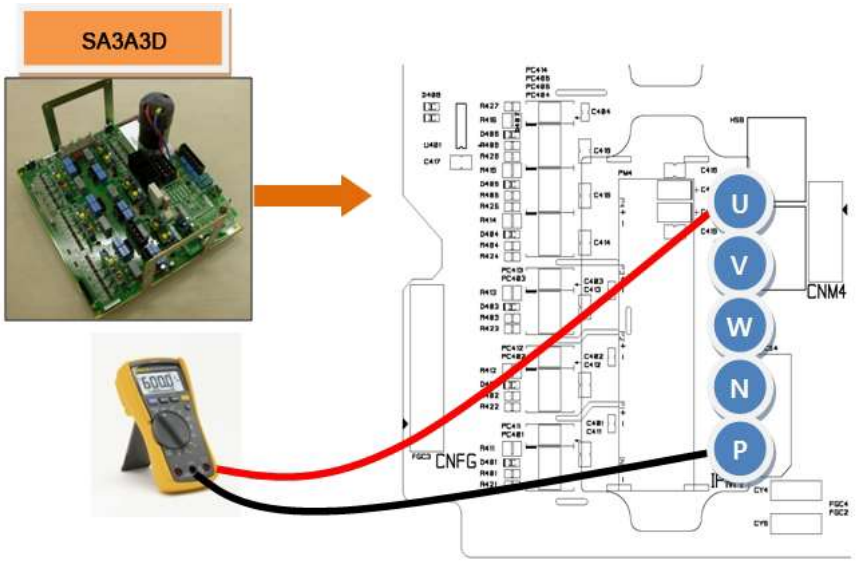
Figure 1.51 Checking the servo drive unit output cable

■ Examine the switch device of Servo Drive Unit
Switch device of Servo Drive Unit switches the direct current voltage that supplied from diode module and output the alternating current for each phases. If a short circuit occurs at the internal terminal of switch device, over-current flow and it will cause an IPM fault error. Please remove the connector and check if a short circuit has occurred between the output terminal in a switch device of Servo Drive Unit and the P (or N).
If a short circuit exists, the Servo Drive Unit need to be replaced and also the cable that connects the Servo Drive Unit to the motor needs to be examined.

➢ Hi5 controller
- Medium size Robot's diode module : SA3X3Y
- Small size Robot's Servo Drive Unit: SA3A3D



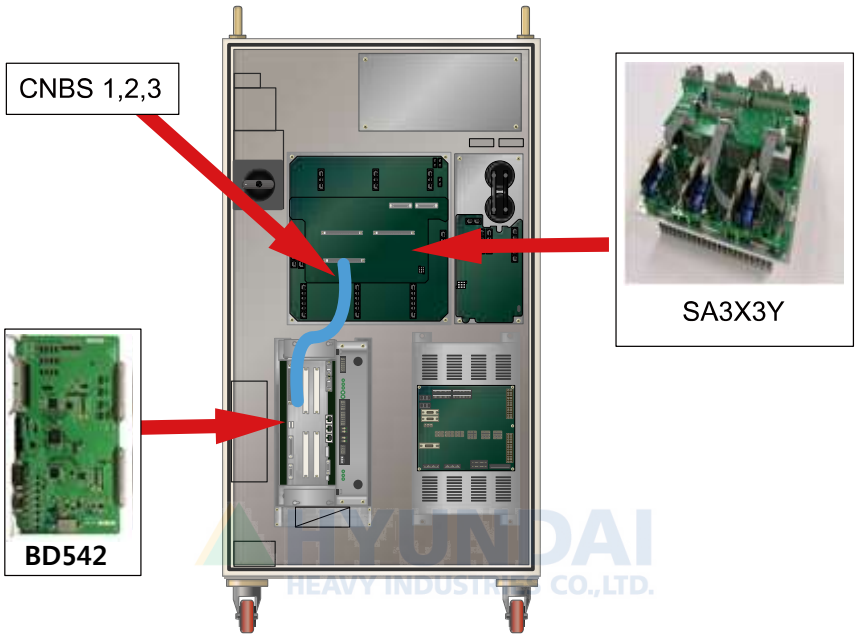
(a) Hi5-N00 controller (SA3X3Y)



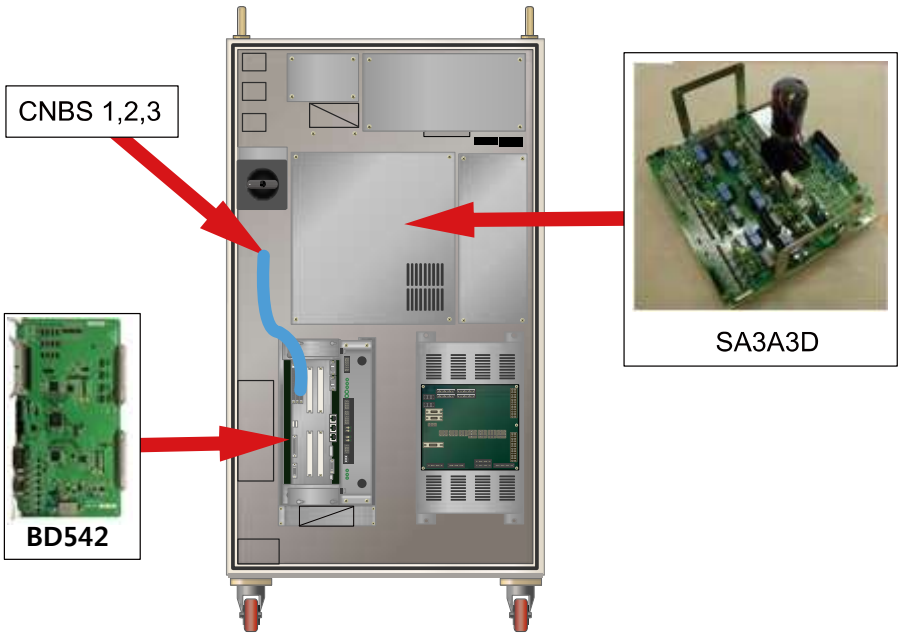
(b) Hi5-N30 controller (SA3A3D)

Figure 1.52 Checking the switching device short-circuiting

■ Replacement of CNBS cable and examining the error CNBS
Servo Drive Unit that drives the motor receives a command from the Servo Board (BD542) through CNBS cable, and the current output of internal amplification circuit will be transferred to the motor through wirings that connected to each connectors of axis.
If the error does not persist after the replacement of cable, cable is faulty. Please replace the CNBS cable with new one.



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.53 Arranging the parts related to the motor driving

- Replacement of Servo Board and examine it
  If the error does not persist after the replacement of Servo Board, Servo Board is faulty. Please replace the Servo Board with new one.

- Replacement of Servo Drive Unit and examine it
  If the error does not persist after the replacement of Servo Drive Unit, Servo Drive Unit is faulty. Please replace the Servo Drive Unit with new one.

  - Medium size Robot's Servo Drive Unit: SA3X3Y
  - Small size Robot's Servo Drive Unit: SA3A3D

- Replacement of Servo Motor and examine it
  If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

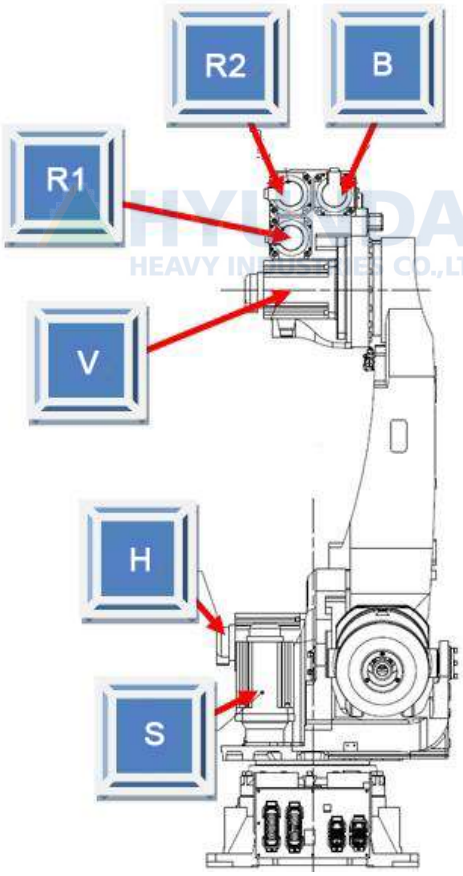


Figure 1.54 Locations of each axis's motor (HS165 Robot)

(2) Please examine the Robot at the step that an error occurs

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

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

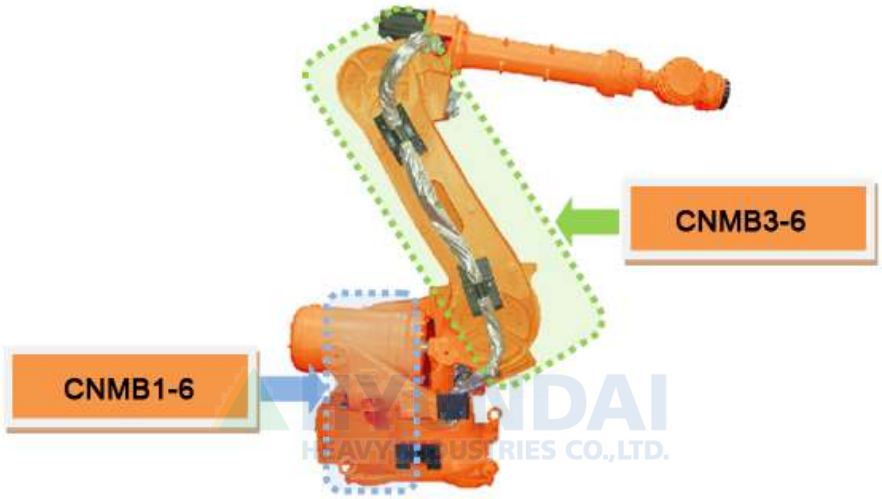


Figure 1.55 Location of wiring examination for each axis (HS165)

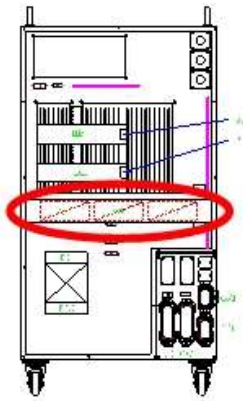
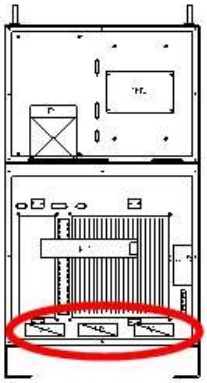
- Reduce the speed of Robot's operation in order to confirm the error
  If an error occurs at a step that generates rapid changes of axis speed which is caused by the position changes of Robot, reduce the operation speed to confirm the error. If the error does not persist after the speed is reduced,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

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

(3) Check the controller's cooling fan.

If the IPM fault error occurs after over 5 minutes since the start of the robot, it means that the controller's cooling system has caused abnormalities, surpassing the allowable temperature specifications of the IPM motion. The rear face of the controller is equipped with the heat sinking plane of the servo driving gear and the fan for cooling the regenerative discharge resistance.

Table 1-4 Position for installing the Hi5 controller pan

Hi5-N**	Hi5a-C1*	Hi5a-C0*
		

- Checks for the motion of each fan
  When the fan does not rotate or the speed is abnormally low, change the involved fan, please. The fan's life span changes depending on motion, environments and time.

- Checks for the voltage of fan power supply
  If all fans do not work, check the fan for the input voltage, please. The input voltage has been set as AC 220V, and the allowable range is within 10 % of rated voltage. When the voltage is low more than 10 %, the fan's reduced RPM causes the decline in cooling effectiveness. When the voltage is low, check the connector used for the fan and the input voltage of the controller.

1.1.12. E0113 (○ Axis) Over-current

1.1.12.1. Outline

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

1.1.12.2. Causes and examine methods

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

(2) Examine the Motor power line.
- Check the wiring that connects the Robot and Controller.
- Check the Robot's internal wiring.
- Check the Controller's internal wiring.

(3) Examine the CNBS cable between the Controller's internal Servo Board and the Drive Unit

(4) Replace other components

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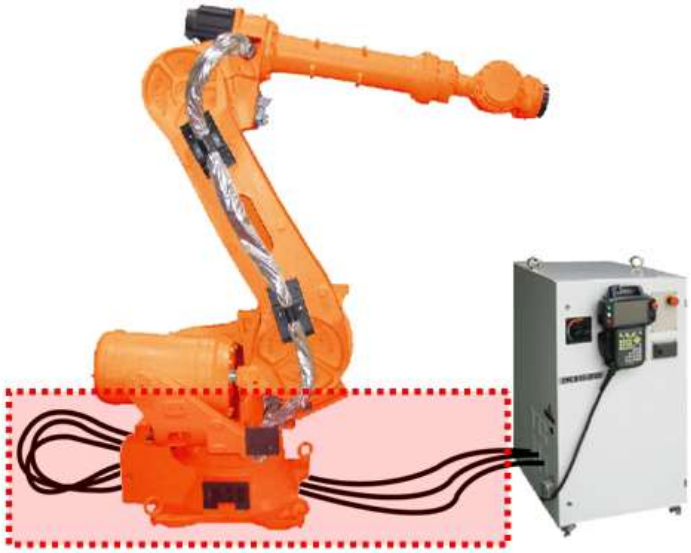
(1) Check if the axis with an error has mechanical interference with other equipment
This error may occur if the Robot had a mechanical interference or collisions. If the Robot is out of the operation area, please move it back into the operation area by using a manual control.

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

Warning
Be cautious. Examination while the power is on may cause an electrocution.

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



<External wiring>

Figure 1.56 Basic Installation diagram of the robot and control period

- Check the Robot's internal wiring
  Examine for a short circuit, faulty on a wiring that connected to Robot's internal motor is required

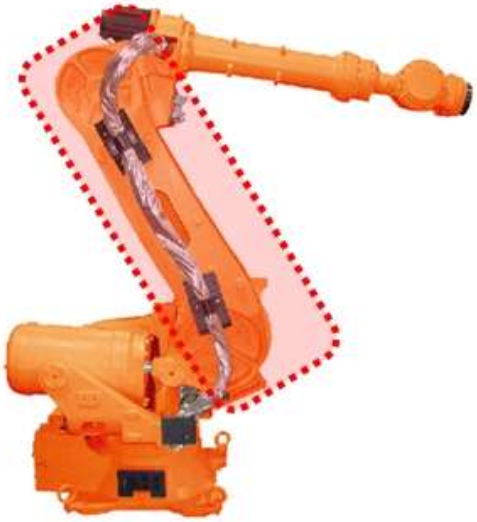


Figure 1.57 Robot's internal wiring

■ Check the Controller's internal wiring.
Examine on a controller's internal AMP and installed wiring is required.

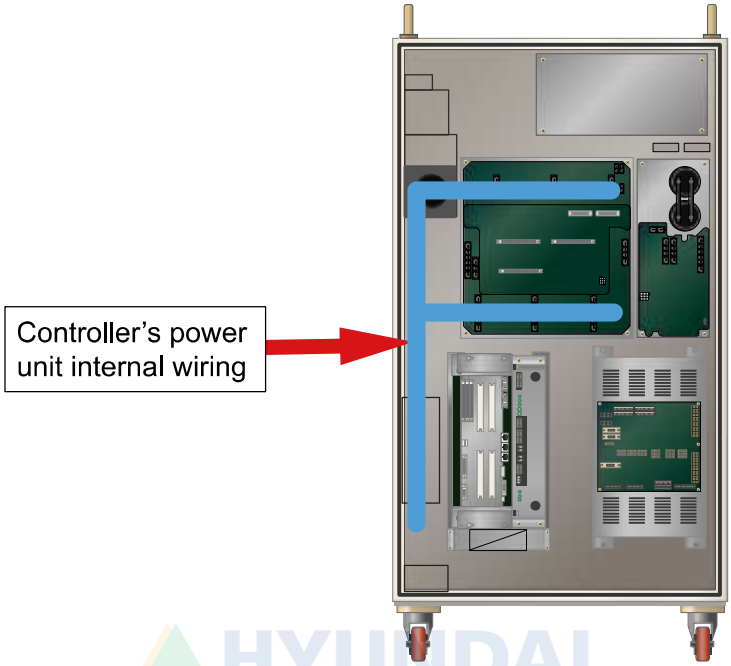


Figure 1.58 Controller internal side (Power unit)

(3) Examine the CNBS cable between the Controllers' internal Servo Board (DSP board) and the Drive Unit.
Please examine if the CNBS cable is installed properly. If the cable is not installed properly, or the cable is faulty, this error may occur.

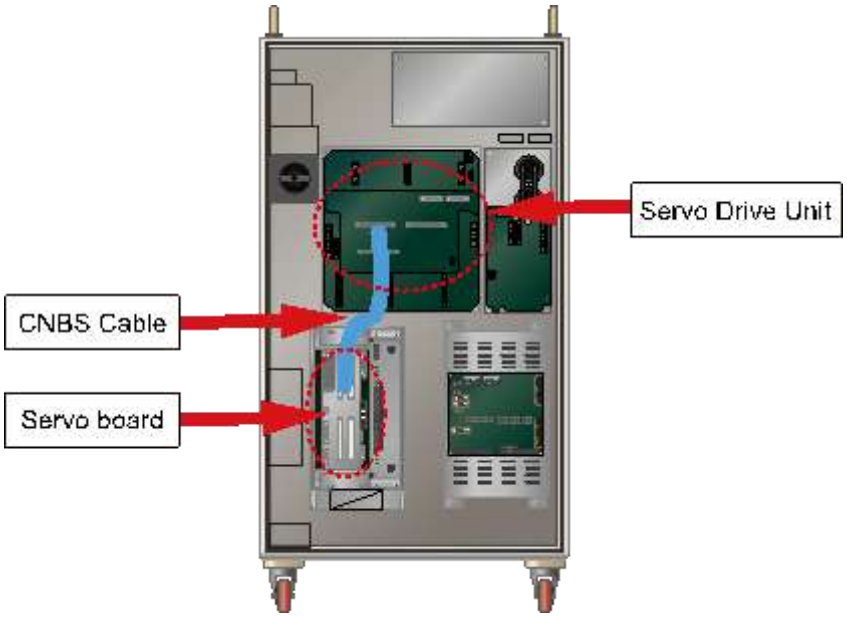


Figure 1.59 Controller internal side (CNBS cable)

(4) Replace other components

Replace the component in order of Servo Board (BD542) → Servo Drive Unit → Motor to confirm the occurrence of an error.

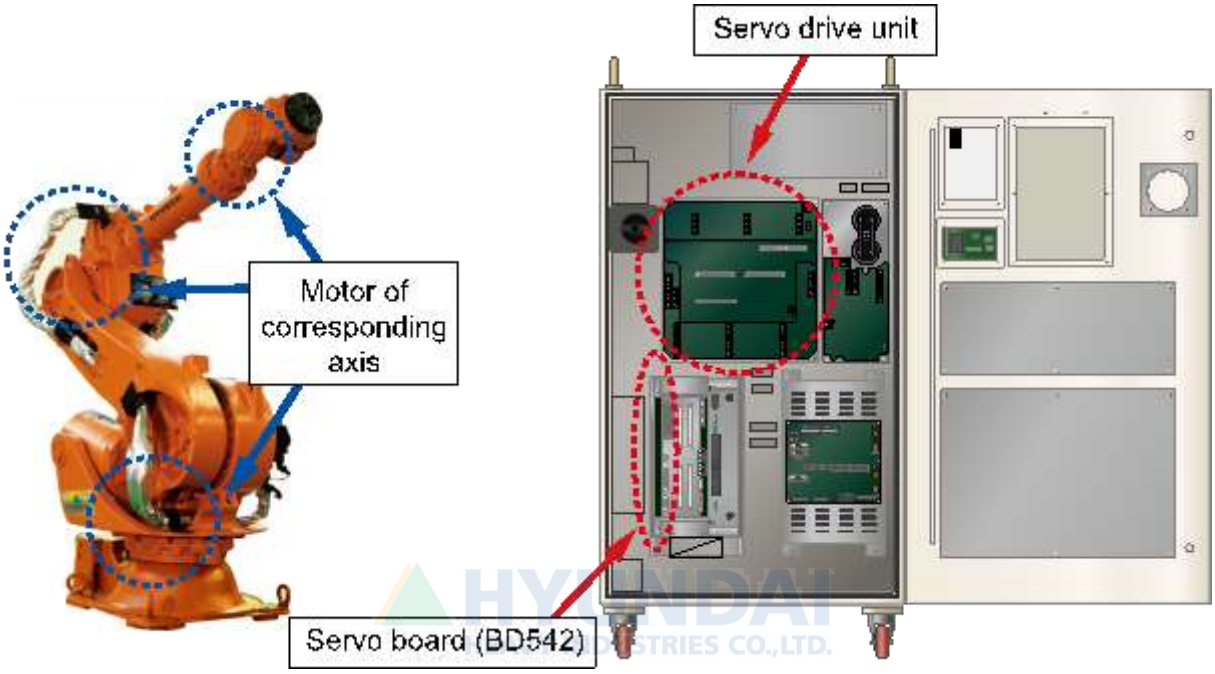


Figure 1.60 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.13. E0114 Decrease control voltage for operating device

1.1.13.1. Outline

Control power that supplied to the Servo Drive Unit +15V has been reduced. This error is detected by the Servo Drive Unit and transferred to the Servo Board through CNBS cable.

1.1.13.2. Causes and examine methods

(1) Please check the power indicator LED.
- Please check the 'POW' LED of Servo Drive Unit.
- Please check the '+15V' LED of SR1 (control power supply unit).

<Case: Both of module's LED are OFF>

(2) Please check the output of SR1. (control power supply unit)
- Please remove CNBS cable from BD542 and check the LED.
- Please remove the Servo Board from the Rack and check the LED.

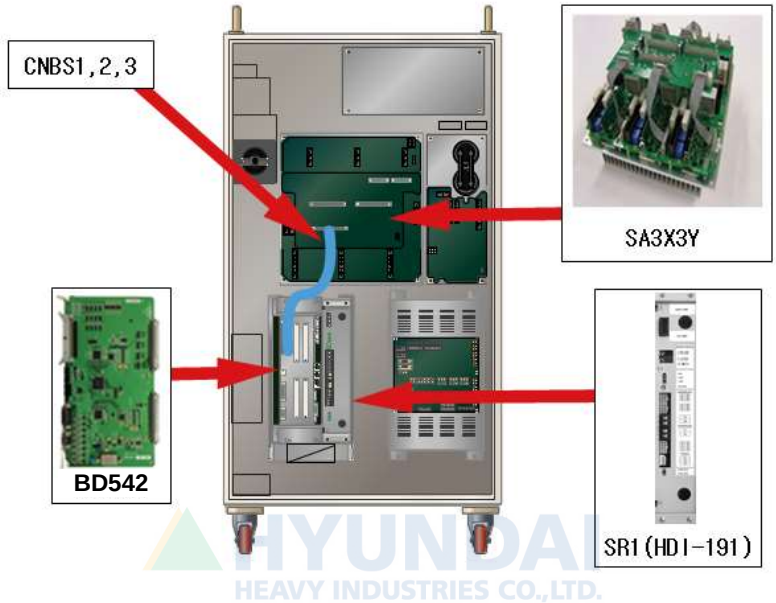
(3) Please examine the SR1. (control power supply unit)
- Please check the input voltage to SR1.
- Please replace the SR1 and check the LED.

<Case: Only the Servo Drive Unit's 'POW' LED is OFF>

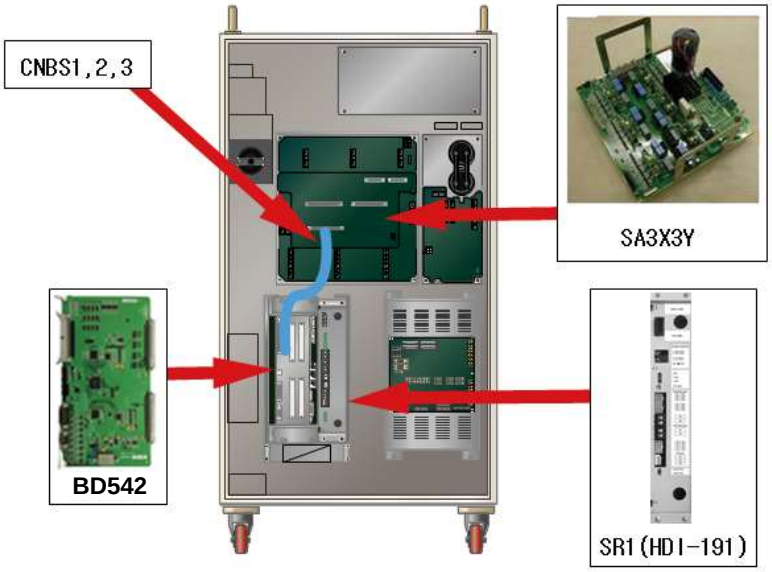
(4) Please replace the related components and check the power indicator LED.
- Please replace CNBS cable and check the LED.
- Please replace the Servo Board and check the LED.
- Please replace the Servo Drive Unit and check the LED.

(1) Please check the power indicator LED.

Drive unit control voltage reduction error is caused by a reduction of control voltage +15V. This error will be detected by the Servo Drive Unit and transferred to the Servo Board (BD542) through CNBS1, 2, 3 cables to be handled.



(a) Hi5-N00 controller

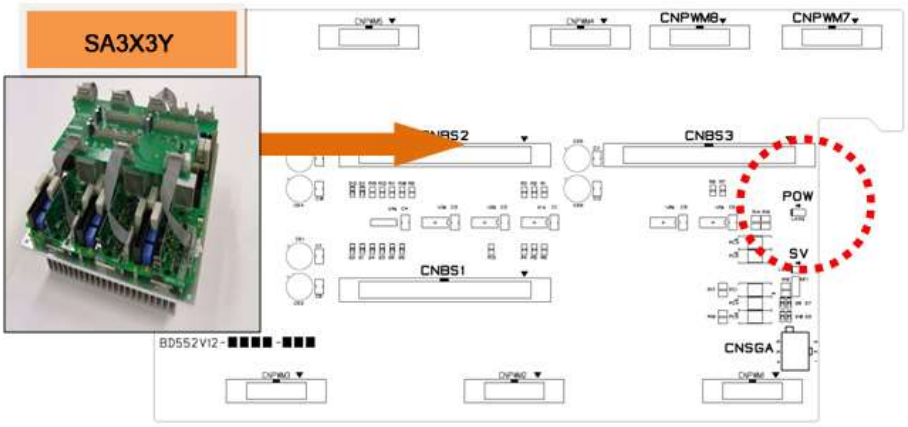


(b) Hi5-N30 controller

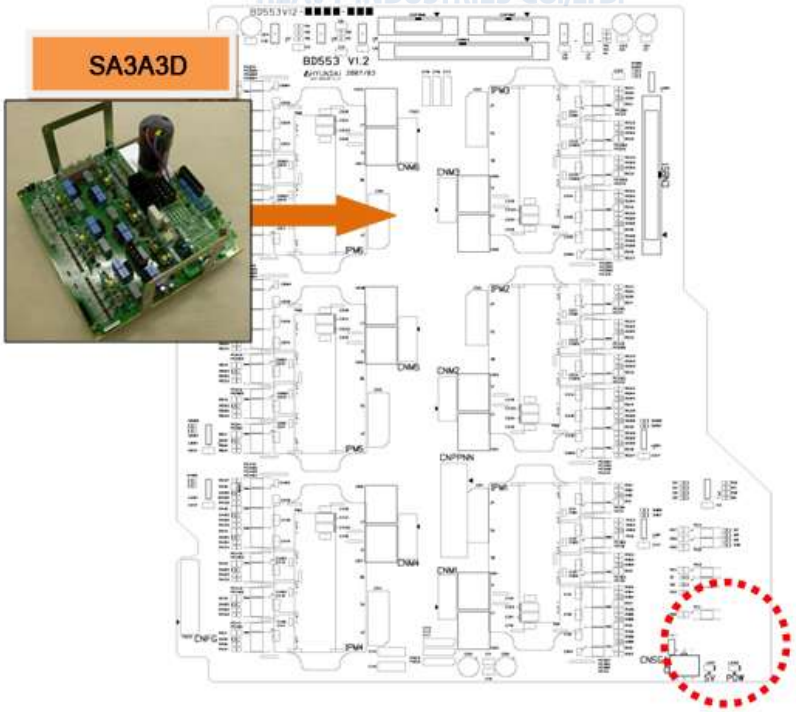
Figure 1.61 Arranging the parts related to the drive unit control voltage drop

- Examine the 'POW' LED of Servo Drive Unit
  Check "POW" in the drive unit control voltage error detection module.
  If the power is being supplied normally, the LED light should be stays on.

  - Medium size Robot's Servo Drive Unit: SA3X3Y
  - Small size Robot's Servo Drive Unit: SA3A3D



(a) Hi5-N00 controller (SA3X3Y)



(b) Hi5-N30 controller (SA3A3D)

Figure 1.62 Arranging the parts related to the "POW" LED

- Examine the '+15V' LED of SR1
  Please check the LED of SR1 if the Servo Drive Unit's 'POW' LED light is off.
  Please check if the LED of SR1 and the LED of Servo Drive Unit are both off at the same time.

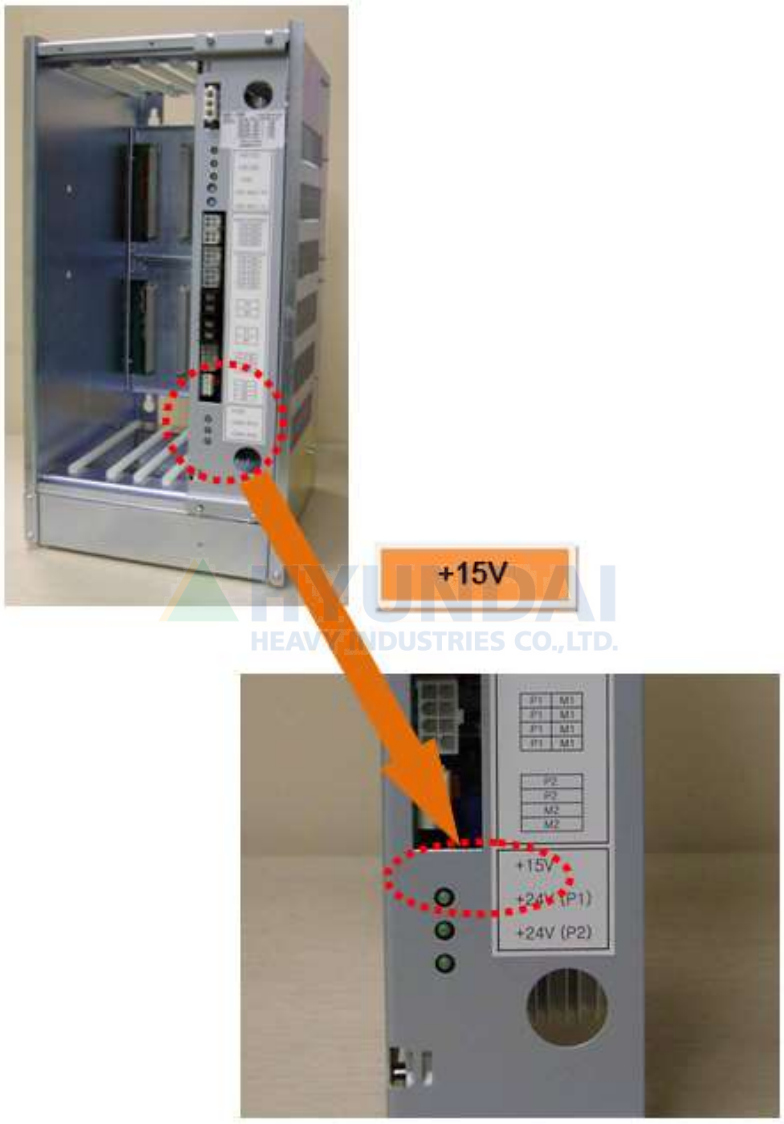


Figure 1.63 Locations of '+15V' LED Related Components of SR1

(2) Please check the output of SR1.

Please remove the wirings and components that are connected to the Servo Drive Unit and examine the '+15V' LED in order to check the output of SR1 itself.

- Remove CNBS cable and check the LED
  Please remove the CNBS1, CNBS2, CNBS3 that connect the Servo Drive Unit and the Servo Board. After the removal, please check the LED of SR1. If the '+15V LED' of SR1 turns to ON after the removal of cables, the Servo Drive Unit is faulty. Please replace the Servo Drive Unit with new one.

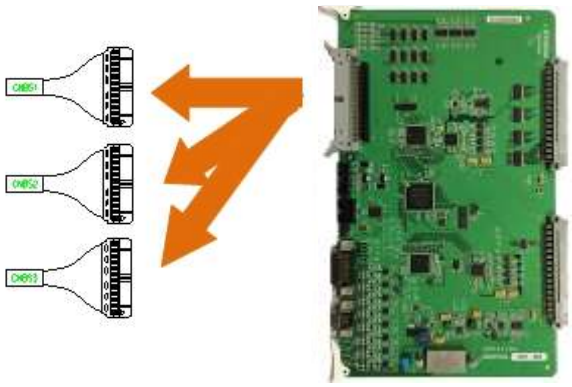


Figure 1.64 Removal of CNBS cable

- Remove the Servo Board and examine the LED
  Please check the SR1's LED after you remove the Servo Board from a Rack. If the '+15V LED' of SR1 turns to ON after the removal of Servo Board, the Servo Board is faulty. Please replace the Servo Board with new one.

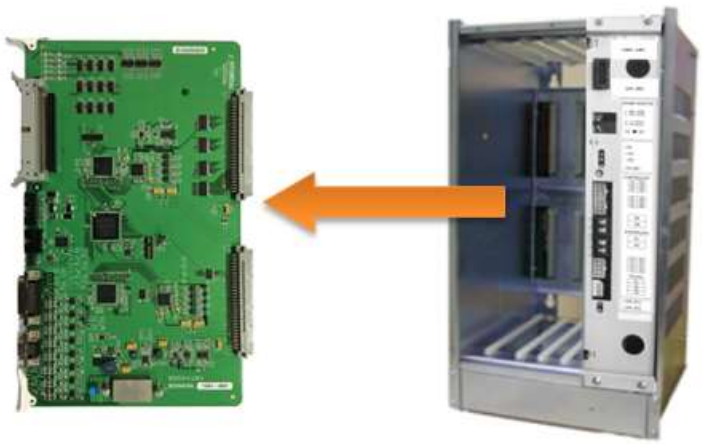


Figure 1.65 Removal of Servo Board from the Rack

(3) Please examine the SR1 (control power supply unit)

Control power supply unit received AC 220V (input) and output the necessary control power to each board from the internal circuit.

- Examine the input voltage of SR1
  If the input voltage to SR1 exceeds the specification, the output of control power may have an error. If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's single-phase internal voltage examination procedures.

  - SR1 input voltage specification: single-phase AC 48V
  - Allowed range: 44V ~ 52V

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

(4) Please replace the related components and check the power indicator (LED)

Please replace the Servo Drive Unit, Servo Board, CNBS cable and check the 'POW' LEF of the Servo Drive Unit.

- Replace the CNBS cable and check the 'POW' LED
  Please replace the CNBS1, CNBS2, CNBS3 that connects the Servo Drive Unit and the Servo Board, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, cable is faulty. Please replace it with new one.

- Replace the Servo Board and check the 'POW' LED
  Please replace the Servo Board, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, the Servo Board is faulty. Please replace it with new one.

- Replace the Servo Drive Unit and check the 'POW' LED
  Please replace the Servo Drive Unit, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, the Servo Drive Unit is faulty. Please replace it with new one.

  - Medium size Robot's Servo Drive Unit: SA3X3Y
  - Small size Robot's Servo Drive Unit: SA3A3D

1.1.14. E0115 (○ Axis) Received command code error

1.1.14.1. Outline

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

1.1.14.2. Causes and examine methods

(1) Please examine if the Main Board and the Servo Board are installed properly.
- Examine if the board is installed properly.
- Examine if board is faulty

(2) Examine if the versions of the Main Board and the Servo Board matches

(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

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Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.66 Methods for inserting a USB into the teach pendant

Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to,

- Service
- 5. File manager

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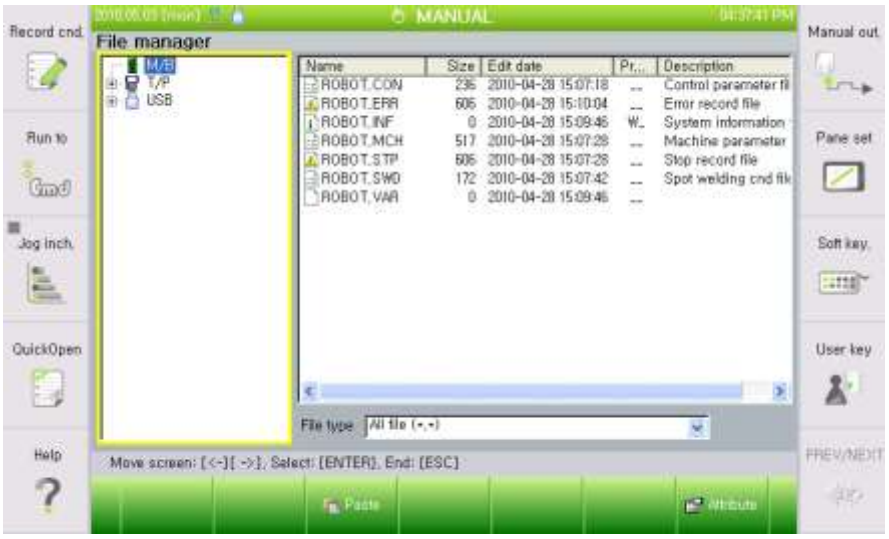
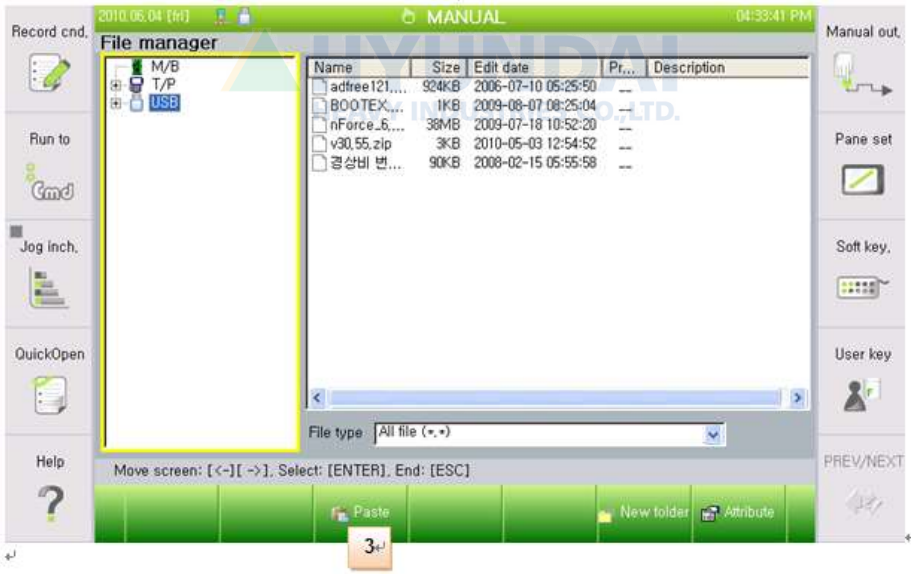
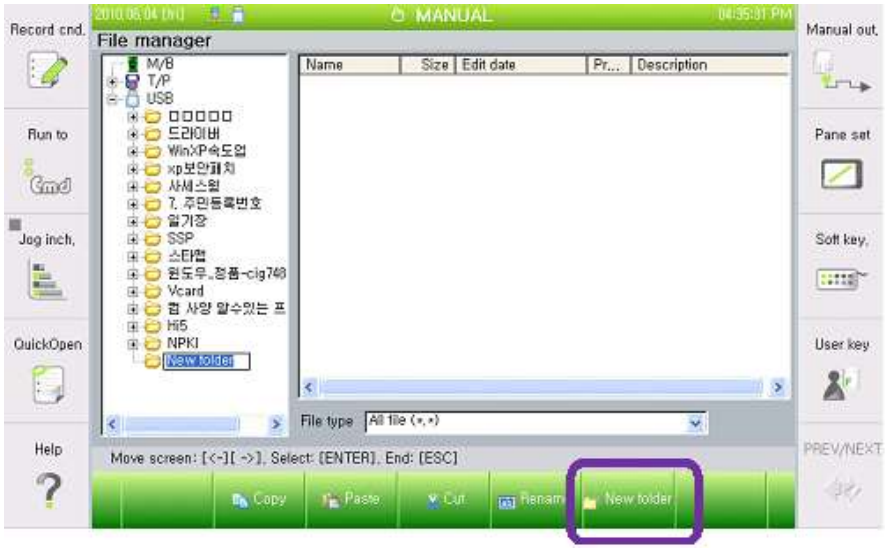
And the screen that is similar to windows explorer will be displayed.



At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Examine if the board is installed properly
  Please remove the Main Board and the Servo Board from the Rack and re-install them again.

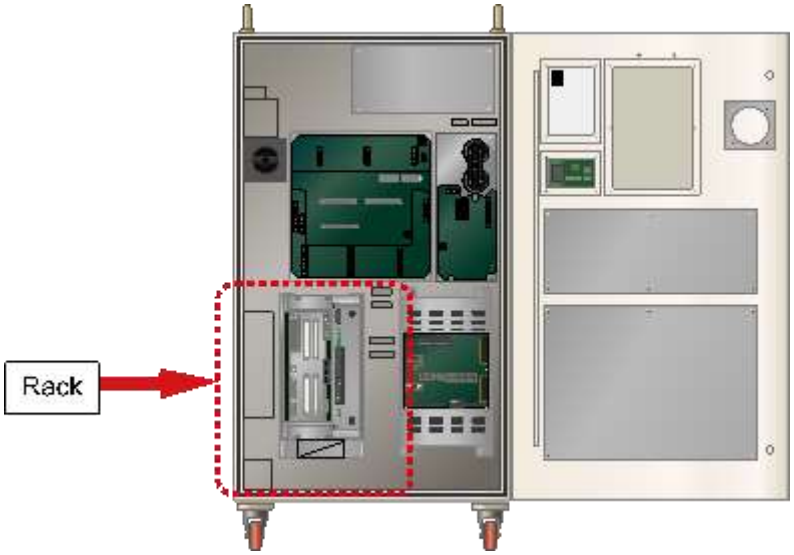


Figure 1.67 Location of Rack Inside of the Controller

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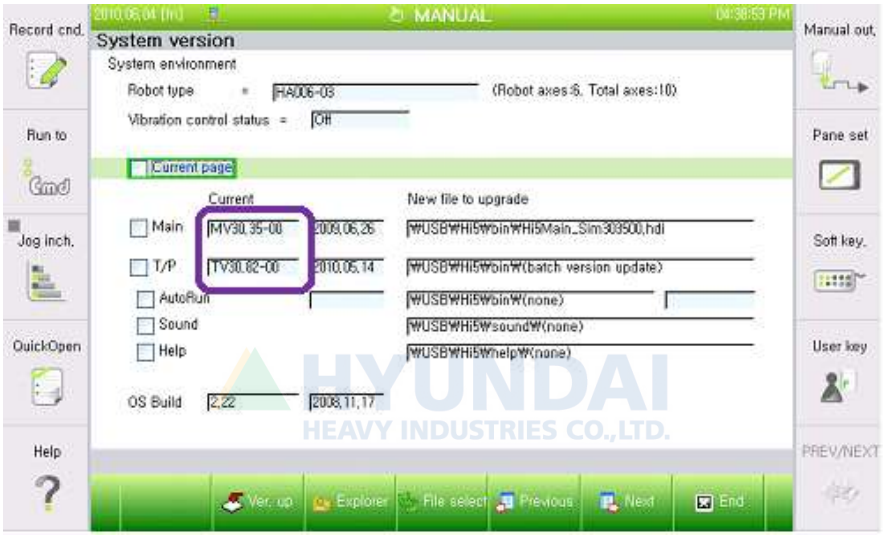
- Examine if the board is faulty.
  To examine if the board is faulty, please replace it with new one.

(2) Examine if the versions of the Main Board and the Servo Board matches

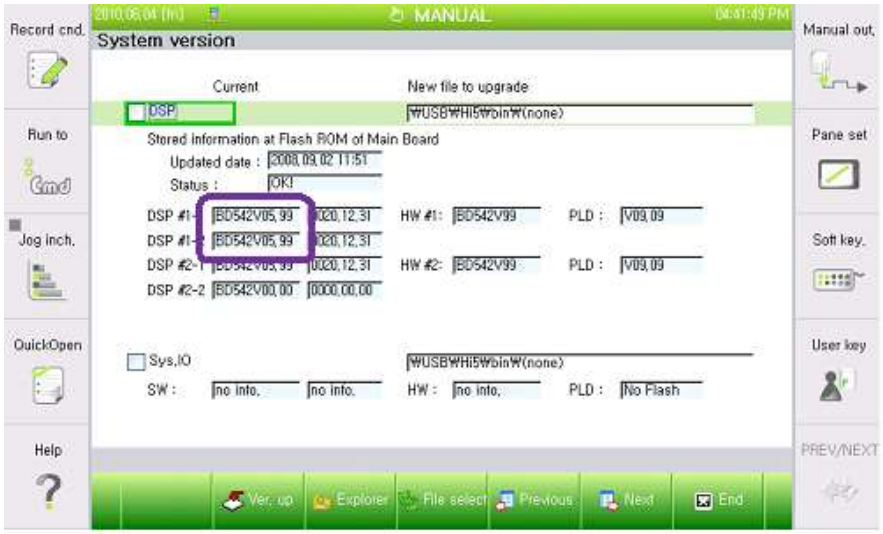
When the controller turns on, it will check the versions of Main Board and the Servo Board
If the version does not match, an error of “E0179~E181 DSP version mismatch” will be displayed.
Please contact to our A/S department in order to update the system with a proper version.

Versions of the Main Board and the Servo Board can be checked from the below menu.

- Service
- System diagnosis
- System version



Press [F6: next page] to check the version of Servo Board



1.1.15. E0117 (○ Axis) Position deviation set value exceeded

1.1.15.1. Outline

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

1.1.15.2. Causes and examine methods

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

(2) Check if the brake release works properly.
- Examine if the brake release of each axis has an error
- Examine the error on brake's power supply.

(3) Examine the wiring status.

(4) Check if the rated load is used.

(5) Position deviation setting level error.

(6) Please replace other components.

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(1) Check if the axis with an error has mechanical interference with other equipment.
This error may occur if the Robot had a mechanical interference or collisions. If the Robot is out of the operation area, please move it back into the operation area by using a manual control.

(2) Check if the brake release works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

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

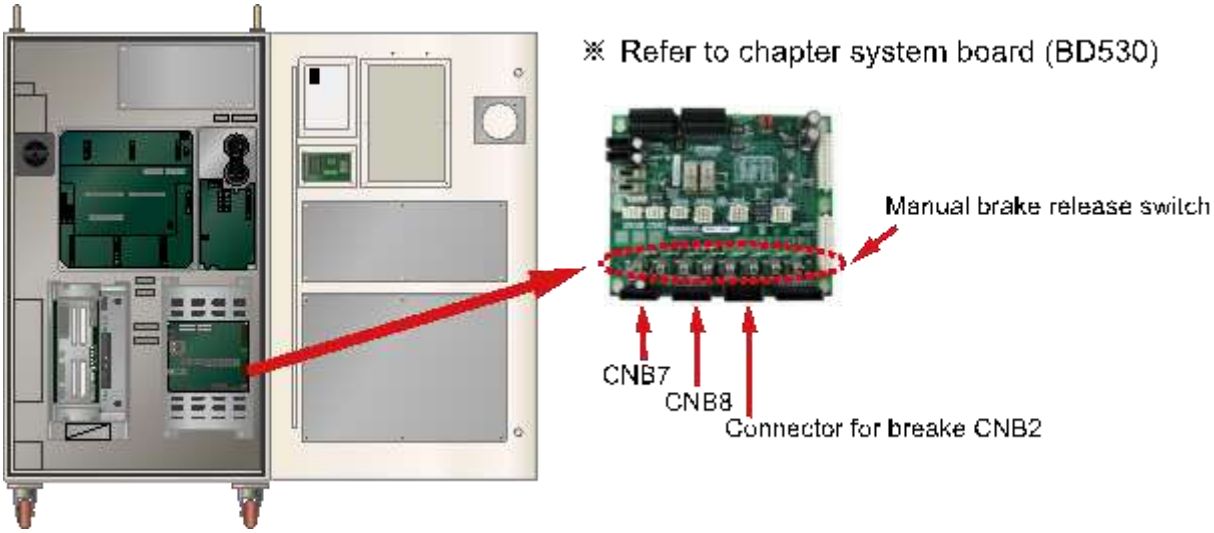
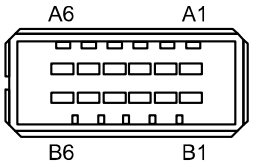


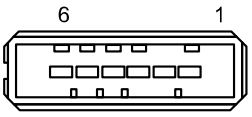
Figure 1.68 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, and CNB8 connector) and use the manual brake switch for the brake voltage's output. Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.



CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.69 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1:Private input signal』 → 『Overload (Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

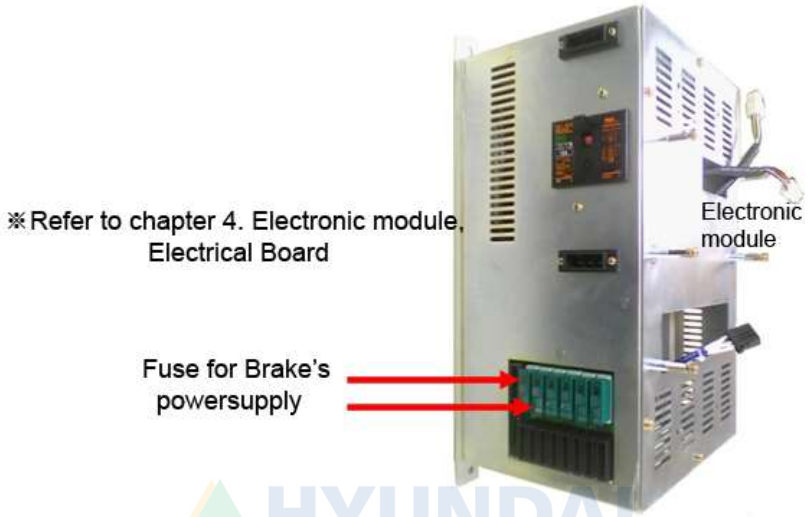


Figure 1.70 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

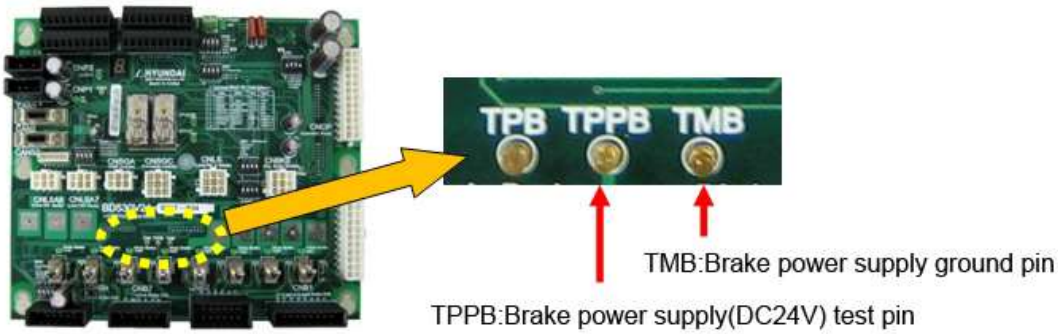


Figure 1.71 Brake Power Supply Test Pin

(3) Examine the wiring status.
Check if the motor wiring (U, V, W phase) has been short-circuit from the other wiring or ground lines (FG).

(4) Check if the rated load is used.
If the total weight exceeds the rated load, please refer to the Robot's specification and adjust the load to within the rated load.

(5) Position deviation setting level error

If the position deviation setting value is smaller than the next maximum measured value, please increate the setting value.

Maximum measured value of position deviation after few cycles of operation x 1.5

Figure 1.72 Monitoring Screen of the Maximum Measured Position Deviation Value from TP

Figure 1.73 Modifying Screen of Position Deviation Value from TP

(6) Please replace other components.
Replace the component in order of Servo Board (BD542) → Servo Drive Unit → Motor to confirm the occurrence of an error'.

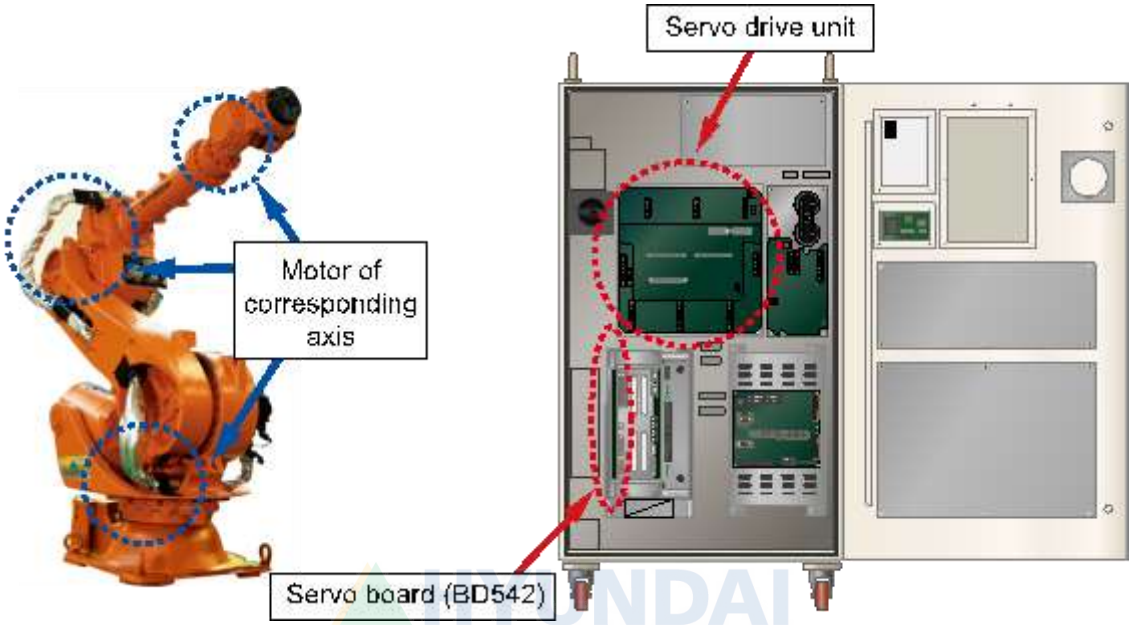


Figure 1.74 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.16. E0119 (○ Axis) Overload

1.1.16.1. Outline

Motor or the drive unit is being overloaded. If motor or the drive unit is overloaded, the Servo Board detects an error and immobilizes the Robot.

1.1.16.2. Causes and examine methods

(1) Please check if the Robot is loaded within its rated load.

(2) Please examine if there is a possible collision point during the Robot's operation.

(3) Please check if the axis brake works properly.

(4) Please replace the Servo Board and examine an error.

(5) Please examine if the Drive Unit operates normally.

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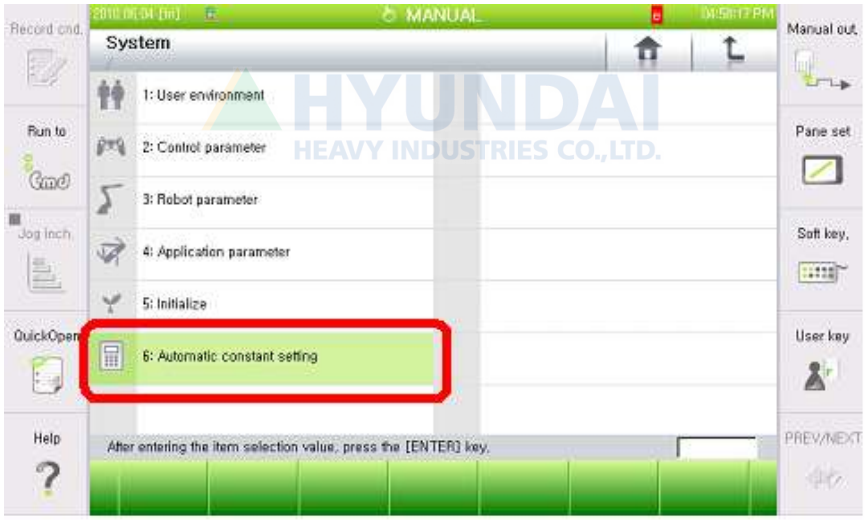
(1) Please check if the Robot is loaded within its rated load.

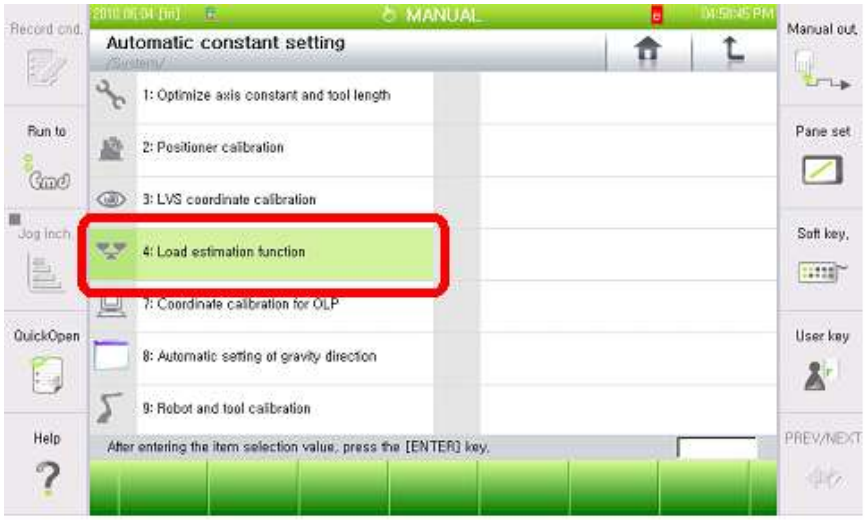
Please check if the Robot is loaded within its rated load. This error may occur if the load exceeds Robot's specification (load does not only include the tools that can be attached at the end of Robot, but also include all the cables and other components that can be attached to the Robot.

Using measuring equipment is recommended, but if it is not an option, load can be measured by using a 'load estimation function' from the controller. However this function only can measure the load of a tool that attached at the end of the Robot.

Method to estimate the load is as below.

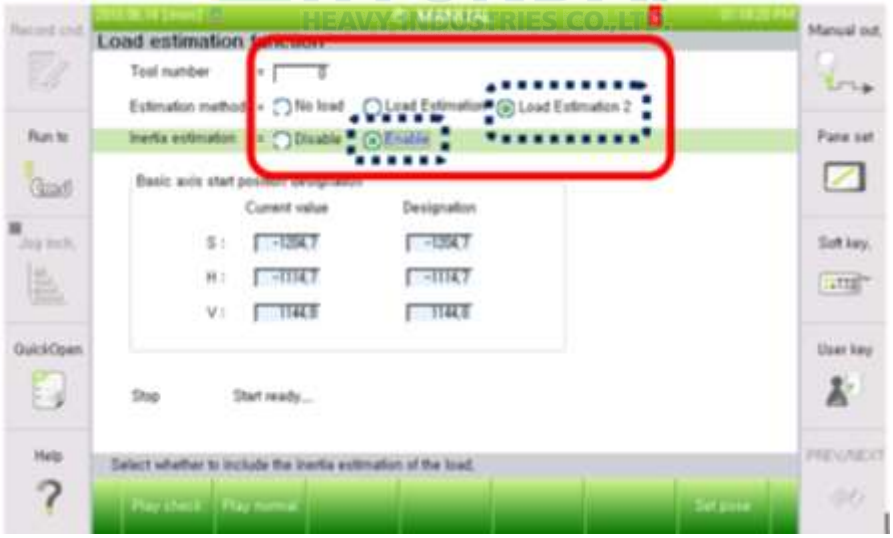
■ Enter to the load estimate function
『[F2]: System』 → 『6: Automatic constant setting』→ 『4: Load estimation function』



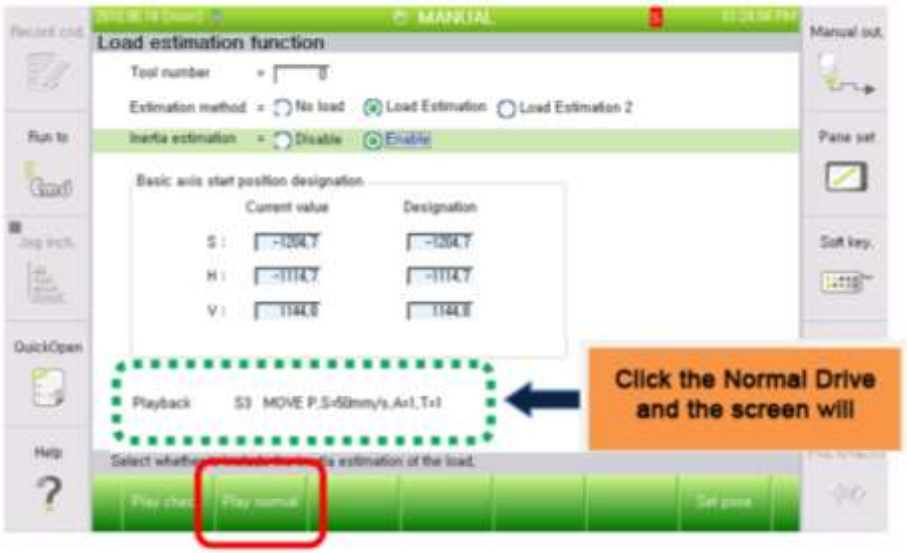


■ Select the tool number, estimation method, enable status of inertia estimation from the load estimation function.

- Tool number to save after the load estimation
- Estimation method: Load estimation 2
- Inertia estimation: Enable



- Click Normal Drive to execute.
  Press the Motor On switch, and hold the deadman and click the Play Normal.



Decide if you want to register the result of load estimation.

- Once the load estimation drive has completed, the estimated result will be displayed on the screen.

If you press the close button, a message box will appear to ask you if you want to reflect the result. If you click 'yes' it will be saved.

(2) Please examine if there is a possible collision point during the Robot's operation.
Please check if there is a point where the Robot may be interfered or have a collision in the operation area. This error may occur if the Robot is interfered by other equipment. In that case, please modify the job program so the interference will not occur.

(3) Please check if the axis brake works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

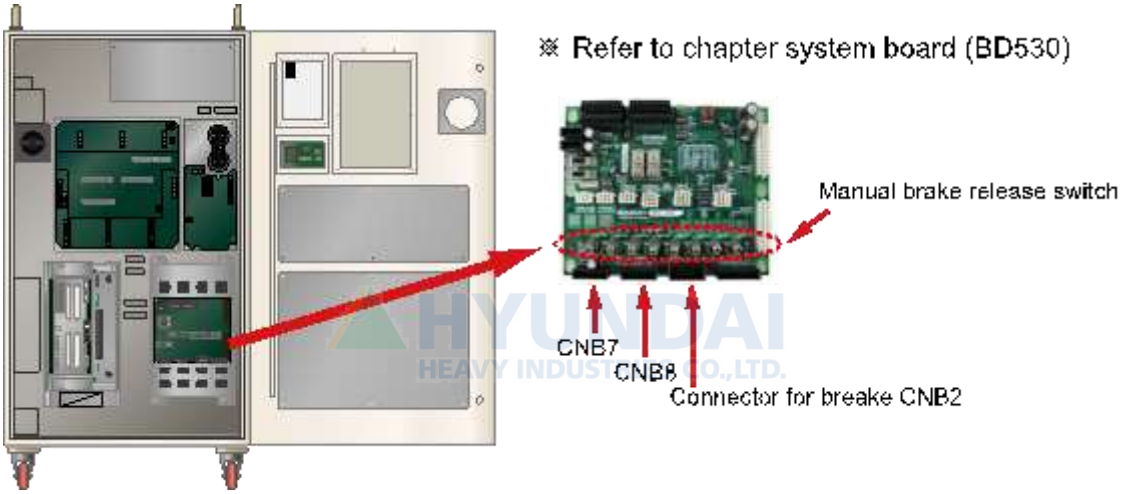


Figure 1.75 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, CNB8 connector) and use the manual brake switch for the brake voltage's output.
Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.

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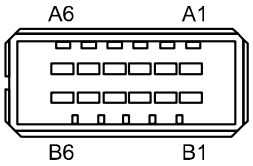
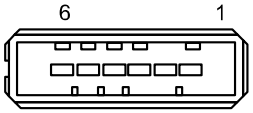


CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.76 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1: Private input signal』 → 『Overload(Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

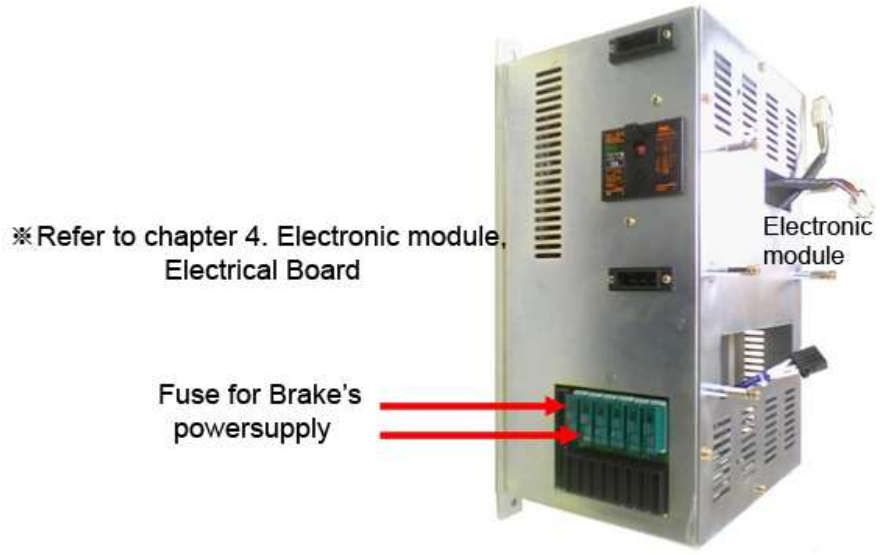


Figure 1.77 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

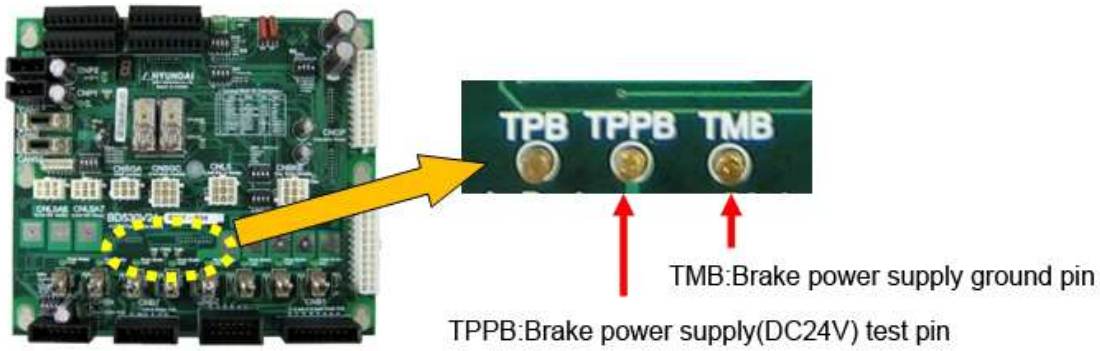


Figure 1.78 Brake Power Supply Test Pin

(4) Please replace the Servo Board and examine an error.

This error may occur if there is an error on the Servo Board. Please replace the board to check.

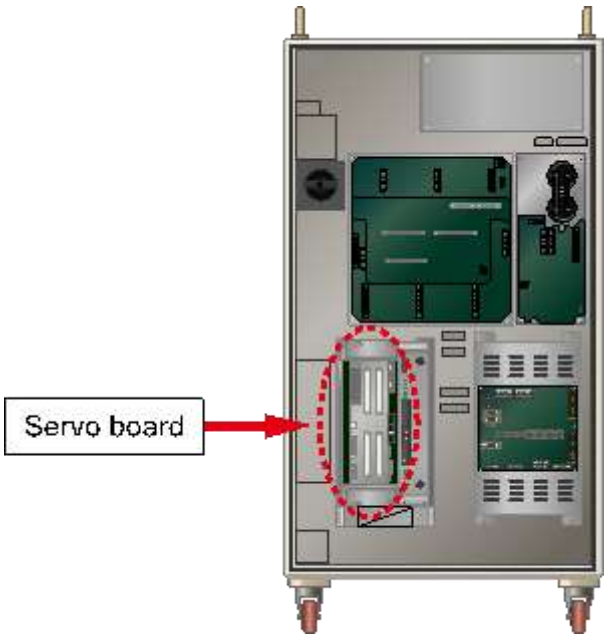
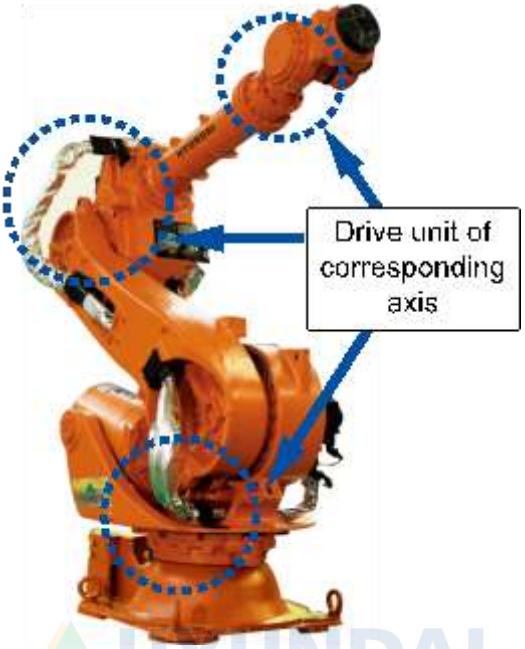


Figure 1.79 Replacing the servo board

(5) Please examine if the Drive Unit operates normally.

Please check if the Drive Unit of corresponding axis (Motor, Decelerator) works properly.



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1.1.17. E0122 Servo ON limit time exceeded

1.1.17.1. Outline

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

1.1.17.2. Causes and examine methods

(1) Please examine if the Main Board and the Servo Board are installed properly.
- ■ Examine if the board is installed properly.
- ■ Examine if board is faulty

(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.80 Methods for inserting a USB into the teach pendant

Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to

- Service
- 5. File manager

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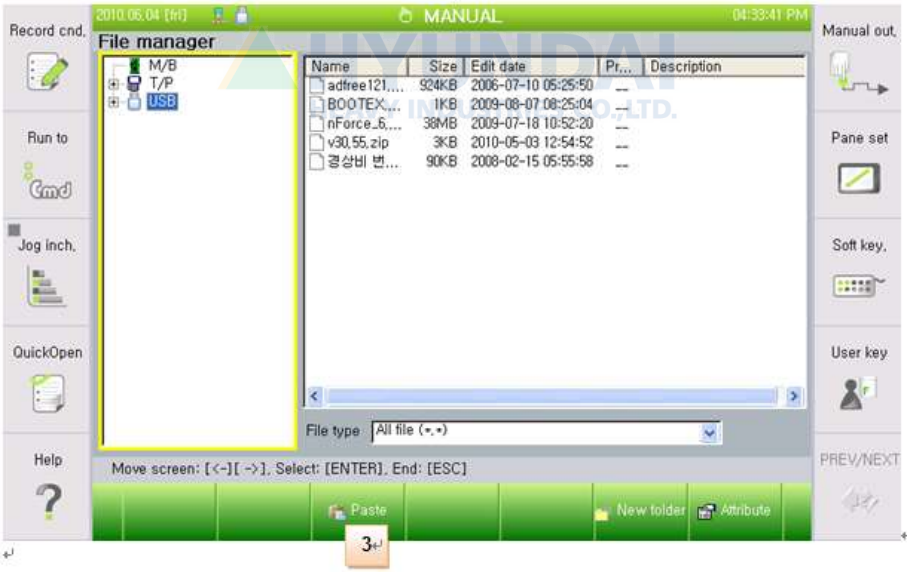
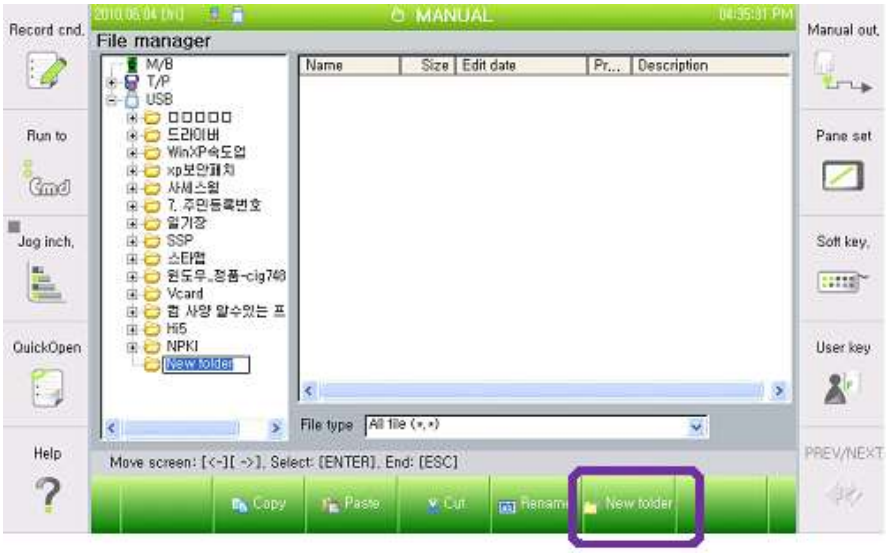
And the screen that is similar to windows explorer will be displayed.

At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Examine if the board is installed properly
  Please remove the Main Board and the Servo Board from the Rack and re-install them again.

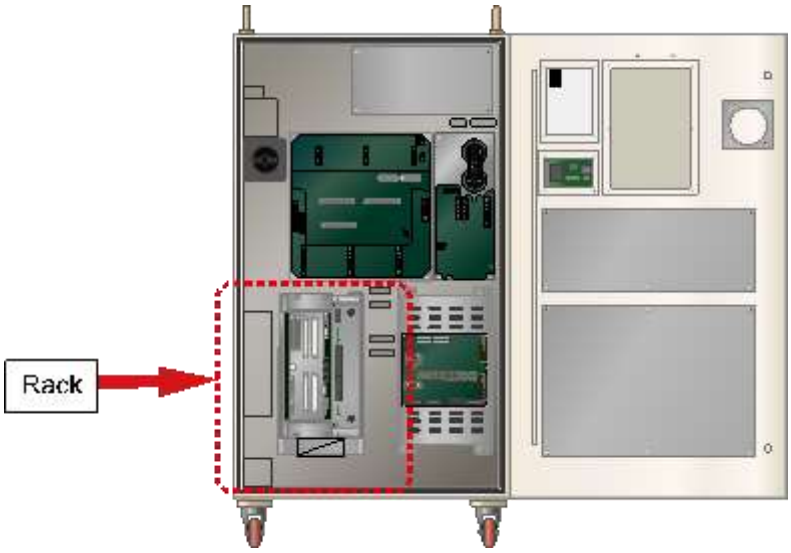


Figure 1.81 Location of Rack Inside of the Controller

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

1.1.18. E0127 MSHP operation error
1.1.19. E0140 MSPR operation error

1.1.19.1. Outline

Motor's power supply is supplied to the AMP according to the open/close status of Magnetic contactor MC1, and MC2.
Status of MC1 and MC2 are being monitored by Main's conditions and E0127 (MSHP operation error) or E0140 (MSPR operation error) will be generated when an abnormal operation is detected.

(1) E0140 (MSPR operation error)
For a reason that cannot be identified by Main, the Magnetic contactor MC1
① Does not turn On while an attempt is made,
② Turns off while it should stays on

(2) E0127 (MSHP operation error)
For a reason that cannot be identified by Main, the Magnetic contactor MC2
① Does not turn On while an attempt is made,
② Turns off while it should stays on

In order for MC1 or MC2 to on, many conditions need to be satisfied, and even if when they are on, they can be off for some reasons. Main can identify the causes for Magnetic contactor's operation error if it is a case that provides a monitoring function such as safety signals. However if the main cannot identify the Magnetic contactor's operation error, a number of examines are required.

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1.1.19.2. Causes and examine methods

(1) Command system malfunction
- Error on receiving data from the Main
- CPUERR or EXOUT signal has occurred, or an error of the corresponding line
- Old system I/O Board (BD531V10) is used from the remote mode
- Error on the safety signal system
- Error that occurred due to the safety related unit's wiring malfunction
- System Board malfunction

(2) Monitoring system malfunction
- Cabling (Wire, Connector etc.) malfunction
- Electrical Module malfunction
- System Board malfunction

(3) Other malfunction
- Case when E0043 and E0140 both occurs at the same time

To identify the cause of these two errors (MSPR operation error, and MSHP operation error), you must understand the Motor's power supply insertion system. Basic concept of Motor's power supply to the Amp (Drive Unit) is as below.
Main will send out the MC1 Motor power on 1 command (MCON1) and waits (while monitoring the sub point of contact) until the MC1 is activated. At this stage, if the MC1 does not activates within certain amount of time, E0140 (MSPR operation error) will occur. On the other hand, if MC1 successfully operated, Main will send out the MC2 Motor power on 2 command (MCON2) and waits (while monitoring the sub point of contact) until the MC2 is activated. Again, if the MC1 does not activates within certain amount of time, E0127 (MSHP operation error) will occur.
If the Magnetic contact MC1 and MC2 turns on according to the Main's command, AC220V R, S, T 3-phase power supply will be supplied to the Amp.

While the motor is on, the Main will monitor if the MC1, and MC2's status is on at all time.
If the Magnetic contact goes off for a reason that cannot be identified by the Main, these errors will occur.

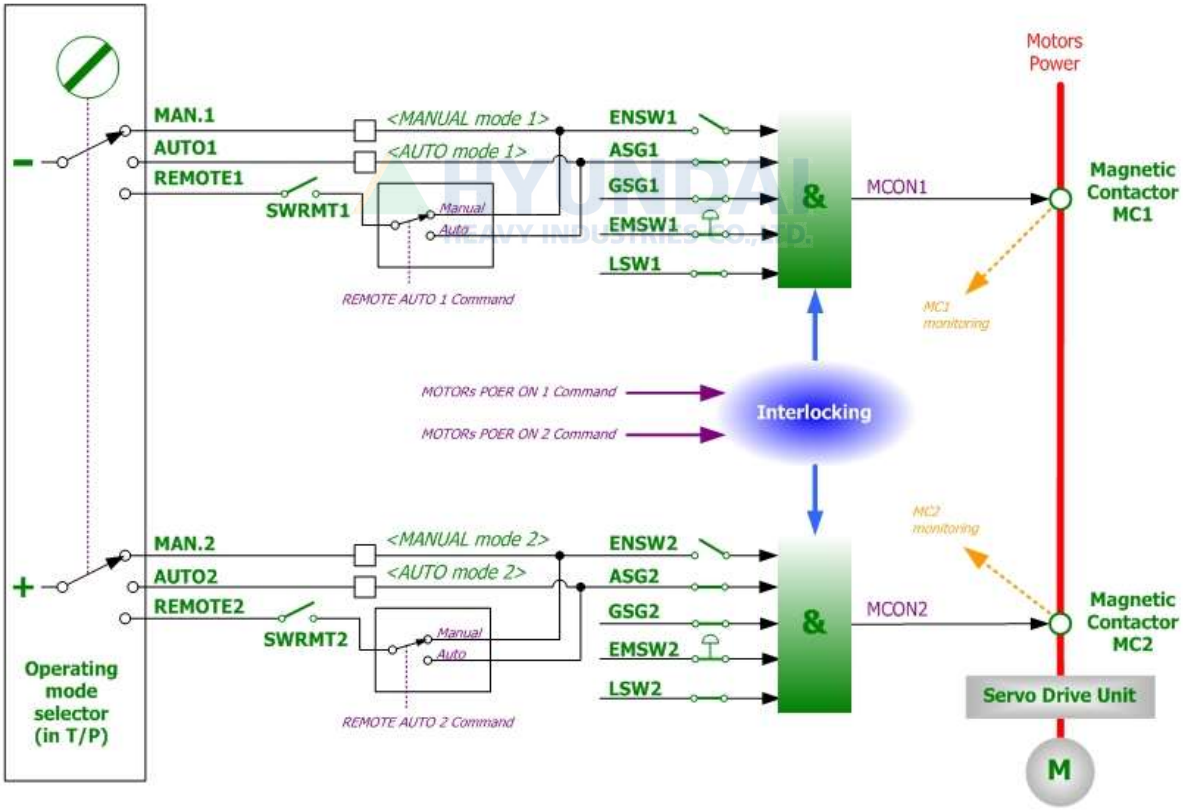

Figure 1.82 Concept Diagram of Safety Circuit for Motor Power's Opening/Closing

(1) Command system malfunction

Motor on command from the main has been blocked for some reason, if you do not hear any sound of operation and a message of 'MSPR operation error' is displayed while the motor on attempt is made.

- Error on receiving data from the Main
  If a communication error occurs between the Main Board and the System Board, the System Board will block the Motor On command for a safety reason. Generally the Main Board also detects the communication error at the same time, so the MSPR operation error or MSHP operation error will not occur. However if the Main cannot detect the communication error, these errors can be generated. This is a case when the control status of safety switch related components (Teach Pendant emergency stop switch input, OP panel's emergency stop switch input) are being transmitted to the Main Board, but output from the Main Board (Motor ON) will not be transmitted to the System so the hardware wise Motor On command is cannot be executed.

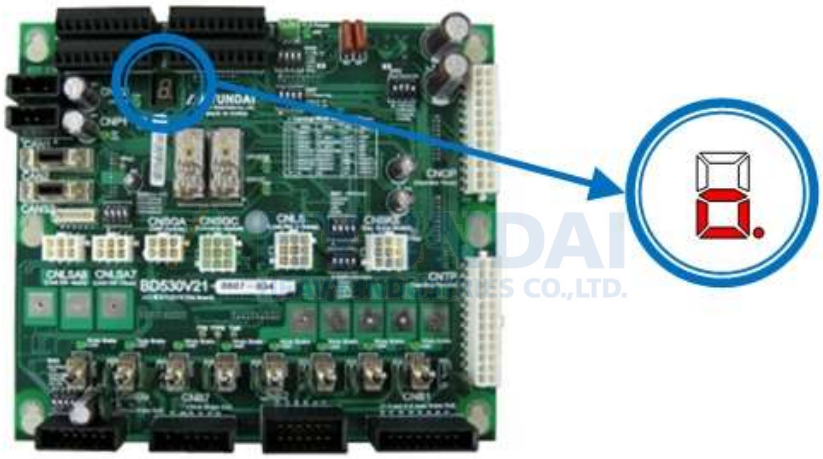

Figure 1.83 7-SEG Indicator of the System Board when a Communication Error Occurs

- How to judge:
  System Board's 7-segment index may give you an indication of the situation. 7-segment displays "o." to indicate that the current communication with the Main Board is in abnormal status.

- Actions:
  Firstly, please restart the controller and observe if the same error persists. If it does, the communication input unit of the System Board has an error. Please replace the System Board.

- CPUERR or EXOUT signal has occurred, or an error of the corresponding line
  Main Board generates CPUERR or EXOUT signals in a case when systemic error has occurred (e.g. power shut down, Servo error). This signal will be transferred to the System Board and block the motor on command in terms of hardware. Motor's power will be immediately shut down for a safety reason. However, these signals may be generated abnormally, and it will shut down the motor's power.

  - How to judge:
    System Board's 7-segment index may give you an indication of the situation. 7-segment displays "H." when CPUERR is being transmitted to the System Board. Also the CPUERR, EXOUT LED which located at the center of the System Board indicate the error situation (Figure 1.84) These LED lights will be on if it is a normal status, and the lights will be off if it is not.

  However if the signal appears time to time for a very short moments, 7-segment and LED won't be able to indicate it. In such case, error occurrence must be observed while ignoring the two signals by using DIP switch SW1. Method to ignore the signal is to, as shown in the Figure 6.91, turn on the No 1 (to ignore CPUERR) and the No 2 (to ignore EXOUT) of the DIP switch SW1. At this point all LED lights will be on.

  If the error no longer persists after the system restart, Main Board generated these signals or CANS1 Connector/Cable malfunction is suspected.

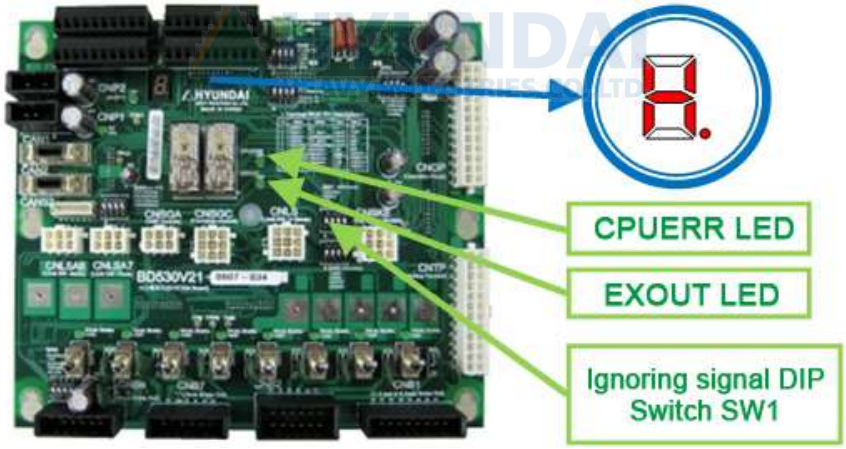

Figure 1.84 Indication of 7-SEG, LED (on System Board) when CPUERR Error is Occurred

  - Actions:
    If a Main Board generating this signal without any other indication of errors, please check the PLD version of the Main Board. Over V0.7 is normal. If Main Board's PLD version is normal, please examine the CANS1 connector and cables.

Cautions: Please use only No 1 (to ignore CPUERR) and No2 (to ignore EXOUT) of the DIP switch SW1 for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

- Old system I/O Board (BD531V10) is used from the remote mode
  If an old system IO board (BD531V10) is used on a remote mode, this error may occur. Motor on command will not be executed because this type of board does not have remote mode function.

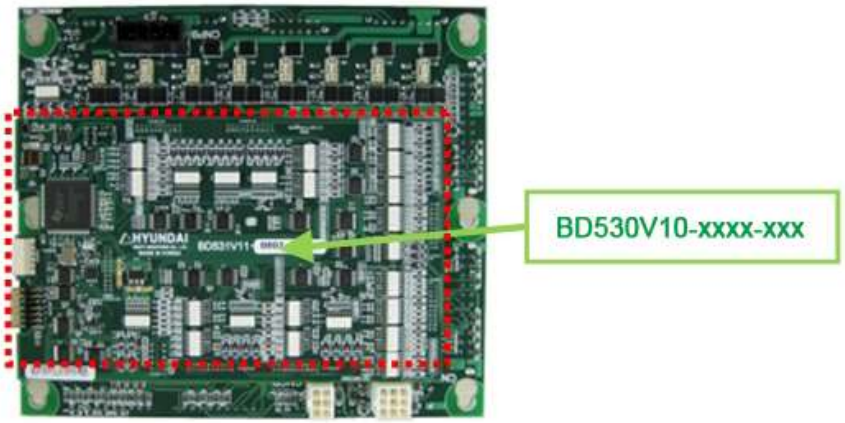

Figure 1.85 Checking Method of Old System I/O Board (BD531V10)

- How to judge:
  This board is attached at the back of the System Board. Please remove the System Board from Electrical Module and check the system I/O board number at the back (Figure 1.85).

- Actions:
  If the installed board is “BD531V10”, please replace it with a board with the hardware version above “BD531V11”.

■ Error on the safety signal system
Motor on command from the main has been blocked for some reason, if you do not hear any sound of operation and a message of 'MSPR operation error' is displayed while the motor on attempt is made without any other error messages.

The motor on command will not be executed if there is a problem on a safety signal system as explained earlier (Figure 1.82). Safety devices (Safety guard, emergency stop switch etc) are mechanically operating devices, but their monitoring is operated electronically. So a safety device malfunction, or any electronic shock (noise, surge), wiring error, short circuit can cause an error. To confirm, please remove the connected safety device's wiring and rewire them to ignore the input.

Cautions:
Please use only for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

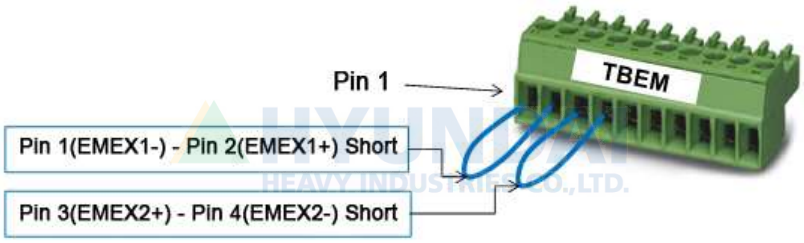

Figure 1.86 Method to Ignore the External Emergency Stop Input

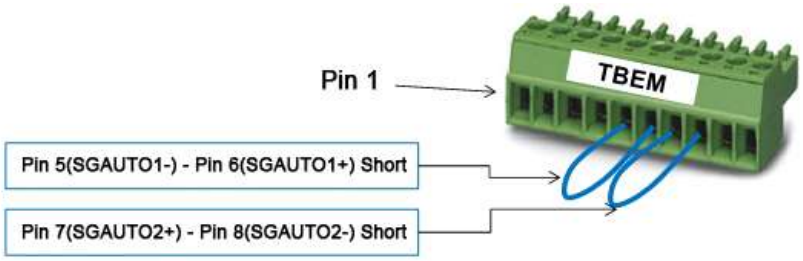

Figure 1.87 Method to Ignore the Safety Guard (Auto) Input

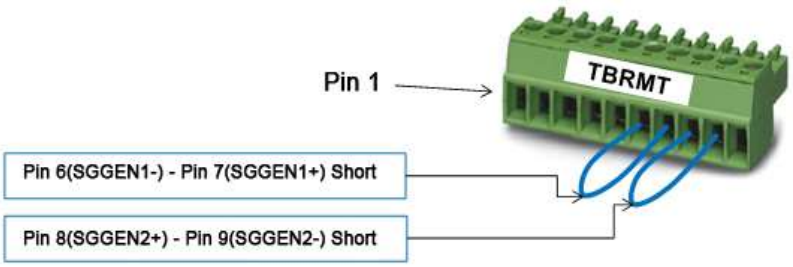

Figure 1.88 Method to Ignore the Safety Guard (General) Input

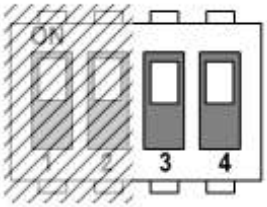

Figure 1.89 Method to Ignore the (P-COM input) External Emergency Stop (3,4 of SW6 is ON)

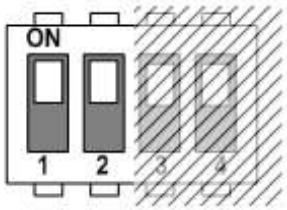

Figure 1.90 Method to Ignore the (P-COM) Safety Guard (Auto) (1,2 of SW6 is ON)

As explained, if the error does not persist when these safety switch inputs are ignored, the problem exists in the safety switches and wirings. Please check them.

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Cautions:
Please use only for a testing purpose and please switch it back to normal after the test. This ignores the emergency safety related functions and it may cause safety related problems if operates while ignoring these functions.

■ Error that occurred due to the safety related unit's wiring malfunction
If there is a problem in a wiring of devices that are related to the safety such as Safety guard(Auto), the error for a corresponding safety signal may not be detected and it will generate E0140 (MSPR operation error).
This error occurs from a waiting of manual mode drive preparation (Status that the Teach Pendant's motor on LED is flickering) switches to automatic mode, and motor on attempt is made on an automatic mode.

For example, there is a case when the wiring of Safety guard (Auto) is faulty. There are two types of input method (point of contact input, P-common input) that enters safeguard to the System Board (BD530) and the point of contact input's wiring error may cause a problem. Proper wiring separates each safe chain and connects the each end of point of contact (Figure 6.98) However if the chain's wiring is mixed and connected, the controller will not be able to detect the Safety guard's error due to an electronic error (Figure 6.99). If the motor on is attempted at this time, not sufficient power supply for Magnetic contactor's safe relay operation will be supplied and it will generate E0140 (MSPR operation error).

➢ How to judge:
Phenomenon of Safety guard wiring malfunction is as below.

- If a safe chain connection is removed (5, 6 wiring or 7, 8 wiring), Safety guard error will be detected in automatic mode and displays E0043 error.
- However, if all chains are connected (5, 6, 7, 8 wiring are all connected), Safety guard error will not be detected in automatic mode (E0043 error does not occur).

If the above phenomenon appears, please examine the Safety guard (Auto)'s wiring. Firstly, please remove the terminal block TBEM from the board, and perform a short circuit test from a removed terminal block connector's (TBEM) safeguard input terminal (socket) while activating the guard device.

- If you close the guard device (point of contact – close status), 5, 6 terminal (socket) will be shorted. Also 7, 8 terminal (socket) will be shorted.
- If you open the guard device (point of contact – open status), 5, 6 terminal (socket) will be open. Also the 7, 8 terminal (socket) must be open status.

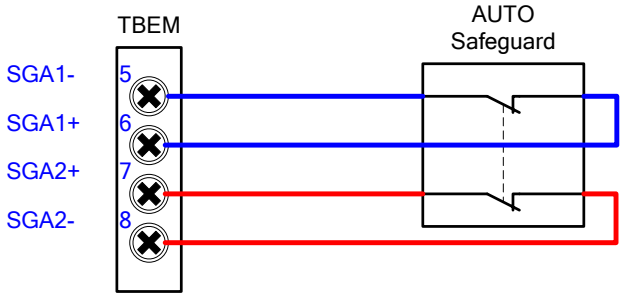

Figure 1.91 Good example of Safety Guard (Auto) wiring

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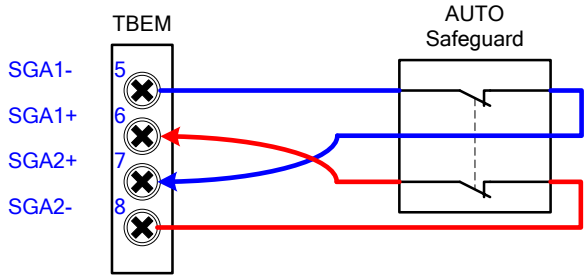
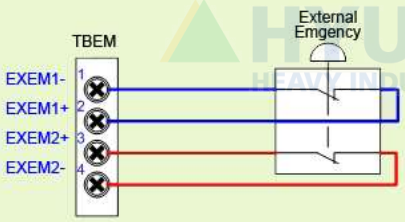
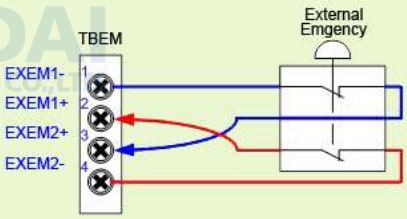
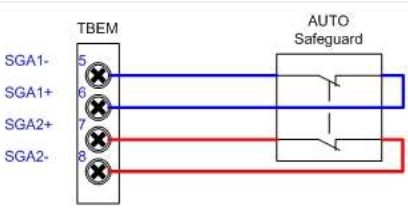
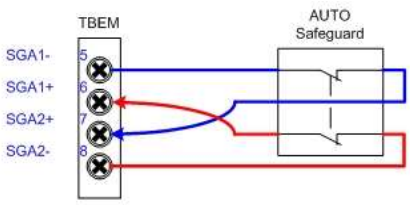
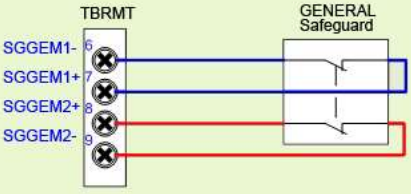
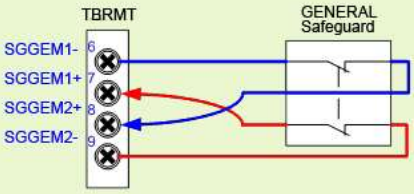


Figure 1.92 Bad example of Safety Guard (Auto) wiring

➢ Actions: Please modify the wiring of Safety guard (Auto) correctly (Figure 6.99)

Error occurrence caused by the wiring error of safeguard has been explained in above. This applies same to all safety related signals (Safety guard (General), Safety guard (Auto), external emergency stop switch, various limit switches), so please refer to (table 6-5) to compare the normal and abnormal wiring examples.

Table 1-5 Error on safety related device's wiring

Classification	Normal wiring	Abnormal wiring
External emergency stop switch		
Safety guard (Auto)		
Safety Guard (General)		

■ System Board malfunction
When motor on is attempted, if you do not hear the activating sound of controller's internal Magnetic contactor (MC1) and a message of "MSPR operation error" is displayed, please examine all the above. If no problem is found from the above examinations and same error persists, System Board malfunction might be the cause. Please replace it.

(2) Monitoring system malfunction

When motor on is attempted, if you do hear the activating sound of controller's internal Magnetic contactor and a message of "MSPR operation error" or "MSHP operation error" is displayed, the cause of an error might be the Monitoring system malfunction. In order to confirm the Monitoring system malfunction, please do as below.

The status of Magnetic contactor MC1 and MC2 is monitored by using the sub point of contact and can be accessed by the Teach Pendant. (Figure 1.93) From the Teach Pendant, MC1 (PreCharge) and MC2 (Motors Power) signal can be accessed by Private input signal monitoring window. Motor off status will be displayed as a white color background and motor on status will be displayed as yellow color background.

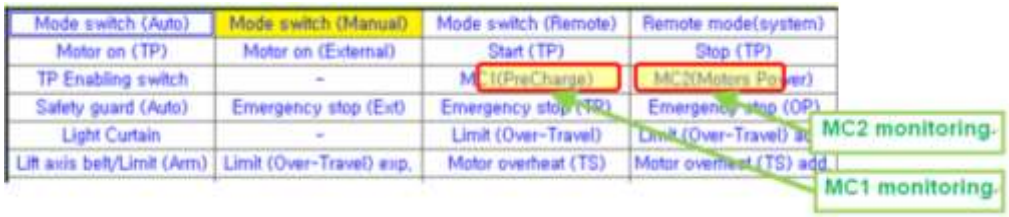


Figure 1.93 Method of Magnetic Contactor Monitoring

Please attempt the motor on in automatic or manual mode and confirm the activation sound of the Magnetic contactor as well as the displayed status of MC1, and MC2.

- At first, if MC1 is displayed with a yellow color for a moment (with the sound of Magnetic contactor's activation) and E0140 (MSPR operation error) message is appears, it means that there is no error in MC1's sub point of contact and the monitoring system.

- After the activation of MC1, if MC2 is displayed with a yellow color for a moment (with second sound of Magnetic contactor's activation) and E0127 (MSHP operation error) message is appears, it means that there is no error in MC1's sub point of contact and the monitoring system.

With the above methods, if you confirmed that the monitoring of MC1 and MC2 is not working (Monitoring signal is not displayed in yellow while you can hear the sound of Magnetic contactor's activation), the following devices has to be examined (Figure 1.94).

① Cable CNMC
② Electrical Board relay SR1, SR2 (inside of Electrical Module)
③ Sub point of contact for MC1 and MC2 – Magnetic contactor (inside of Electrical Module)
④ Wiring between the Electrical Board and the Magnetic contactor (inside of Electrical Module)
⑤ System Board (input signal processing unit)

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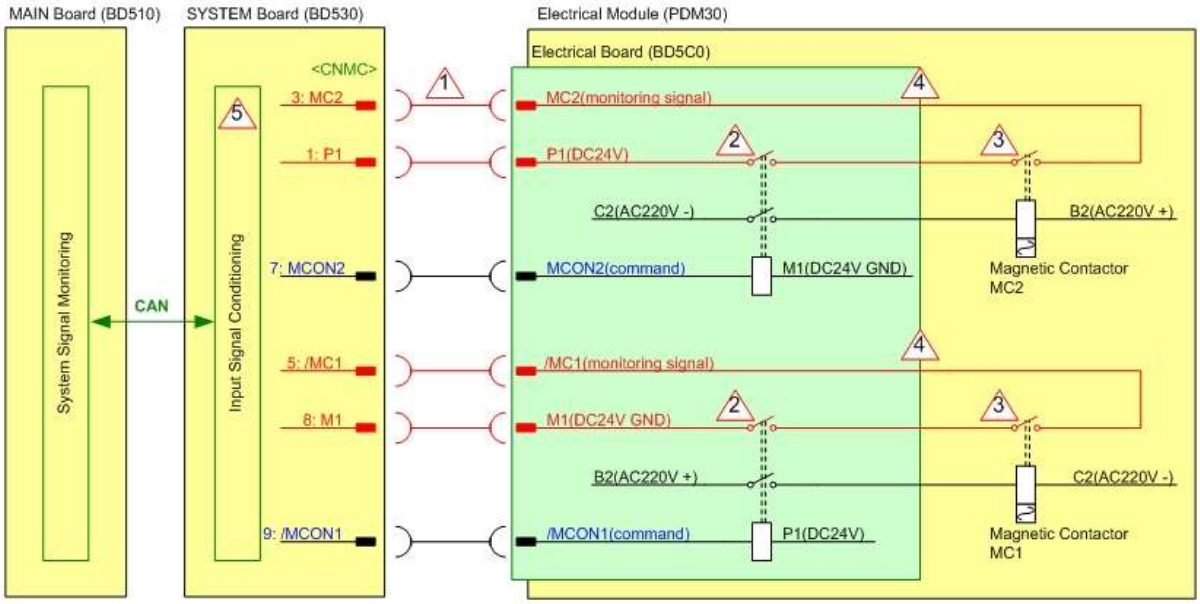

Figure 1.94 Diagram of the Monitoring System – Magnetic Contactor

- Cabling (wires, connector etc) malfunction
  Please check the cabling between the Electrical Module (PSM or PDM) that an electrical connector is installed and the System Board (BD530) that collects monitoring signals.
  The cable name is CNMC and it enters to the Electrical Module through the top rear of the System Board (Figure 1.95). Please check the connection status of this cable's connector.

Figure 1.95 CNMC Cable on the Electrical Module

- Electrical Module malfunction
  Monitoring signal of the Magnetic contactor is transmitted to the System Board through many devices that are inside of the Electrical Module. So if one of those devices has an error, the Main will not be able to detect even if the Magnetic contactor is operated. Internal electrical module malfunction can be categorized as a electrical board (BD5C2 or BD5C0), Electrical connector (MC1, MC2), and wirings between the electrical board and the electrical connector (Figure 1.96) However it is difficult to examine the inside of Electrical Module in a field where a Robot has already been installed, so alternatively please replace the Electrical Module

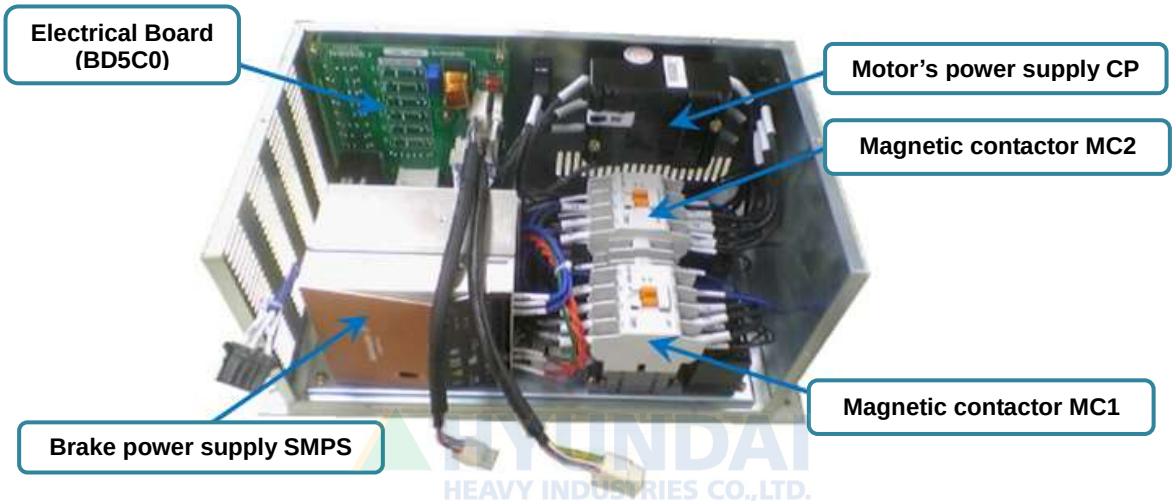

Figure 1.96 Inner Structure of Electrical Module

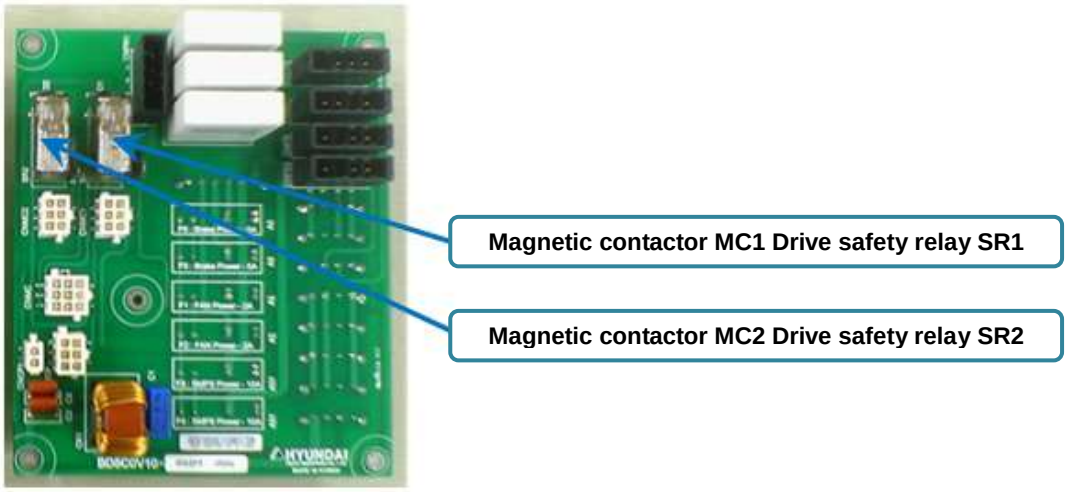

Figure 1.97 Electrical Board

- System Board malfunction
  Input signal process unit malfunction of the System Board can be the cause of this error. Please replace the System Board and check.

(3) Other malfunction

- Case when E0043 and E0140 both occurs at the same time
  E0043(Safety Plug or Light Curtain) with the E0140(MSPR operation error) can occurs from a waiting of manual mode drive preparation (Status that the Teach Pendant's motor on LED is flickering) switches to automatic mode, and motor on attempt is made when the Safety guard (Auto) is open (and the Main software version is below V30.07-00). Please check the Main software version from the Teach Pendant and upgrade if the version is low.

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1.1.20. E0133 (○ Axis) Command value error

1.1.20.1. Outline

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

1.1.20.2. Causes and examine methods

(1) Please examine if the Main Board and the Servo Board are installed properly.
- Examine if the board is installed properly.
- Examine if board is faulty.

(2) Examine if there is a job program that operates a Robot rapidly.

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(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.98 Methods for inserting a USB into the teach pendant

Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to

- Service
- 5. File manager

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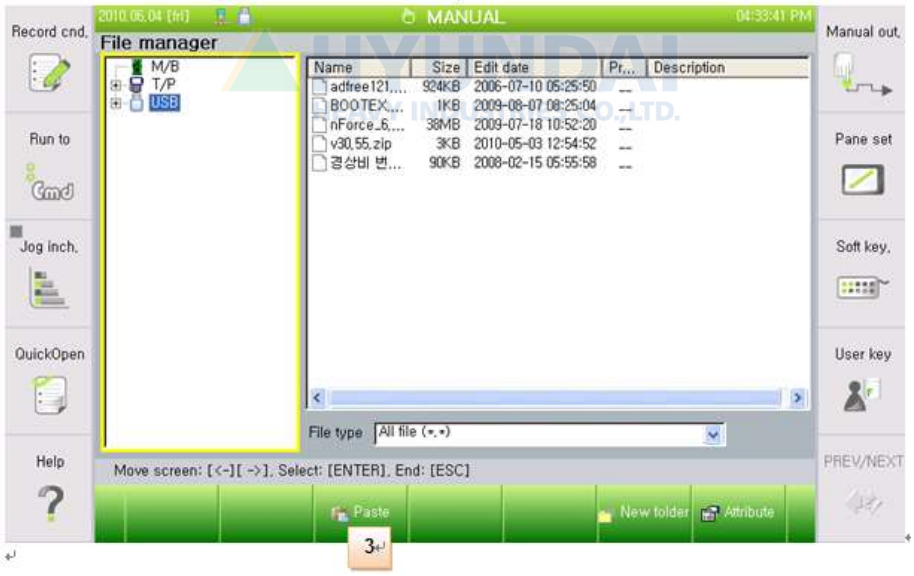
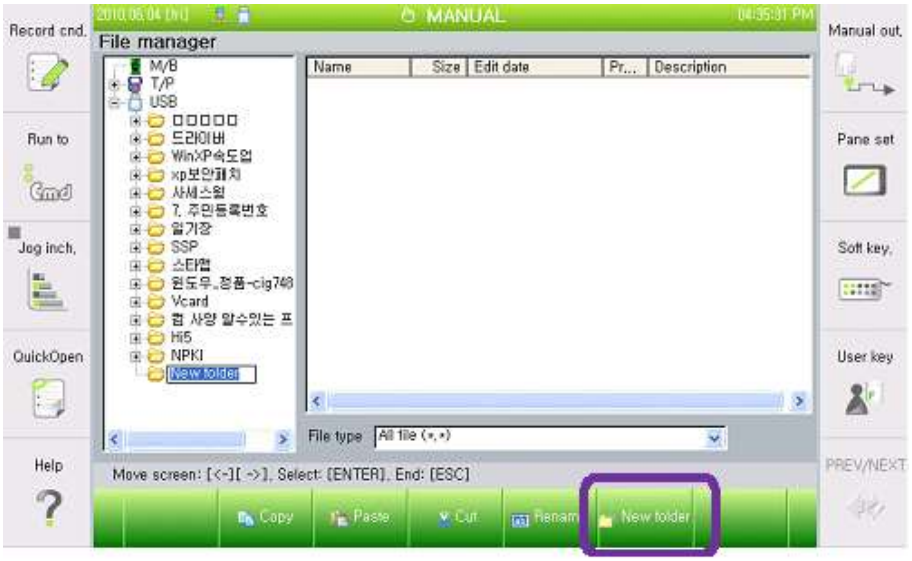
And the screen that is similar to windows explorer will be displayed.

At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Examine if the board is installed properly.
  Please remove the Main Board and the Servo Board from the Rack and re-install them again.

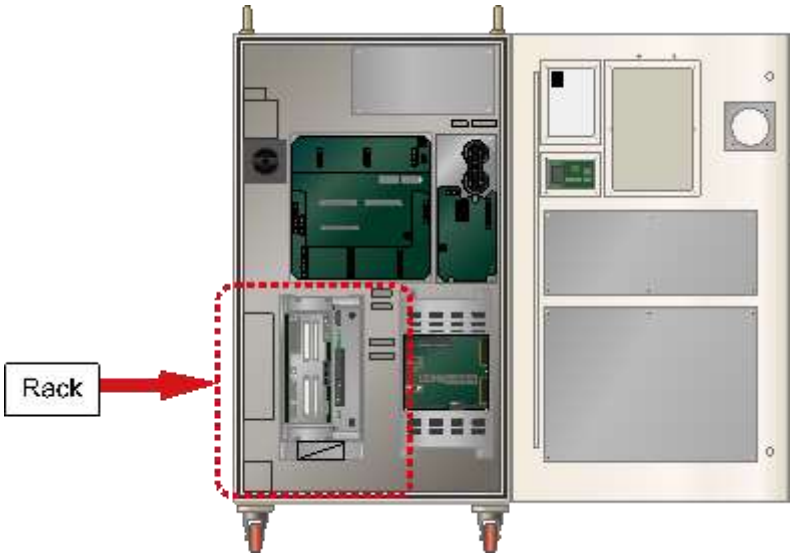


Figure 1.99 Location of Rack Inside of the Controller

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

(2) Examine if there is a job program that operates a Robot rapidly

Please check if the error occurs at a point where the Robot's motion changes rapidly. If the error occurs during the rapid motion, modification of job program is required.

The reason that this error occurs during the rapid motion is as below. During the execution of job program, Robot's position may be twisted in order to move a short distance. At that point, the speed of Robot's axis suddenly increases, and the error may occur if the Servo Board follows the movement. In order to resolve this, please modify the Teaching point of the location (where the position changes rapidly) or make changes on the position of Robot.

1.1.21. E0134 (○ Axis) Maximum speed exceeded

1.1.21.1. Outline

Speed of Robot's axis exceeded the maximum speed limit while an operation. An error will be generated and the Robot will be immobilized since the Robot is not being controlled normally.
When the Main Board sends a command to the Servo Board, it will send a limited command so that the Robot will not exceed the maximum speed limit. Maximum speed exceeded error may occurs if the Robot's speed triggers an overshoot because the Robot could not follow the command.

1.1.21.2. Causes and examine methods

(1) Please check if the tool data has entered correctly.

(2) Please check if the position of Robot is close to the singular point.

(3) Please check the setting value of condensation acceleration/deceleration parameter and the load factor.

(4) Please adjust the job program.

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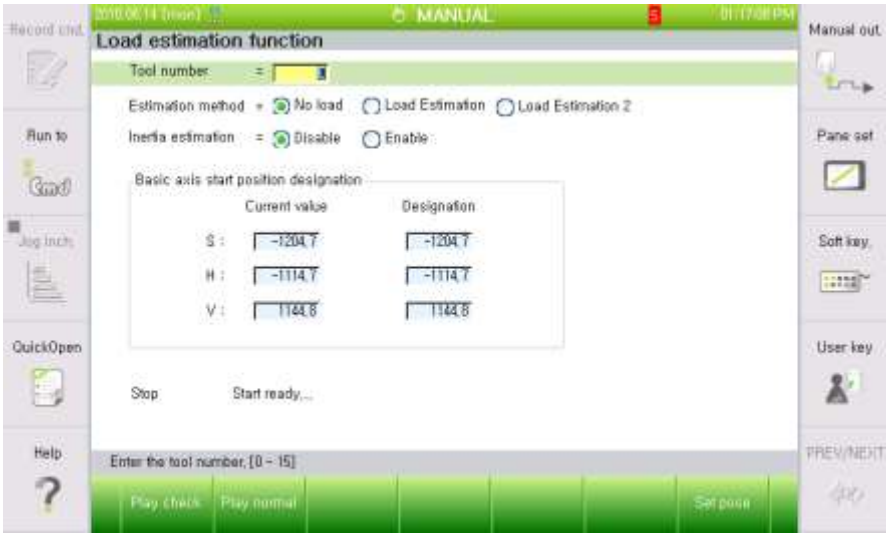
(1) Please check if the tool data has entered correctly.

If the weight or the inertia of tool is different from the registered value at the controller, Robot's control performance will be reduced and the maximum speed limit exceeded error can occur. Tool's weight and the inertia can be registered from the below menu according to the number of tools.

- System
- 3. Robot Parameter
- Tool data

You may use the load estimation function in order to set the weight of tool or the inertia automatically.

- System
- Automatic constant setting
- 4. Load estimation function



(2) Please check if the position of Robot is close to the singular point.

This error may occur, if you execute L interpolation or C interpolation instead of PtP interpolation near the position of singular point.

Singular point occurs when the B axis is close to 0 deg, or the center of wrist part is close to the spin central axis of S axis. When passing near the singular point is required, please change the corresponding step to PtP interpolation.

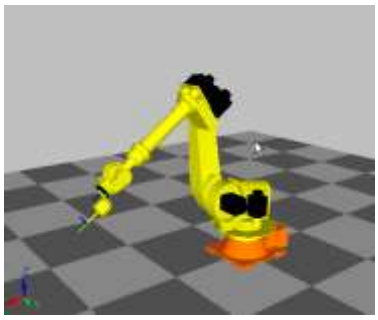


Figure 1.100 Axis B Singular Point

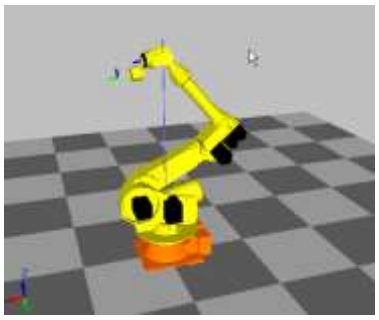


Figure 1.101 Axis S Singular Point

(3) Please check the setting value of condensation acceleration/deceleration parameter and the load factor.

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

- System
- 3. Robot Parameter
- 34. Acceleration /Deceleration Parameter

(4) Please adjust the job program.

Please make changes of conditions (from the job program) on a corresponding step, or the one step prior to it. Firstly, try "Acc=0", secondly, reduce the step speed, and thirdly, add one more step on a movement routine.

1.1.22. E0165 (○ Axis) Servo lock cannot be maintained

1.1.22.1. Outline

Power for the drive of Motor or the drive unit is not being supplied. The current that generated by a Servo control for the Robot or drive unit's operation is not being supplied. For such cases, the Servo Board detects an error and the controller will stop the release of brake and block the current that supplied to the motor or the drive unit.

1.1.22.2. Causes and examine methods

(1) Examine the Motor power line.
- Check the wiring that connects the Robot and Controller.
- Check the Robot's internal wiring.
- Check the Controller's internal wiring.

(2) Examine the CNBS cable between the Controllers' internal Servo Board and the Servo AMP.

(3) Replace other components.

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(1) Examine the power line

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

Warning

Be cautious. Examination while the power is on may cause an electrocution.

- Check the wiring that connects the Robot and Controller

  Please remove the wirings that connect the controller, Robot or the drive unit to examine each phases (U, V, W) for ground, or a short circuit. If a short circuit is found, please replace the wire.

<External wiring>

Figure 1.102 Basic Installation Diagram of the Robot and Control Period

- Check the Robot's internal wiring.
  Examine for a short circuit, faulty on a wiring that connected to Robot's internal motor is required.

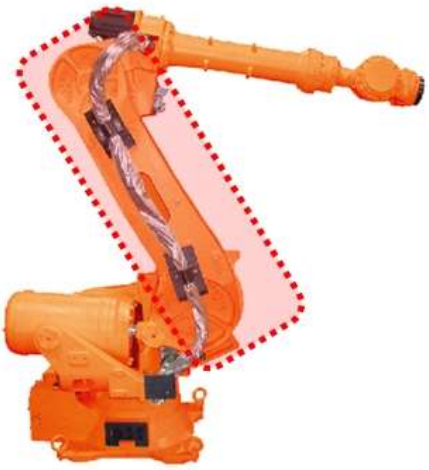

Figure 1.103 Robot's Internal Wiring

- Check the Controller's internal wiring.
  Examine on a controller's internal AMP and installed wiring is required.

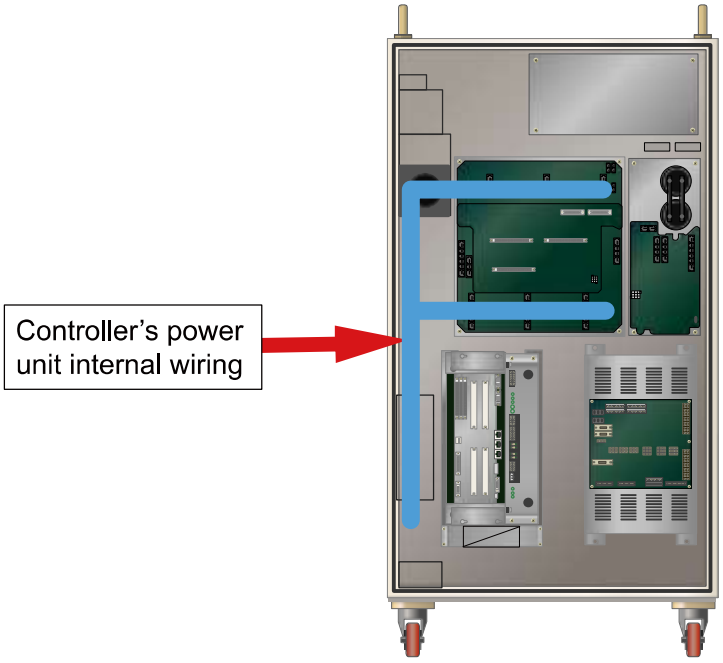

Figure 1.104 Controller internal side (Power unit)

(2) Examine the CNBS cable between the Controller's internal Servo Board (DSP board) and the Drive Unit.

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

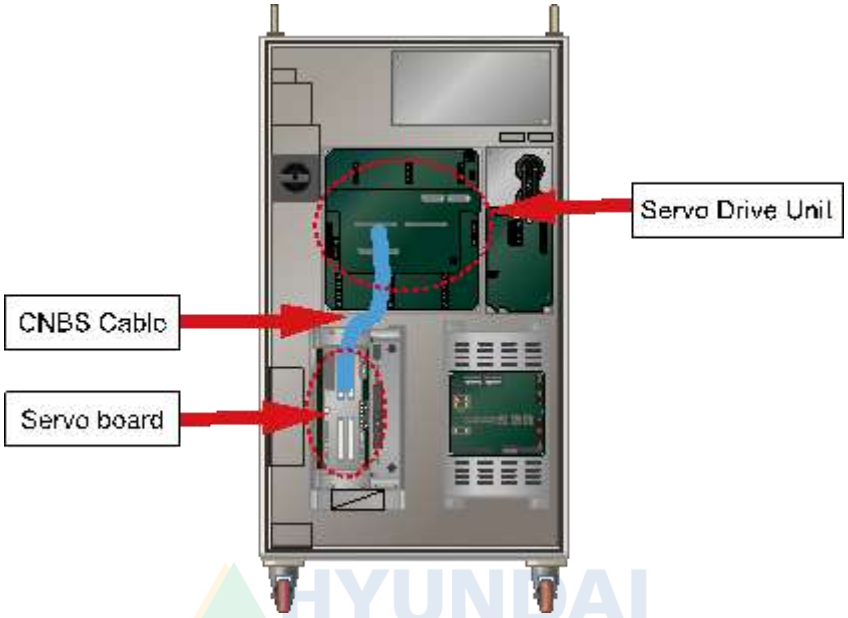

Figure 1.105 Controller internal side (CNBS Cable)

(3) Replace other components.

Replace the component in order of Servo Board → Servo Drive Unit → Motor to confirm the occurrence of an error'.

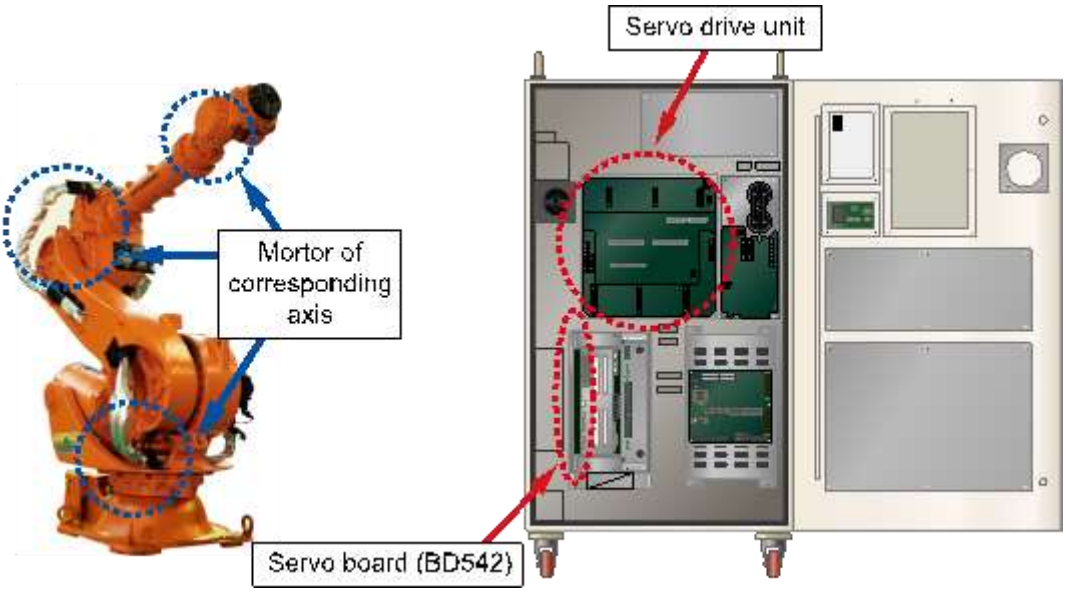

Figure 1.106 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.23. E0223 (○ Axis) Encoder disconnection or communication failure

1.1.23.1. Outline

Servo Board receives data from the encoder periodically through a serial communication in order to perform a Servo control on the motor. This error occurs if the received data from the encoder violates the communication protocol.

This error may occur due to a fault of components that received the data from the encoder, or the problems in an encoder shield lines or the wiring.

1.1.23.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder.

(2) Please replace the Servo Board and test it.

(3) Please replace the Motor and test it.

(4) Please examine the wiring.

(5) Please examine the communication status of wiring after the repair.

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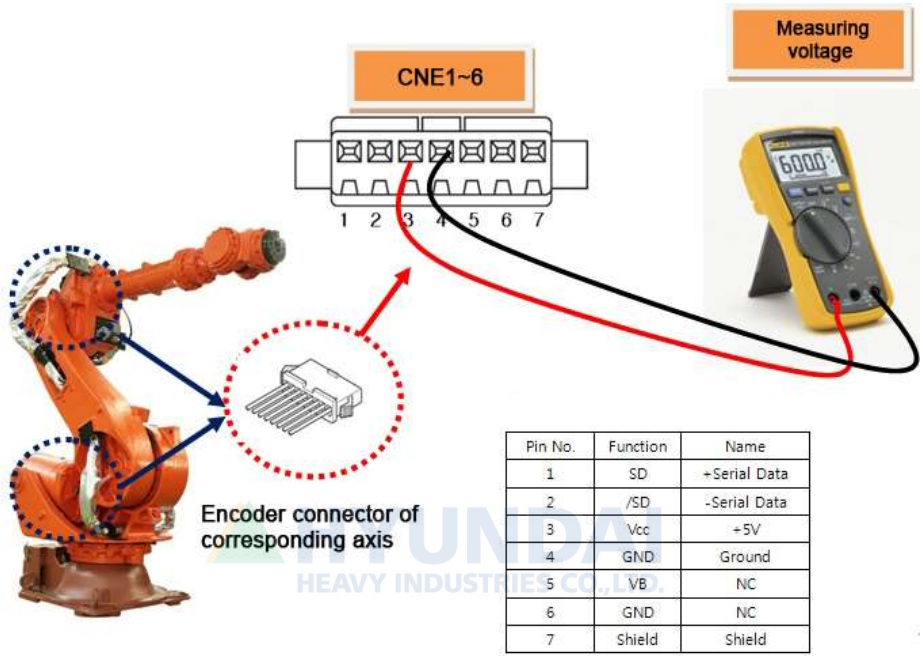
(1) Please check the supply voltage to the Encoder.

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

Please measure the voltage of encoder side's connector-pin (3-4).



Pin No.	Function	Name
1	SD	+Serial Data
2	/SD	-Serial Data
3	Vcc	+5V
4	GND	Ground
5	VB	NC
6	GND	NC
7	Shield	Shield

Figure 1.107 Measuring the encoder voltage

If the measured voltage is lower than the reference voltage, it is required to turn '+5V ADJ(E) voltage adjustment terminal of the encoder power supply to ensure that the connector voltage at the encoder side can be adjusted within the reference voltage.

Figure 1.108 Adjusting the encoder voltage

(2) Please replace the Servo Board and test it.

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

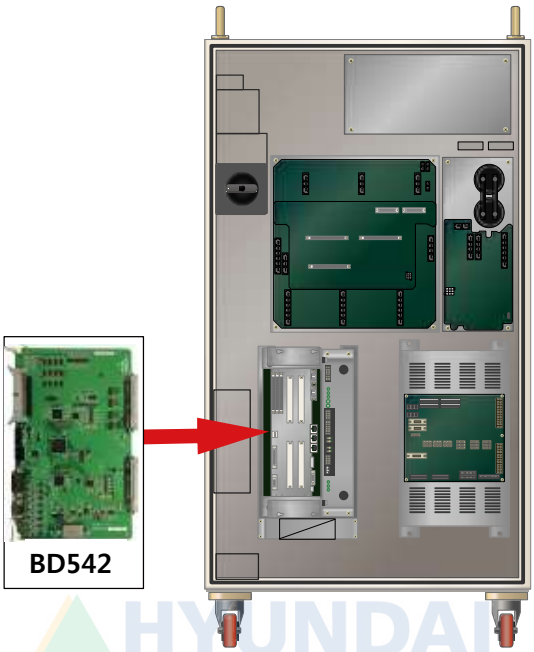


Figure 1.109 Replacing the servo board

(3) Please replace the Servo Motor and test it.

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

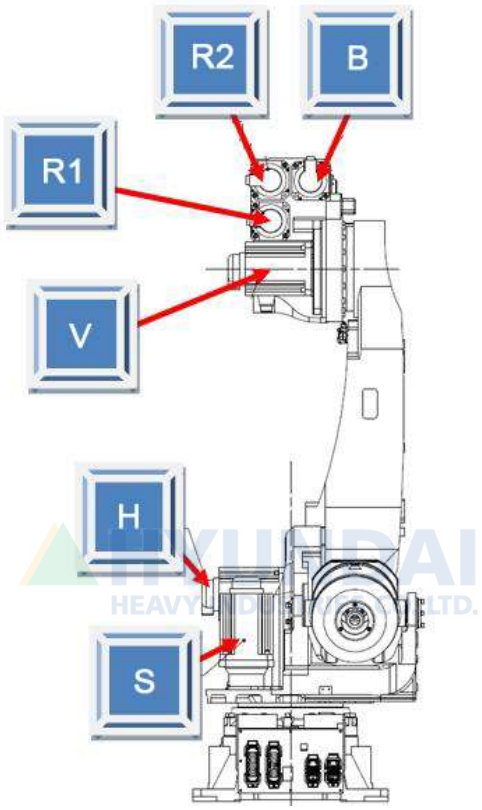


Figure 1.110 Locations of Each Axis's Motor (HS165 Robot).

(4) Please examine the wiring.

Encoder's wiring examination orders are as below.

Firstly, examine the loose contact of the connectors that are related to the Encoder's wiring.

Secondly, examine the short-circuit of encoder's wiring. Please use equipment such as the multi meter (tester) and examine each phase's wiring one by one.

Thirdly, replace the encoder's wiring and test it.

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

- Please examine the internal wiring of the Controller
  Please examine the wiring between the CNEC1, 2 (BD542) connector and the SMPS(P5E, M5E)
  Please examine the wiring between the CNEC1, 2 (BD542) connector and the CEC1.

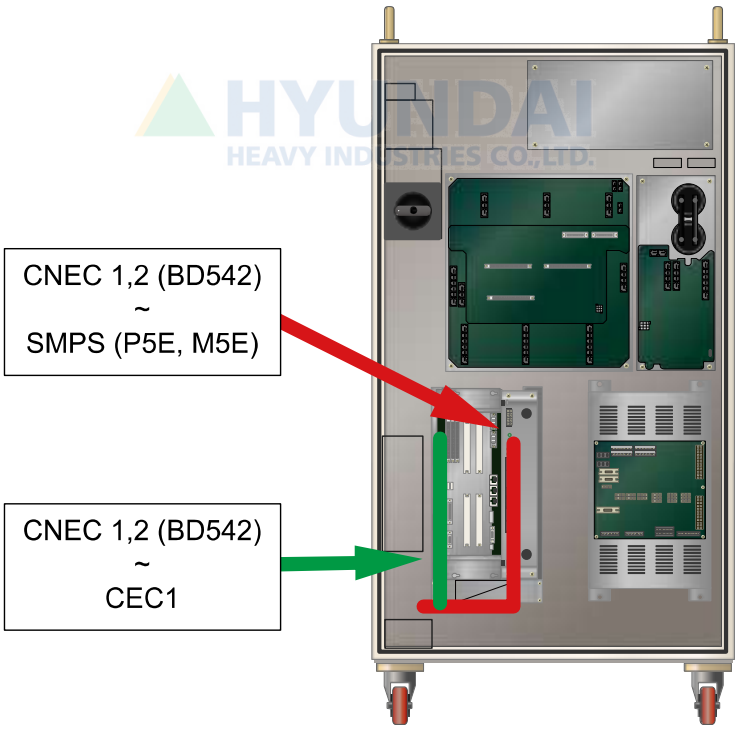


Figure 1.111 Checking the encoder wiring

- Please examine the wiring between the Controller and the Robot.
  Please examine the wiring between the CNEC1 and the CER1.

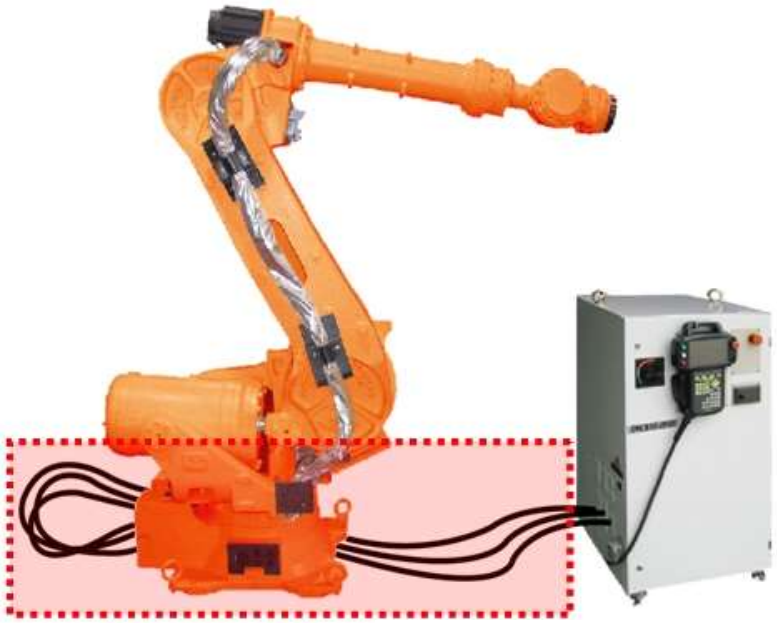


Figure 1.112 Basic Installation Diagram of the Robot and Control Period

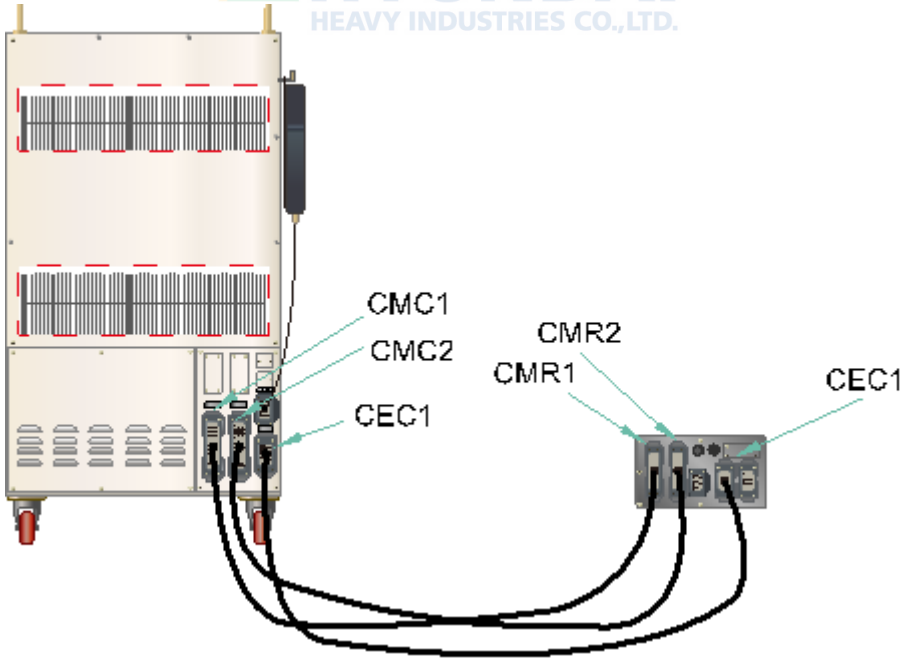


Figure 1.113 Connection between the Robot's manipulator and the Controller

- Please examine the wiring of the mainframe.
  Please examine the wring between the CER1 and CNE1~6 (Encoder side's connector).
  Please refer to the wiring diagram of Robot's maintenance manual.

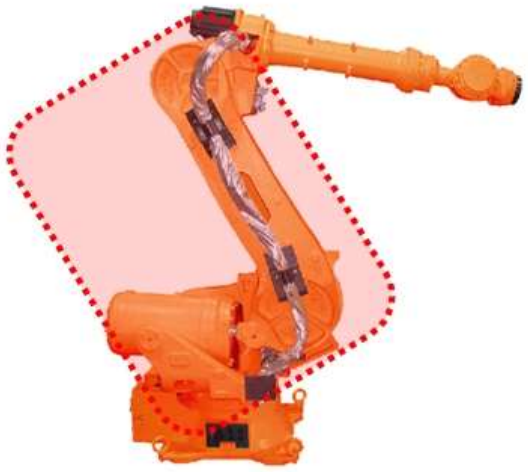


Figure 1.114 Robot's Internal Wiring

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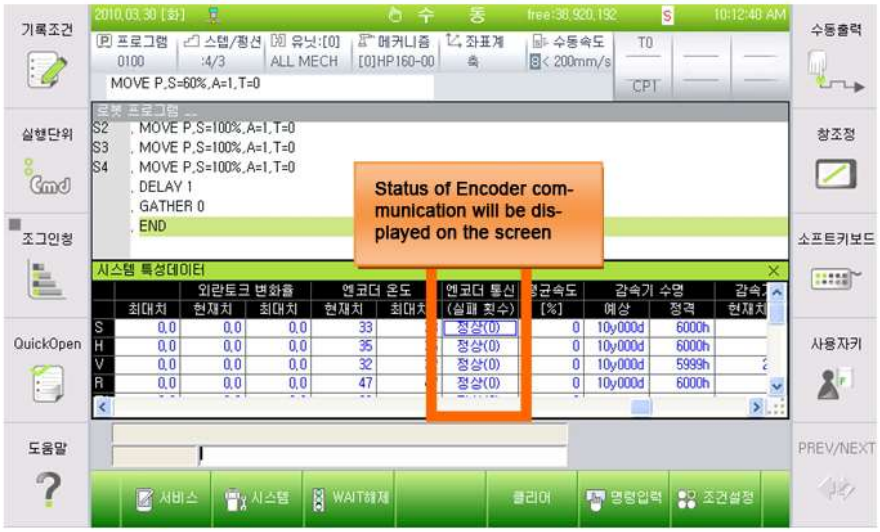
(5) Please examine the communication status of wiring after the repair.

Once actions for the problem are taken, please refer to 『Count of encoder communication failure display function manual』 to check the communication status.



Count of communication failure	Encoder's status	Content
0~2	Normal	Normal status
3~5	Examine required	Wiring, encoder or the board need to be examined
6~8	Warning	Dangerous status. Robot may be immobilized

1.1.24. E0224 (○ Axis) Encoder state error

1.1.24.1. Outline

Servo Board receives data from the encoder periodically through a serial communication in order to perform a Servo control on the motor. This error occurs when the data that received from the encoder is normal, but the result of encoder's self-status check shows an error.

1.1.24.2. Causes and examine methods

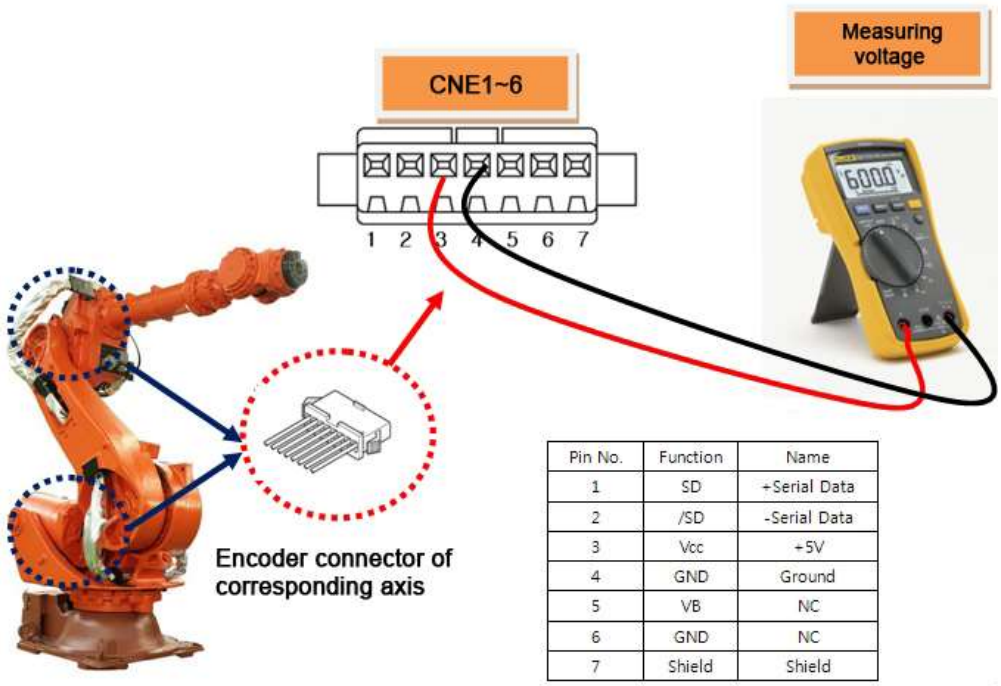
(1) Please check the supply voltage to the Encoder.

(2) Please replace the Motor and test it.

(1) Please check the supply voltage to the Encoder.

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

Please measure the voltage of encoder side's connector-pin (3-4).



Pin No.	Function	Name
1	SD	+Serial Data
2	/SD	-Serial Data
3	Vcc	+5V
4	GND	Ground
5	VB	NC
6	GND	NC
7	Shield	Shield

Figure 1.115 Measuring the encoder voltage

If the measured voltage is lower than the reference voltage, it is required to turn '+5V ADJ(E) voltage adjustment terminal of the encoder power supply to ensure that the connector voltage at the encoder side can be adjusted within the reference voltage.

Figure 1.116 Adjusting the encoder voltage

(2) Replacement of Servo Motor and examine it

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

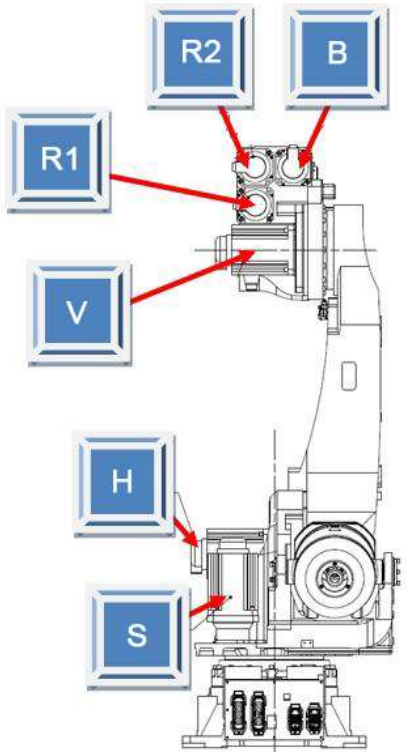


Figure 1.117 Locations of Each Axis's Motor (HS165 Robot)

1.1.25. E02200 Main body limit switch in operation

Previous error code: E0002 Hardware limit switch in operation

1.1.25.1. Outline

Limit switch that is installed at the end of operation area of Robot's each axis has been activated. The Robot will be immobilized immediately for a safety reason and will not be operational until it is moved to a safe operation area by an appropriate method.

1.1.25.2. Causes and examine methods

(1) The robot deviated from the hardware operation area.

(2) Move the robot inside the operation area.
- Methods for recovery when deviating from the operation area

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(1) The robot deviated from the hardware operation area.

Please confirm if the Robot actually went out of operation area. The software limit error may occur while the robot is deviating from the maximum operation area. Please take an appropriate action to move the Robot back into the operation area.

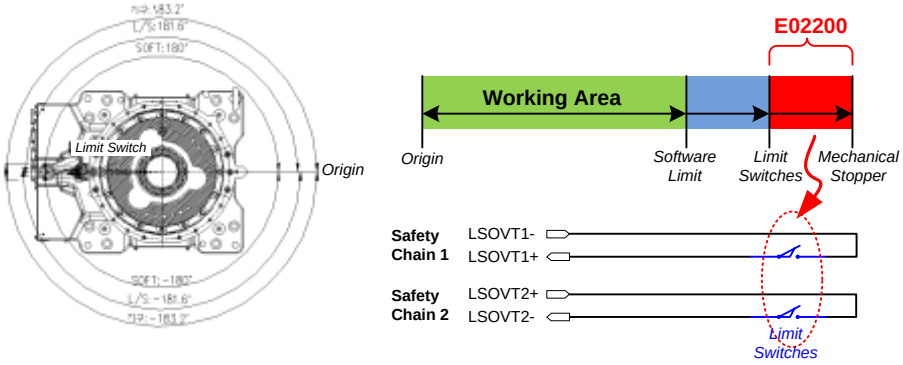

Figure 1.118 E02200 Occurs while the main body limit switch is in operation

Operation area may vary to the each Robot model, so as the installed location of limit switches. Please refer to the corresponding Robot's maintenance manual - "Limitations of Operation area"

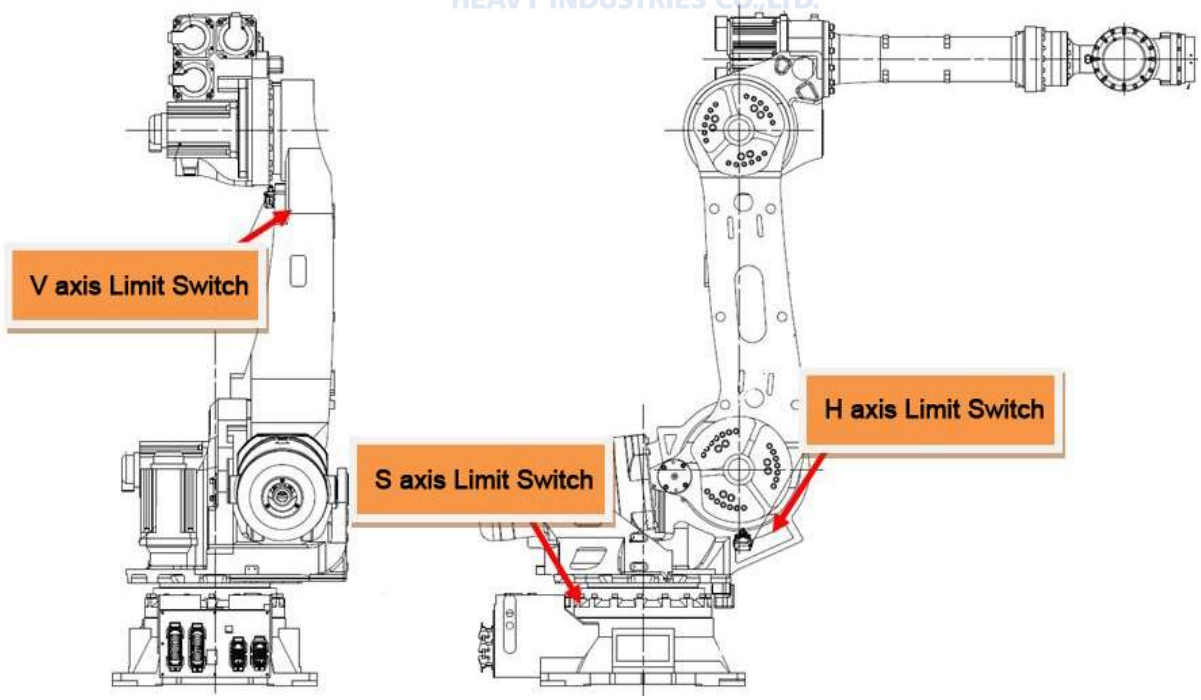

Figure 1.119 Example of the position for installing a hardware limit switch (HS165/HS200)

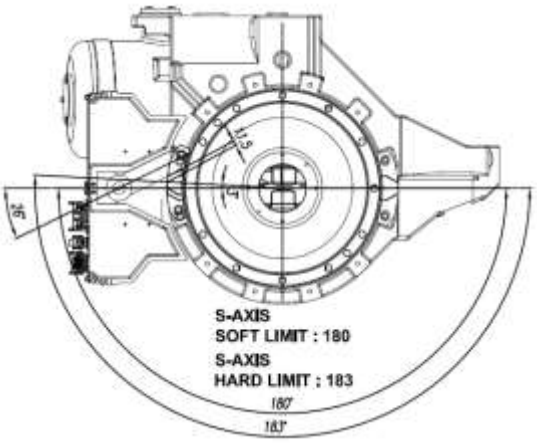

Figure 1.120 Example of the hardware limit switch operation range (HS165/HS200 S axis)

(2) Move the robot inside the operation area.

Move the robot inside the operation area by referring to the following methods for recovery when it has deviated from the operation area.

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

Execution should be carried out according to the following conditions and sequence to move the robot while the hardware limit switch is in operation.

A) Enter from the manual mode to the system mode.
B) Hold the enabling switch in the teach pendant.

C) Turn on the motor in this state.
D) Move the robot into the inside of the operation area using the jog key.

1.1.26. E02201 Main body limit switch input mismatch (safety chain 1 off)

Previous error code: E0002 Hardware limit switch in operation

1.1.26.1. Outline

It is deviating from the software limit area of the robot. However, the input of the limit switch installed at the end of the operation area of each of the axes of the robot is not normal. Checking is required as there is a difference between the inputs of safety chain 1 and safety chain 2.

1.1.26.2. Causes and examine methods

(1) When not deviating from the hardware operation area
- Check the limit switch wiring as there is a problem with safety chain 1.

(2) When deviating from the hardware operation area
- Check the limit switch wiring as there is a problem with safety chain 2.

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(1) When not deviating from the hardware operation area

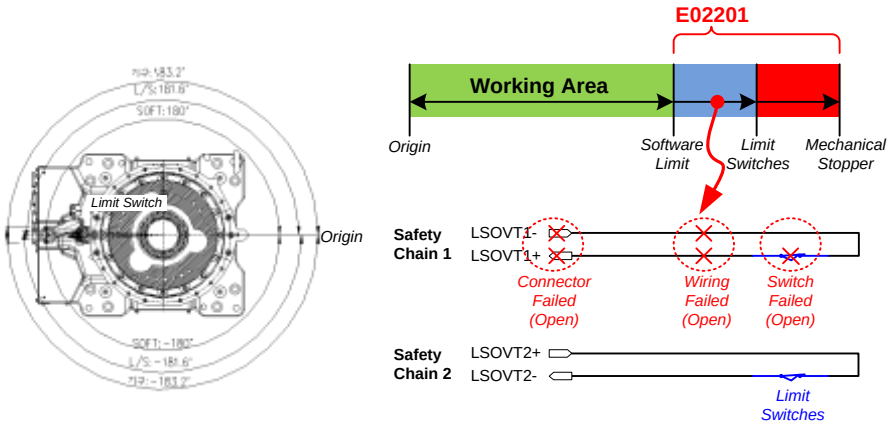

Figure 1.121 E02201 Main body limit switch input mismatch (safety chain 1 off) – inside the hardware operation area

Check the limit switch wiring as there is a problem with safety chain 1.

Even though the robot is inside the hardware limit switch installation area, safety chain 1 is monitored as off. This may be caused by the following reasons.

- Fault with the hardware limit switch: Opened due to some reasons such as damage to the switch.
- Wiring: Defective contact due to the disconnection of or damage to the wiring.
- Connector: Disconnection due to defective contact following the connector being loosened or damaged.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

(2) When deviating from the hardware operation area

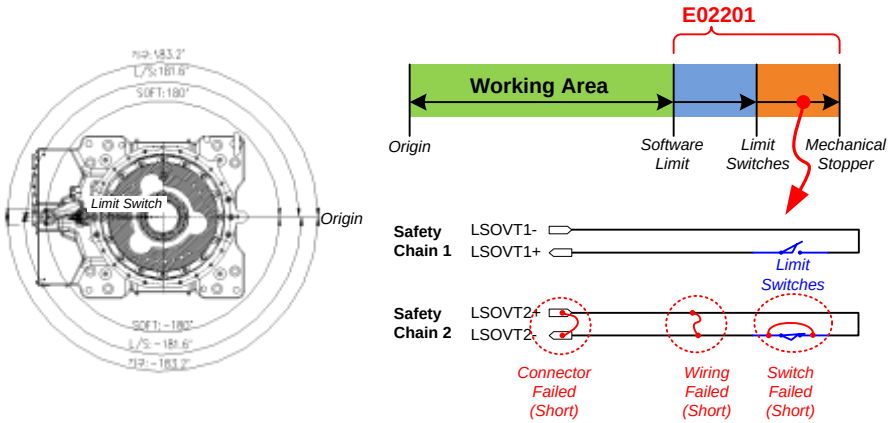

Figure 1.122 E02201 Main body limit switch input mismatch (safety chain 1 off) – inside the hardware operation area

Check the limit switch wiring as there is a problem with safety chain 2.

Even though the robot deviated from the hardware limit switch installation area, safety chain 2 is not capable of detecting the abnormality. In other words, safety chain 2 continues to stay in the closed state.

- Fault with the hardware limit switch: Short-circuited due to some reasons such as damage to the switch.
- Wiring: Short-circuiting of two lines of a pair of wirings.
- Connector: Short-circuiting between pins due to damage to the connector.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

1.1.27. E02202 Main body limit switch input mismatch (safety chain 2 off)

Previous error code: E0002 Hardware limit switch in operation

1.1.27.1. Outline

It is deviating from the software limit area of the robot. However, the input of the limit switch installed at the end of the operation area of each of the axes of the robot is not normal. Checking is required as there is a difference between the inputs of safety chain 1 and safety chain 2.

1.1.27.2. Causes and examine methods

(1) When not deviating from the hardware operation area
- Check the limit switch wiring as there is a problem with safety chain 2.

(2) When deviating from the hardware operation area
- Check the limit switch wiring as there is a problem with safety chain 1.

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(1) When not deviating from the hardware operation area

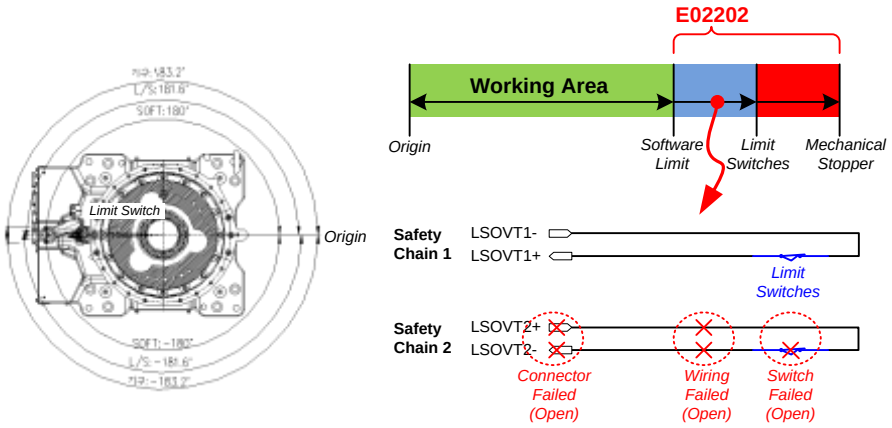


Figure 1.123 E02202 Main body limit switch input mismatch (safety chain 2 off) – inside the hardware operation area

Check the limit switch wiring as there is a problem with safety chain 2.

Even though the robot is inside the hardware limit switch installation area, safety chain 2 is monitored as off. This may be caused by the following reasons.

- Fault with the hardware limit switch: Opened due to some reasons such as damage to the switch.
- Wiring: Defective contact due to the disconnection of or damage to the wiring.
- Connector: Disconnection due to defective contact following the connector being loosened or damaged.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

(2) When deviating from the hardware operation area

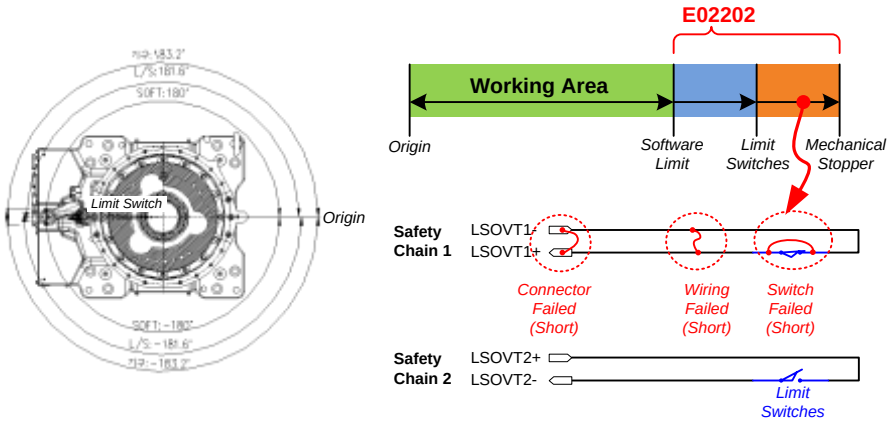


Figure 1.124 E02202 Main body limit switch input mismatch (safety chain 2 off) – outside the hardware operation area

Check the limit switch wiring as there is a problem with safety chain 1.

Even though the robot deviated from the hardware limit switch installation area, safety chain 1 is not capable of detecting the abnormality. In other words, safety chain 2 continues to stay in the closed state. This may be caused by the following reasons.

- Fault with the hardware limit switch: Short-circuited due to some reasons such as damage to the switch.
- Wiring: Short-circuiting of two lines of a pair of wirings.
- Connector: Short-circuiting between pins due to damage to the connector.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

1.1.28. E02206 Main body limit switch disconnected or not connected

Previous error code: E0002 Hardware limit switch in operation

1.1.28.1. Outline

Even though the robot does not deviate from the hardware limit area, it is inputted that the limit switch installed at the end of the operation area of each of the axes of the robot is in operation. As this is an abnormal situation, check the limit switch wiring

1.1.28.2. Causes and examine methods

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded.

Check as there is a problem with the switch or the wiring system.

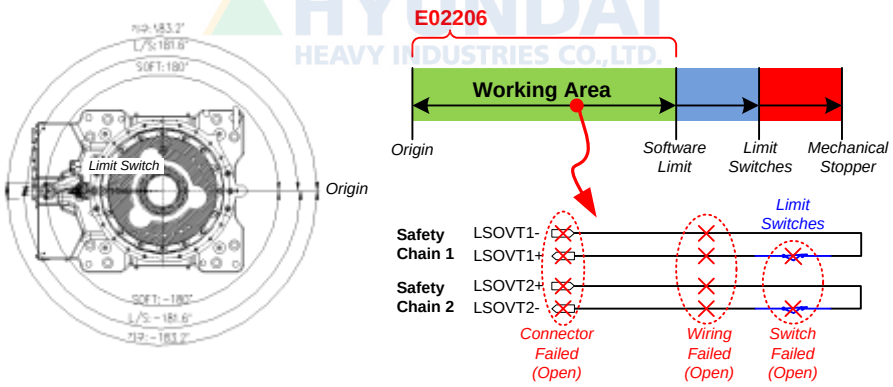


Figure 1.125 E02206 Main body limit switch disconnected or not connected

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded. Check as there is a problem with the switch or the wiring system.

- Fault with the hardware limit switch: Opened due to some reasons such as damage to the switch.
- Wiring: Defective contact due to the disconnection of or damage to the wiring.
- Connector: Disconnection due to defective contact following the connector being loosened or damaged.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

1.1.29. E02207 Main body limit switch input mismatch (safety chain 1 off)

Previous error code: E0002 Hardware limit switch in operation

1.1.29.1. Outline

Even though the robot does not deviate from the hardware limit area, it is inputted that the limit switch installed at the end of the operation area of each of the axes of the robot is in operation. However, checking is required as there is a difference between the input states of safety chain 1 and safety chain 2.

1.1.29.2. Causes and examine methods

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded.

Check as there is a problem with the switch or the wiring system.

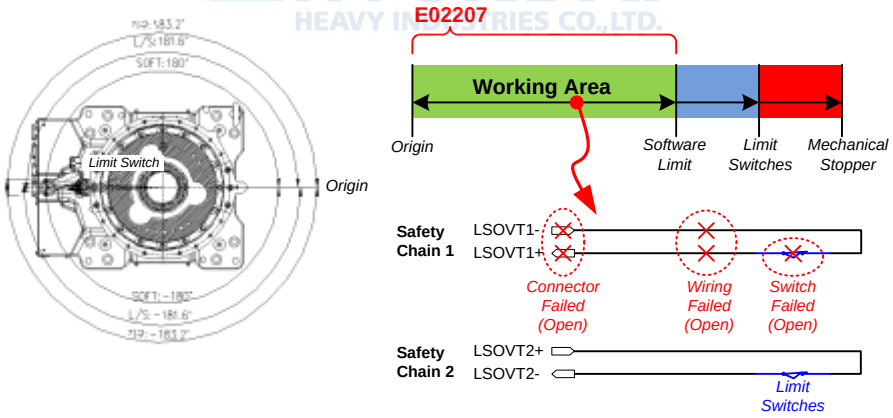


Figure 1.126 E02207 Main body limit switch input mismatch (safety chain 1 off)

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded. The problem occurred due to the opening of safety chain 1. Check the related switches or wiring systems.

- Fault with the hardware limit switch: Opened due to some reasons such as damage to the switch.
- Wiring: Defective contact due to the disconnection of or damage to the wiring.
- Connector: Disconnection due to defective contact following the connector being loosened or damaged.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

1.1.30. E02208 Main body limit switch input mismatch (safety chain 2 off)

Previous error code: E0002 Hardware limit switch in operation

1.1.30.1. Outline

Even though the robot does not deviate from the hardware limit area, it is inputted that the limit switch installed at the end of the operation area of each of the axes of the robot is in operation. However, checking is required as there is a difference between the input states of safety chain 1 and safety chain 2.

1.1.30.2. Causes and examine methods

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded.

Check as there is a problem with the switch or the wiring system.

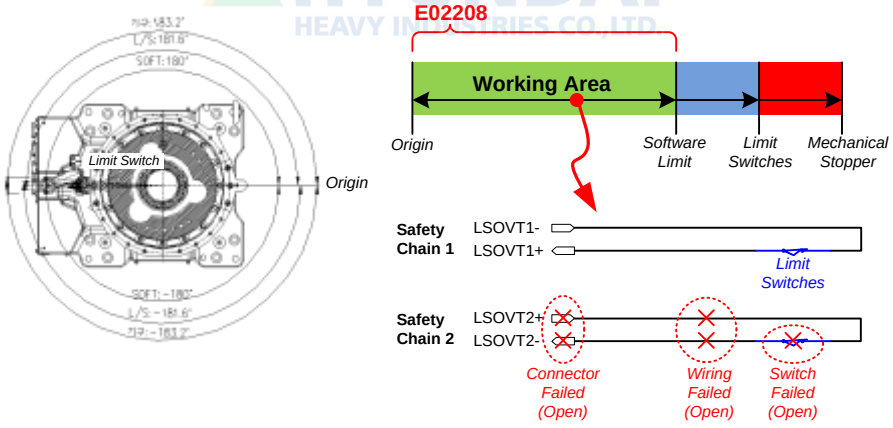


Figure 1.127 E02208 Main body limit switch input mismatch (safety chain 2 off)

This is an abnormal situation in which the hardware limit switch operation is detected even if the software limit is not exceeded. The problem occurred due to the opening of safety chain 2. Check the related switches or wiring systems.

- Fault with the hardware limit switch: Opened due to some reasons such as damage to the switch.
- Wiring: Defective contact due to the disconnection of or damage to the wiring.
- Connector: Disconnection due to defective contact following the connector being loosened or damaged.

For more details about checking, refer to “Hardware Limit Switch Checking Methods.”

1.1.31. Methods for checking the hardware limit switch (when E02201–E02208 occurs)

Refer to the following description regarding the methods for checking when the hardware limit is not operating normally.

(1) Switch state monitoring

The hardware limit input state can be checked through the specific input signal window of the teach pendant.
This window can be accessed by selecting "『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/output Signal』 → 『1: Private input signal』"
If the limit (overtravel) item is displayed in yellow, it means that the hardware limit switch is in operation (open); in other words, the robot deviated from the hardware operation area..

- Cautions:
  On manual mode, a monitoring is enabled only when a Teach Pendant's enabling switch is on. On automatic mode, a monitoring is enabled regardless of a status of enabling switch.

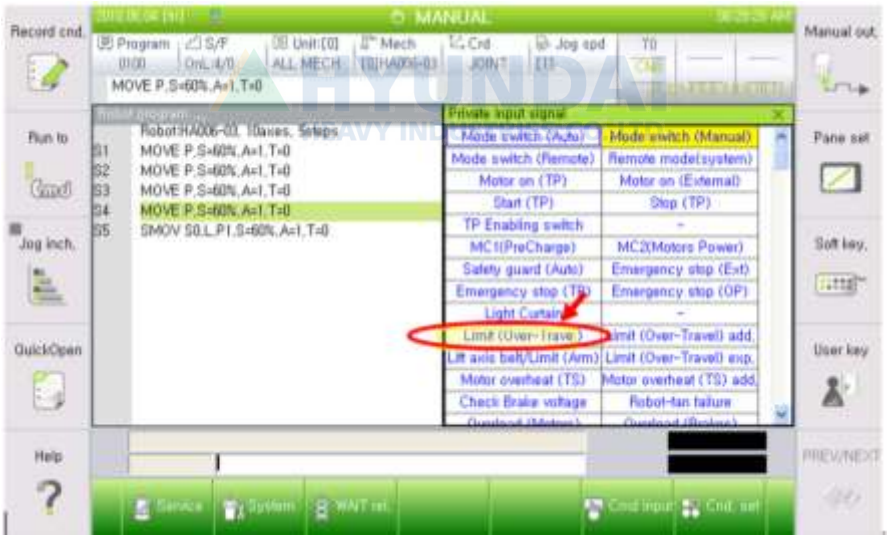


Figure 1.128 Display of the hardware limit switch input state (screen of the teach pendant)

(2) Wiring structure of the hardware limit switch

Understanding the wiring structure is required to find out the cause among the components related to the limit switch. As shown in the following figure, the limit switch is connected from the limit switch inside the mechanical main body, through a cable, to the system board inside the controller.

- Limit switch and mechanical main body wiring
- Wire harness and connectors (CER1 – CEC1)
- Controller internal wiring and connectors (CEC1 – CNLS)
- System board (BD530)

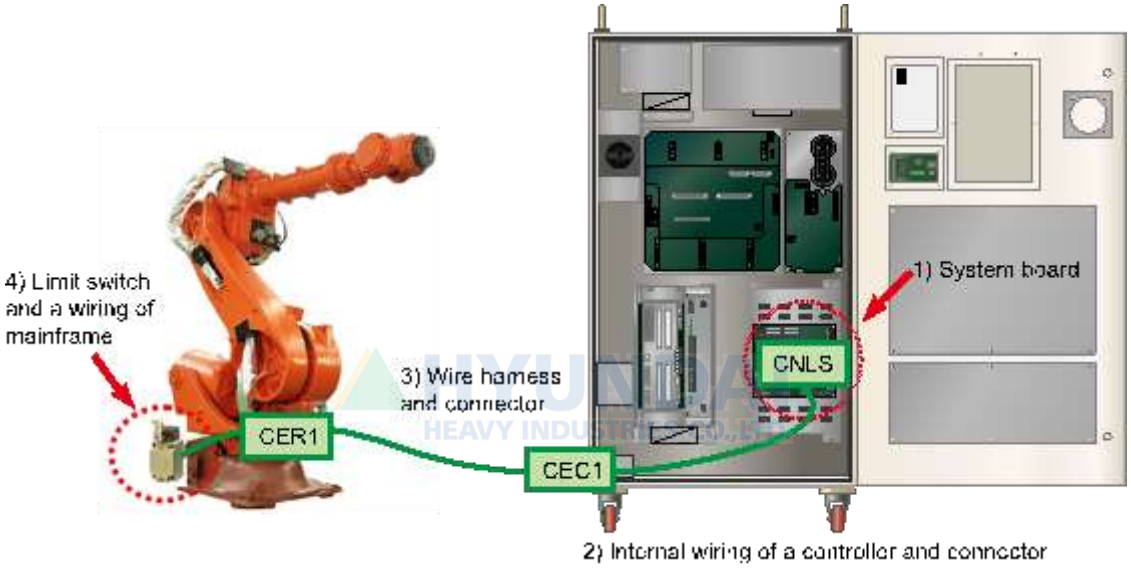


Figure 1.129 Wiring structure of the hardware limit switch

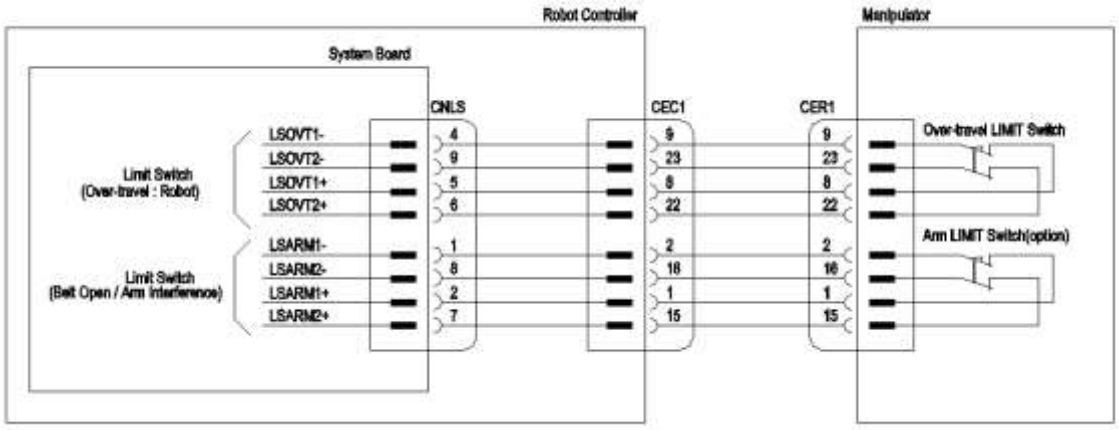


Figure 1.130 Details of the hardware limit switch wiring

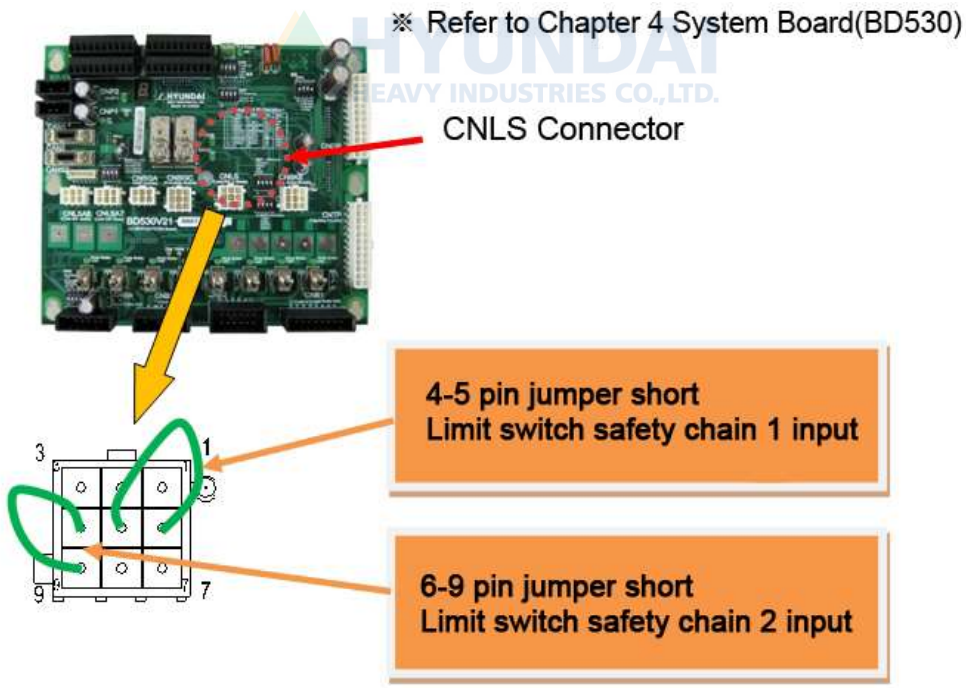
(3) Methods for checking the hardware limit switch

■ **Checking method from a System Board Connector (CNLS)**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages

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

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



■ **Checking method from a Wire Harness (CER1 or CEC1)**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages

This method uses a Wire Harness connector (CER1 or CEC1) to judge if the cable malfunction caused this error.
Please remove CEC1 Wire Harness, and jumper short the pins that are related to the limit switch from a CEC1 connector which is attached to a controller. At this stage, please check the limit (Over-Travel) from the Private input signal monitoring windows.

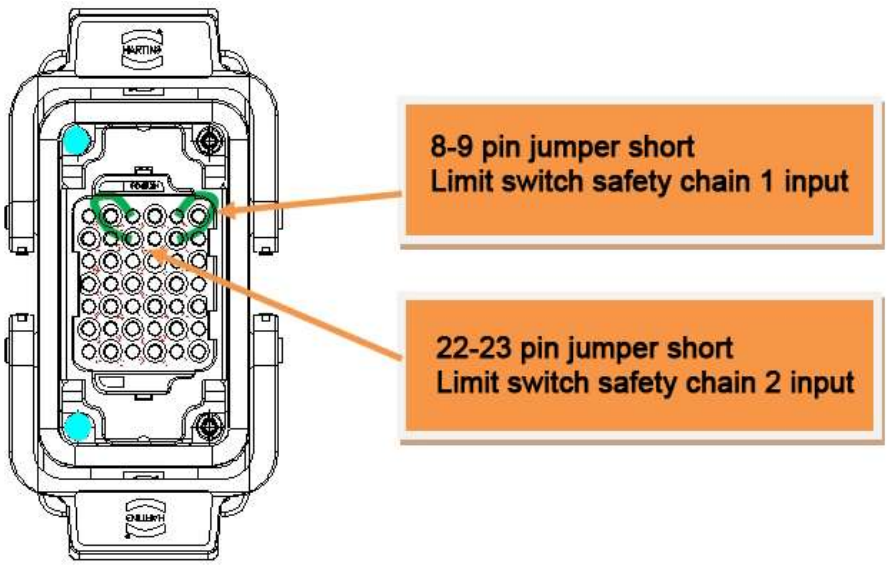
① If it turned to a white color, internal CEC1 Connector (of a controller) - System Board cable or a connector malfunction caused this error. Please examine them or replace them.

② If it is still yellow which indicates that the error persists, please search a problem that caused this error in an area between the CEC1 connector and the limit switch of main frame.

Please reconnect CEC1 Wire Harness, and remove the CER1 Wire Harness from a main frame. After that, please jumper short the pins that are related to a limit switch from a CER1 connector.
At this stage, please check a limit (Over-Travel) from the Private input signal monitoring windows.

① If it turned to a white color, Wire Harness cable between CER1 Connector-CEC1 Connector or a connector malfunction caused this error. Please examine them or replace them.

② If it is still yellow which indicates that the error persists, please search a problem that caused this error in an area between the mainframe sides's CER1 connector and the limit switch.



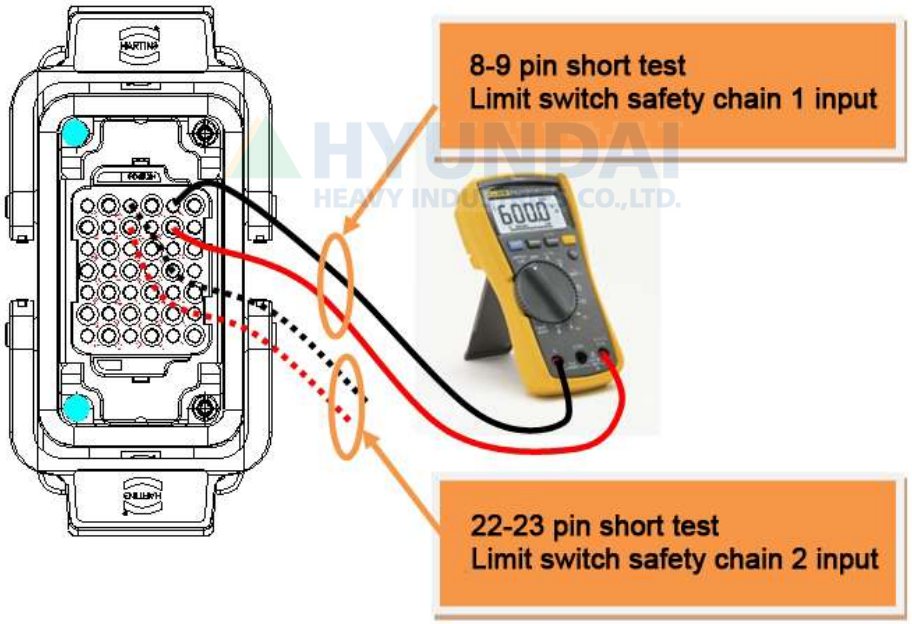
■ **Checking method by examining a limit switch and internal wiring of main frame**

Warning
Please make sure the power of a controller has been completely turned off before you connect or remove any cables. Electrocution may cause personal injuries or a property damages.

Please remove the CER1 Wire Harness from a main frame, and use a multi meter to run a short (shortage) test to examine the lines that are related to the limit switch from a main frame's CER1 connector.

① If resistance is measures as open status, limit switch or a limit switch – CER1 connector or a connector malfunction is suspected. Please examine or replace them.

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



1.1.32. E02340 Elevator shaft belt sensor working (E02340 ~ E02348)

Previous error code: E0044 Lift axis belt disconnect sensor is operating

1.1.32.1. Outline

A sensor that is installed on an axis (one of Robot's operating axis) which transfers the power to the belt is determining whether the belt exists or not. This error will occur, if a belt does not exist in the detection range of the sensor as the belt is broken.
This error also can be caused by an abnormal connection between the sensor and the board that is installed on a controller.

1.1.32.2. Causes and examine methods

(1) Please check the status of the error.
- Please check the Private input signal monitoring window.
- Please check the status of BD58B board's relay operation.

<Error status on monitoring window, but replay is normal(ON)>

(2) Please examine the components that are related to the error detection.
- Please replace CNSGC cable and examine it CNSGC.
- Please replace BD530/BD531 board and examine it.

<Error status on monitoring window, and replay is abnormal(OFF)>

(3) Please examine the Robot.
- Please check the status of belt in the Robot's drive unit.
- Please check the operation of the sensor that detects the broken belt.

(1) Please check the status of the error.

- Check the Private input signal from the monitoring window of TP510
  Firstly, check if the Lift axis belt/Limit (Arm) is being input. This window can be accessed from 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/output signal』 → 『1: Private input signal』. If the Lift axis belt/Limit (Arm) is highlighted in yellow, it indicates an error status.

Figure 1.131 Checking the Lift axis belt from Private input signal

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- Checking the status of BD58B board's relay operation
  Proximity sensor that attached at the Robot's operation part detects a break based on the light reflection from surface of the belt and transmits the ON/OFF signal to the controller. The received signal will be transferred to BD58B board for the fall prevention brake system and as well as to the BD530 (the System Board). Please check the sensor's operation status based on the relay operation status of BD58B board.

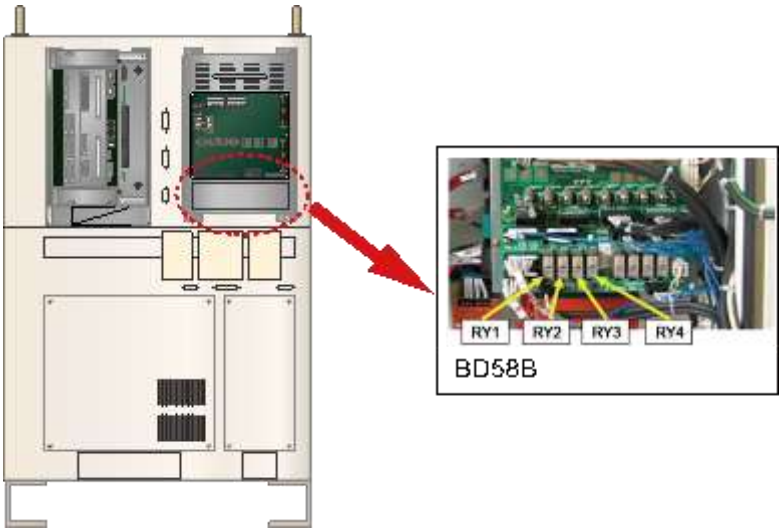


Figure 1.132 Checking the Relay Status of BD58B Board

Relay operation status of BD58B board can be checked as below diagram. Normal status relay operates the coil and can see the empty space at the center.

Figure 1.133 Comparing the Normal and Error Status of BD58B Board's Relay

You may confirm which (in the Robot) axis's detection sensor is operating based on the status of BD58B board's relay operation.

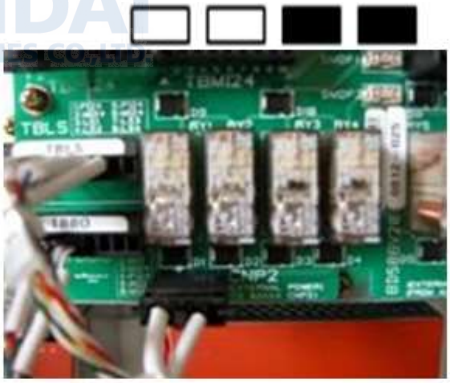
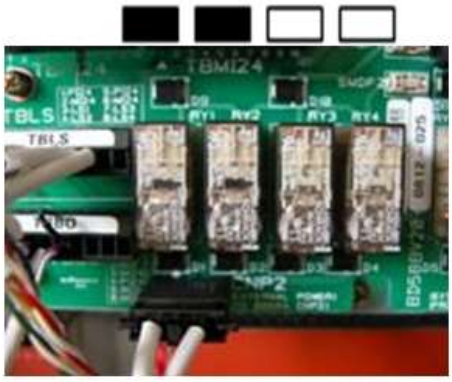
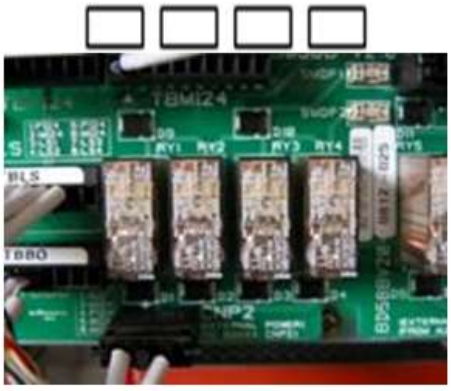
① Normal	② Z1 sensor is off (Z1 axis is broken)
	
③ Z2 sensor is off (Z2 axis is broken)	④ Both Z1/Z2 sensor are off (Z1/Z2 axis are broken)
	

Figure 1.134 Checking the Location of Error Based on BD58B Board's Relay

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

If the Private input signal from the monitoring window and the relay status of BD58B board are different, CNLS cable that connects the BS58B and BD530/BD531, or the BD530/BD531 is faulty. Please refer to the compositions of controller from the manual and examine the each component.

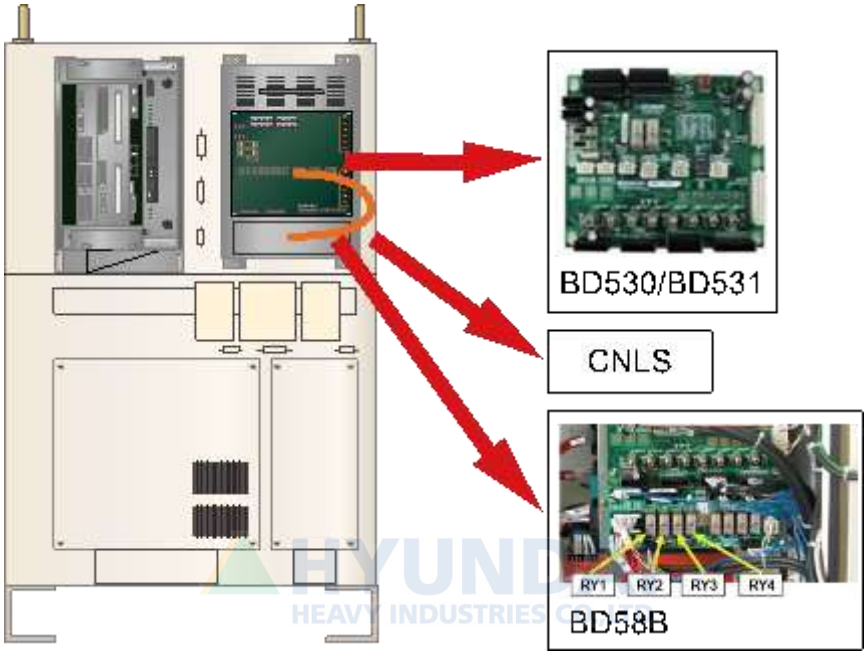


Figure 1.135 Replacing the parts related to the error detection

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

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

Figure 1.136 Replacement of BD530/BD531

(3) Please examine the Robot

If the Private input signal from the monitoring window and the status of BD58B board's relay, BD58B actually acknowledged the error operation of the sensor. Robot's belt and detection sensor must to be checked. Please remove the CNZB1 and CNBZ2 connector of BB58B board in order to prevent a fall of lift axis that may caused by sensor malfunction during the examination of Robot.

Warning

Make sure the CNZB1 and CNBZ2 connectors of BD58B are removed while examining the Robot's belt and break detection sensors in order to prevent the fall of list axis.

- Check the belt's status of Robot's operation part

  Please check the belt of the axis that confirmed by a status of BD58B relay from the Robot. Applicability and location of the belt may be different to each Robot's model. Please check the status of belt according to the Robot's specification and maintenance manual.

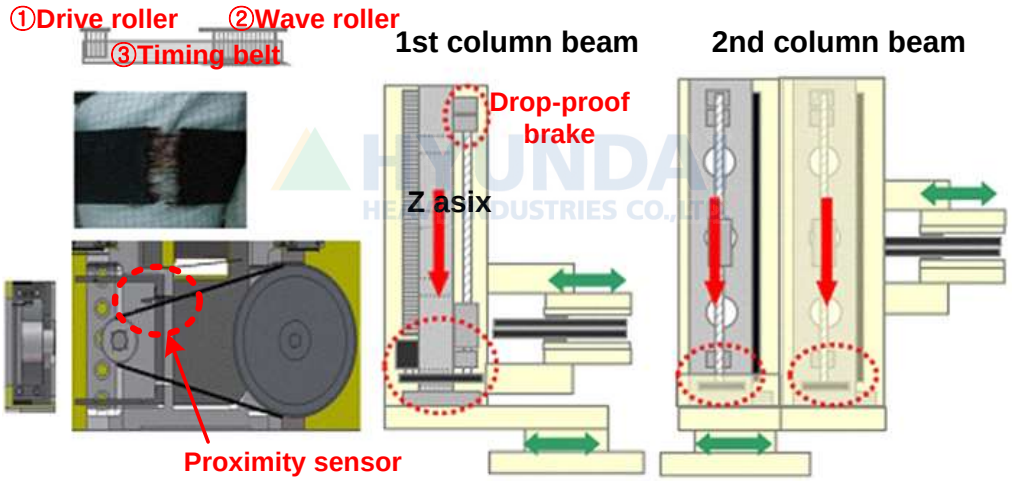


Figure 1.137 Lift Axis Belt and the Break Detection Sensor

- Checking the operation of belt break detection sensor

  Detection sensor is an optical type and it can only detect when the object is within a certain distance. If the object if out of the distance, it will process an error. Please change the distance to the object at the front of detection sensor and check the status of TP511's Private input signal. If the sensor's operation and the result of monitoring do not match, please check the connection of signal line between the sensor and the TBBO terminal block (inside of BD58B board) in the Robot. Sensor's LED green indicates normal status and red indicates error status.

1.1.33. E02450 (○ axis) Encoder not replying to the request

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.33.1. Outline

Servo Board receives data from the encoder periodically through a serial communication in order to perform a Servo control on the motor. This error occurs if the received data from the encoder violates the communication protocol.

This error may occur due to a fault of components that received the data from the encoder, or the problems in an encoder shield lines or the wiring.

1.1.33.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder

(2) Check the encoder wiring

(3) Please replace the Servo Board and test it

(4) Please replace the motor(encoder) and test it.

(5) Please examine the communication status of wiring after the repair

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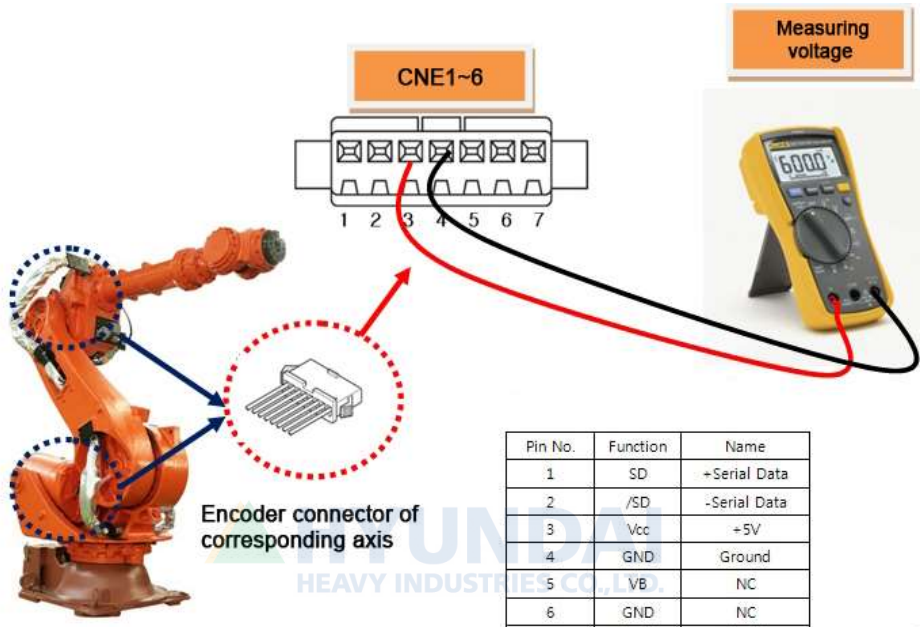
(1) Please check the supply voltage to the Encoder.

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

Please measure the voltage of encoder side's connector-pin (3-4).



Pin No.	Function	Name
1	SD	+Serial Data
2	/SD	-Serial Data
3	Vcc	+5V
4	GND	Ground
5	VB	NC
6	GND	NC
7	Shield	Shield

If the measured voltage is lower than the reference voltage, it is required to turn '+5V ADJ(E) voltage adjustment terminal of the encoder power supply to ensure that the connector voltage at the encoder side can be adjusted within the reference voltage.

(2) Check the encoder wiring.

Encoder's wiring examination orders are as below.

Firstly, examine the loose contact of the connectors that are related to the Encoder's wiring.

Secondly, examine the short-circuit of encoder's wiring. Please use equipment such as the multi meter (tester) and examine each phase's wiring one by one.

Thirdly, replace the encoder's wiring and test it.

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

■ Please examine the internal wiring of the Controller
Please examine the wiring between the CNEC1, 2 (DB544) connector and the CEC1.

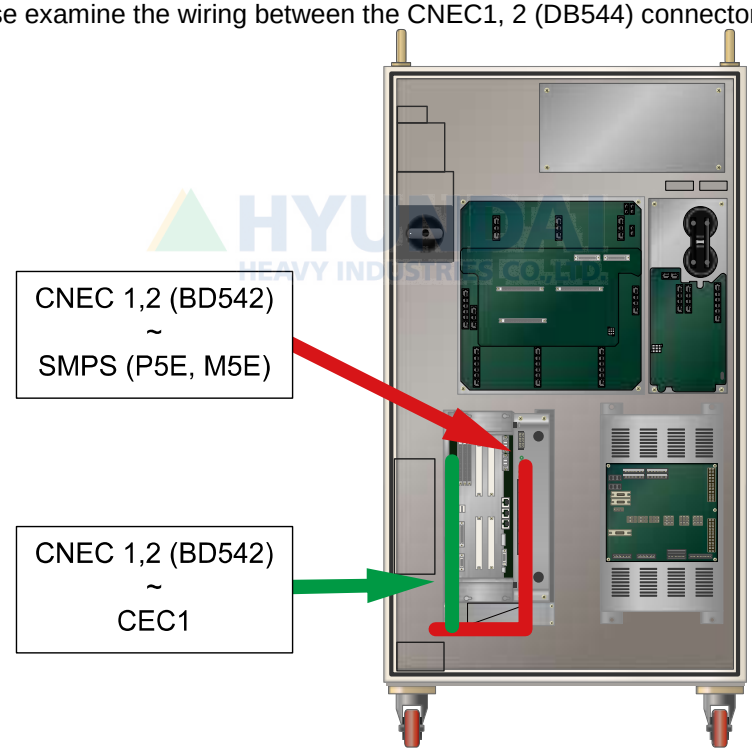


Figure 1.138 Checking the encoder wiring

■ Please examine the wiring between the Controller and the Robot.
Please examine the wiring between the CNEC1 and the CER1.

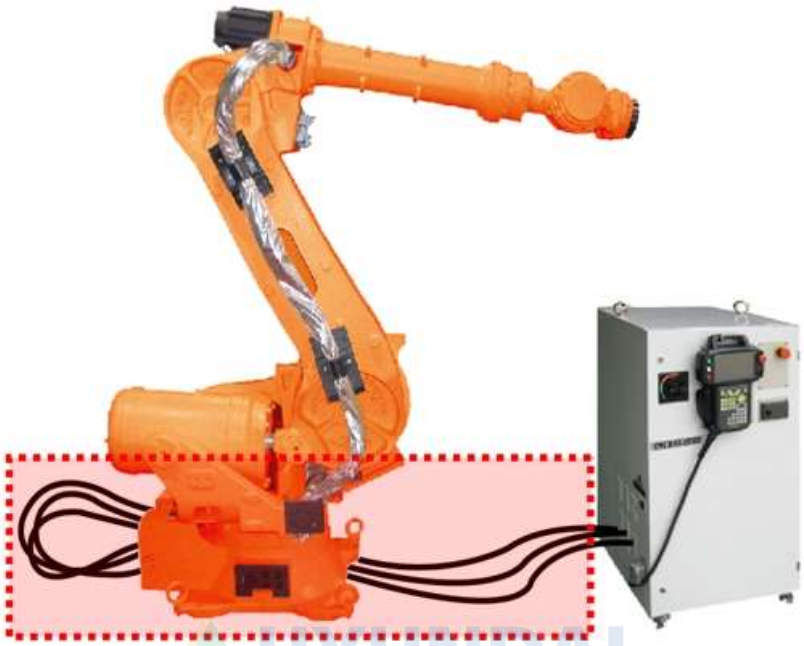


Figure 1.139 Basic Installation Diagram of the Robot and Control Period

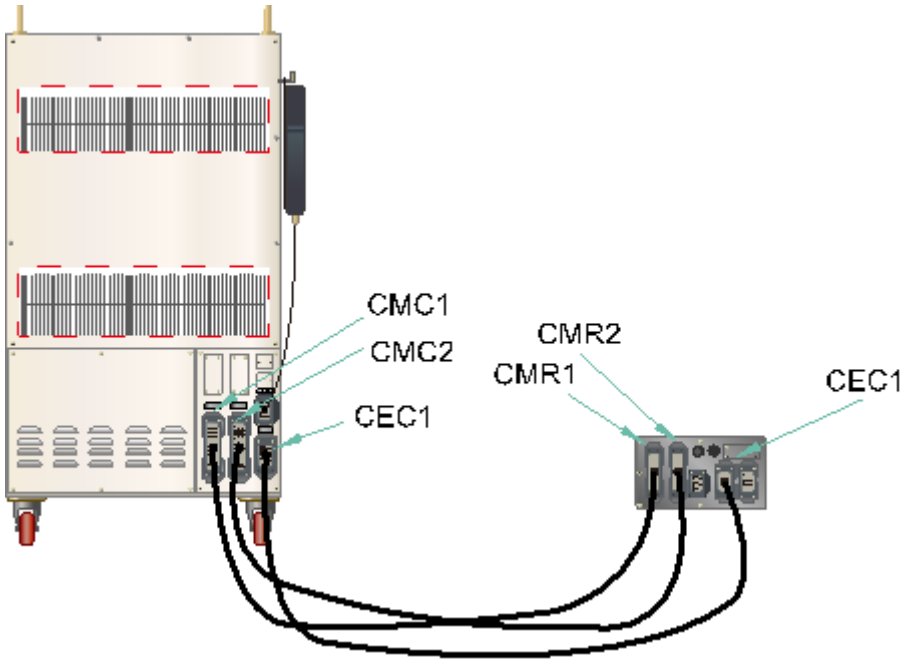


Figure 1.140 Connection between the Robot's manipulator and the Controller

- Please examine the wiring of the mainframe.
  Please examine the wring between the CER1 and CNE1~6 (Encoder side's connector).
  Please refer to the wiring diagram of Robot's maintenance manual.

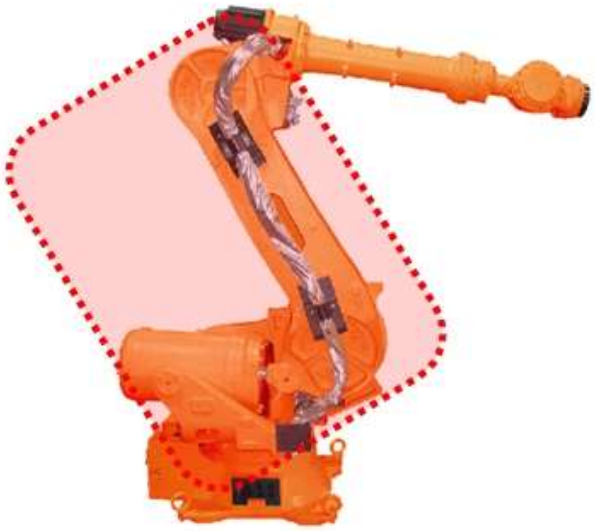


Figure 1.141 Robot's Internal Wiring

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(3) Please replace the Servo Board and test it.

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

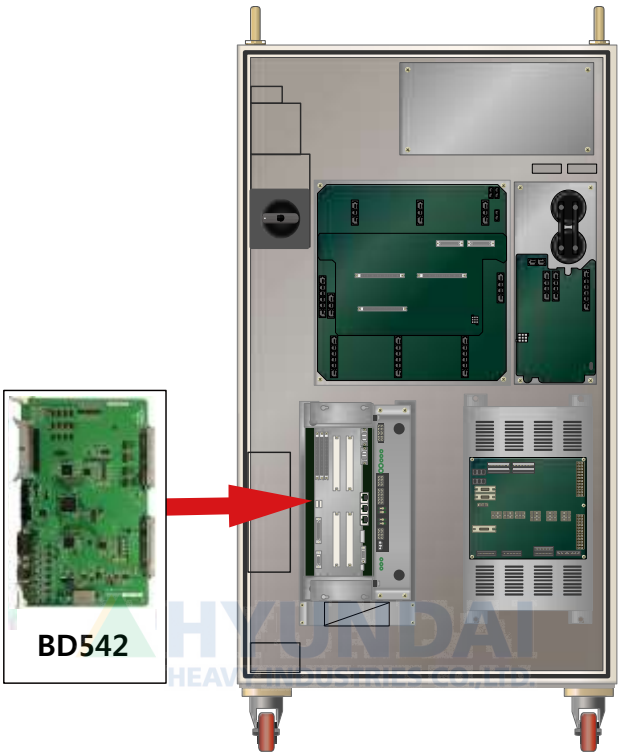


Figure 1.142 Replacing the servo board

(4) Please replace the motor(encoder) and test it.

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

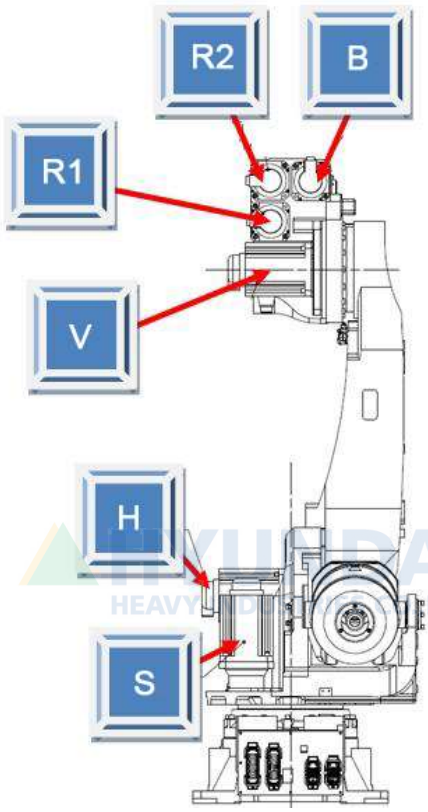
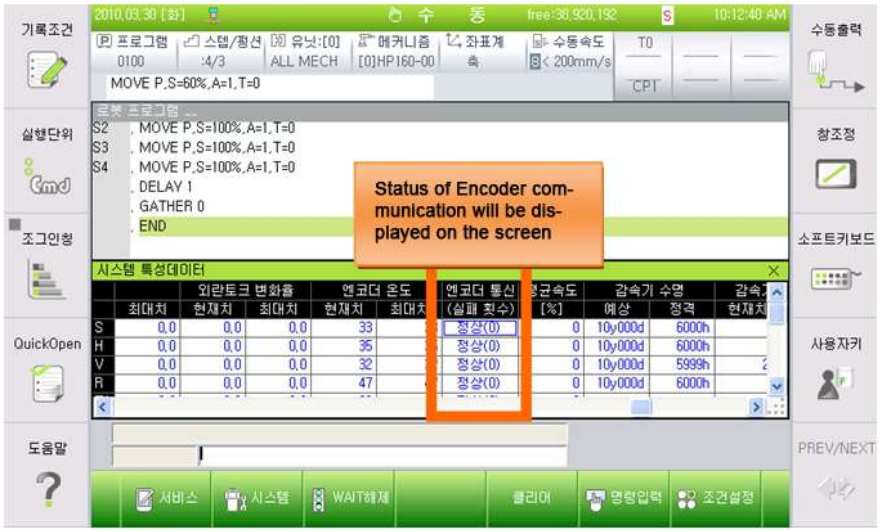


Figure 1.143 Locations of Each Axis's Motor (HS165 Robot).

(5) Please examine the communication status of wiring after the repair.

Once actions for the problem are taken, please refer to 『Count of encoder communication failure display function manual』 to check the communication status.



Count of communication failure	Encoder's status	Content
0~2	Normal	Normal status
3~5	Examine required	Wiring, encoder or the board need to be examined
6~8	Warning	Dangerous status. Robot may be immobilized

1.1.34. E02451 (○ axis) Count of data received from the encoder not normal

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.34.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs because there is a communication failure and the count of the data received from the encoder violates the regulated value.

Mismatch in the count of the data received from the encoder could occur mainly because of a problem with the treatment of the wiring or the encoder shield line, causing the inflow of noise in the encoder signal line.

1.1.34.2. Causes and examine methods

(1) Check the encoder wiring

(2) Please replace the motor(encoder) and test it.

(3) Please replace the Servo Board and test it

(4) Please examine the communication status of wiring after the repair

(1) Check the encoder wiring.

Encoder's wiring examination orders are as below.

Firstly, examine the loose contact of the connectors that are related to the Encoder's wiring.

Secondly, examine the short-circuit of encoder's wiring. Please use equipment such as the multi meter (tester) and examine each phase's wiring one by one.

Thirdly, replace the encoder's wiring and test it.

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

- Please examine the internal wiring of the Controller
  Please examine the wiring between the CNEC1, 2 (DB542) connector and the CEC1.

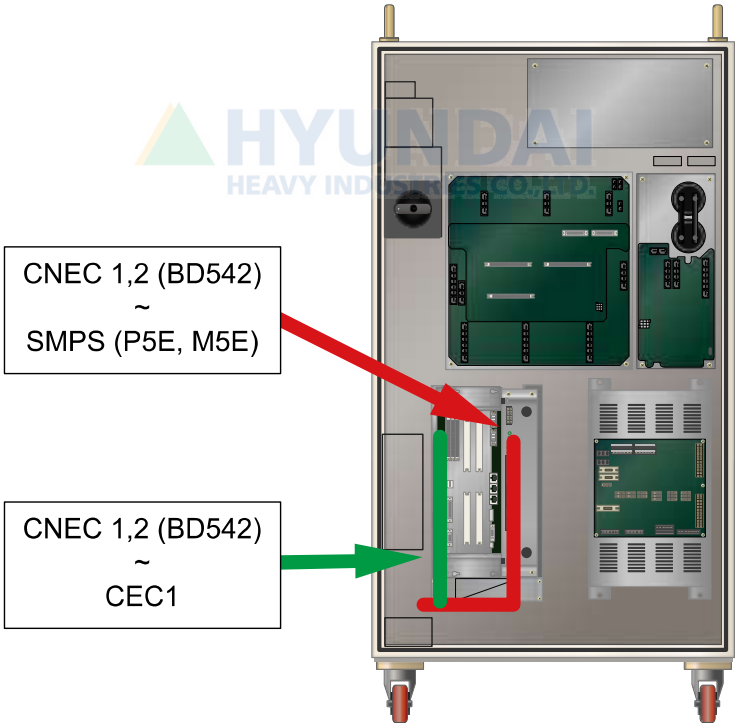


Figure 1.144 Checking the encoder wiring

■ Please examine the wiring between the Controller and the Robot.
Please examine the wiring between the CNEC1 and the CER1.

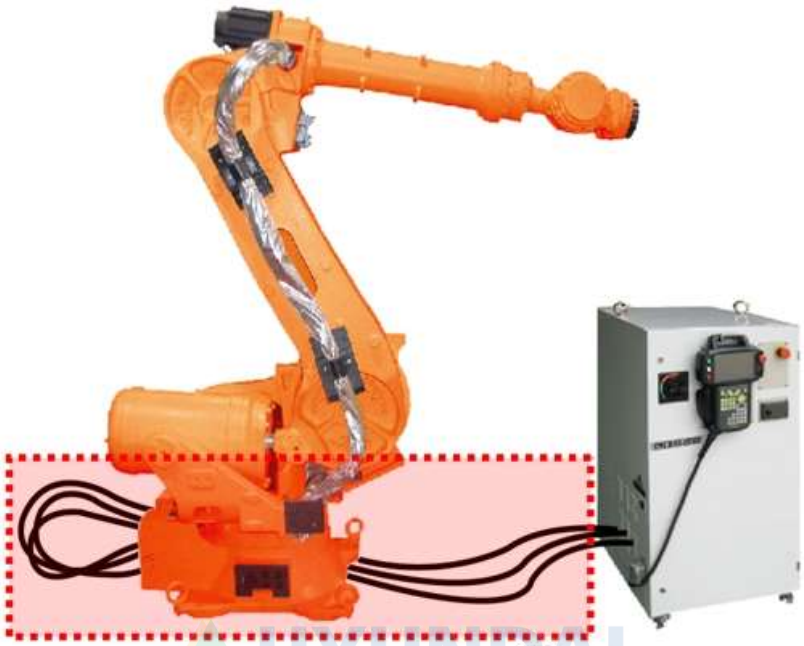


Figure 1.145 Basic Installation Diagram of the Robot and Control Period

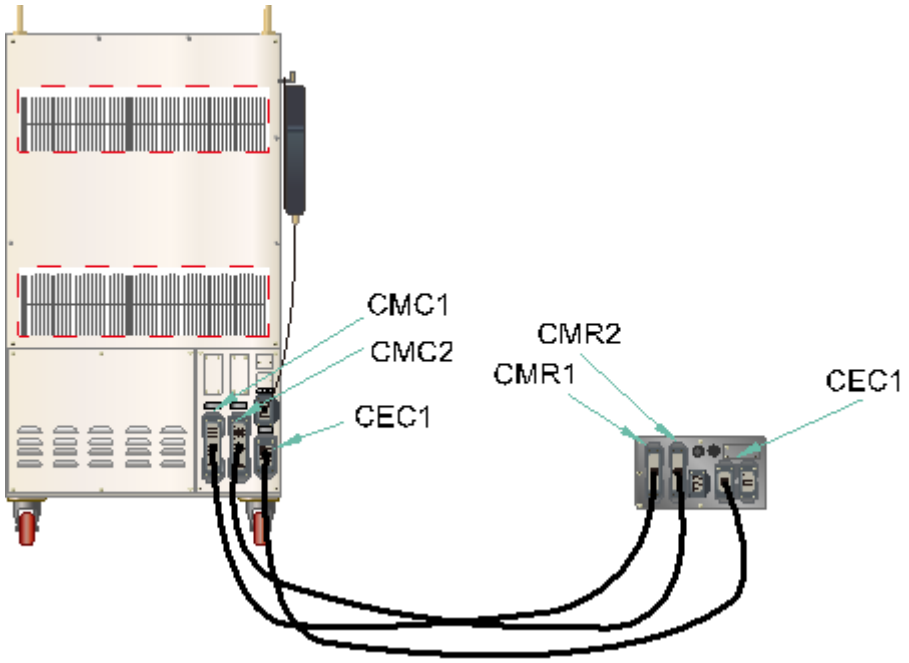


Figure 1.146 Connection between the Robot's manipulator and the Controller

- Please examine the wiring of the mainframe.
  Please examine the wring between the CER1 and CNE1~6 (Encoder side's connector).
  Please refer to the wiring diagram of Robot's maintenance manual.

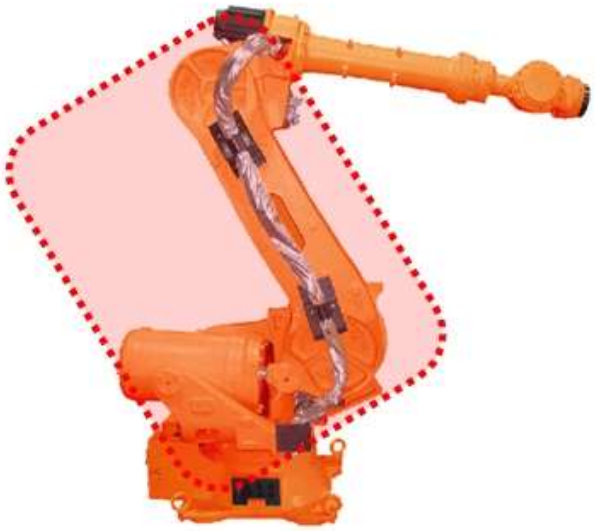


Figure 1.147 Robot's Internal Wiring

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(2) Please replace the motor(encoder) and test it.

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

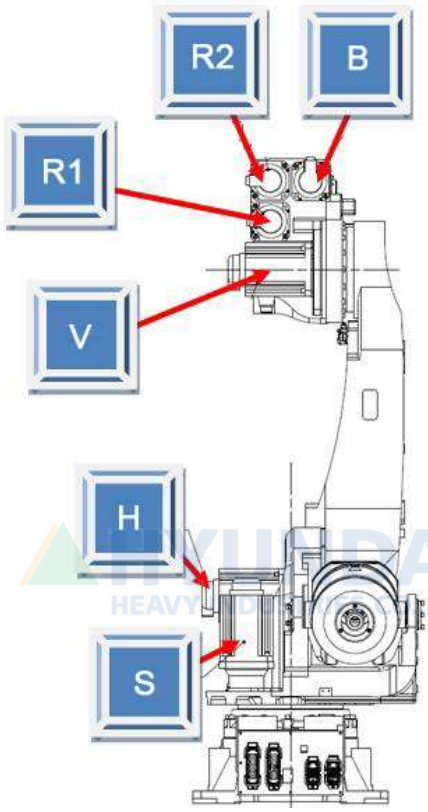


Figure 1.148 Locations of Each Axis's Motor (HS165 Robot)

(3) Please replace the Servo Board and test it.

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

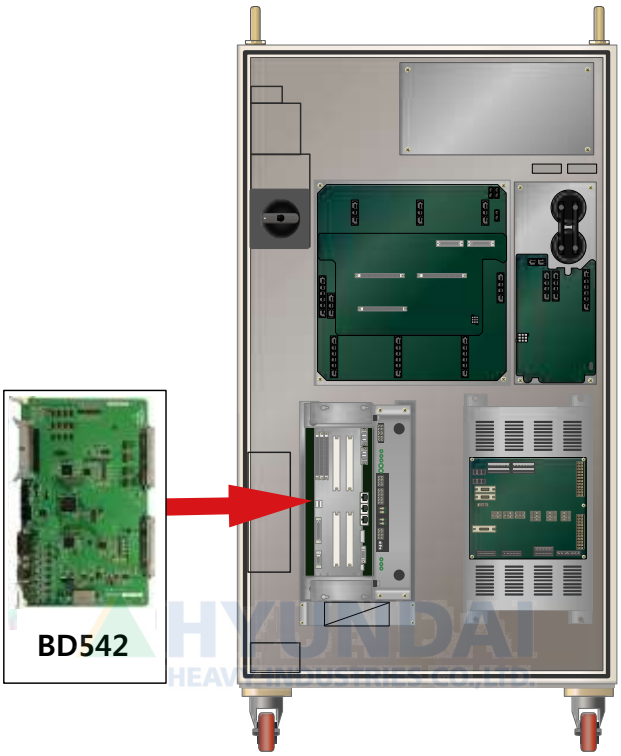
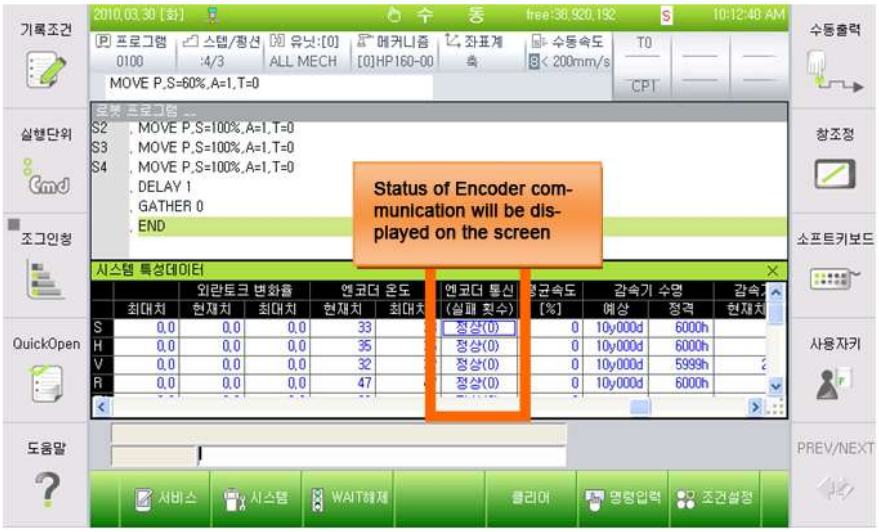


Figure 1.149 Replacing the servo board

(4) Please examine the communication status of wiring after the repair.

Once actions for the problem are taken, please refer to 『Count of encoder communication failure display function manual』 to check the communication status.



Count of communication failure	Encoder's status	Content
0~2	Normal	Normal status
3~5	Examine required	Wiring, encoder or the board need to be examined
6~8	Warning	Dangerous status. Robot may be immobilized

1.1.35. E02452 (○ axis) Encoder data end signal not received

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.35.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs because there is a communication error and the end signal of the data received from the encoder is not received.

If the end signal of the data received from the encoder is not received, it could occur mainly because of a problem with the treatment of the wiring or the encoder shield line, causing the inflow of noise in the encoder signal line.

1.1.35.2. Causes and examine methods

(1) Check the encoder wiring

(2) Please replace the motor(encoder) and test it.

(3) Please replace the Servo Board and test it

(4) Please examine the communication status of wiring after the repair

For more details about the checking methods, refer to "**E02450 (○ axis) Encoder not replying to the request**."

1.1.36. E02453 (○ axis) Encoder data CRD error

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.36.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs because there is a communication failure and the CRC value of the data received from the encoder does not match the CRC value calculated in the servo board.

CRC error with the data received from the encoder could occur mainly because of a problem with the treatment of the wiring or the encoder shield line, causing the inflow of noise in the encoder signal line.

1.1.36.2. Causes and examine methods

(1) Check the encoder wiring

(2) Please replace the motor(encoder) and test it.

(3) Please replace the Servo Board and test it

(4) Please examine the communication status of wiring after the repair

For more details about the checking methods, refer to "**E02450 (○ axis) Encoder not replying to the request**."

1.1.37. E02454 (○ axis) Encoder disconnected or defective contact – motor off

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.37.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the encoder does not reply to the encoder data request from the servo board while the motor is off.

If the encoder does not reply to the encoder data request from the servo board, the abovementioned error could occur due to the disconnection of the encoder wiring or a problem with the encoder power.

1.1.37.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder

(2) Check the encoder wiring

(3) Please replace the Servo Board and test it

(4) Please replace the motor(encoder) and test it.

(5) Please examine the communication status of wiring after the repair

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For more details about the checking methods, refer to "**E02450 (○ axis) Encoder not replying to the request**."

1.1.38. E02455 (○ axis) Encoder data jump error

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.38.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs because there is a communication failure and a jump in the position value of the data received from the encoder.

A jump in the position value of the data received from the encoder could occur mainly because of a problem with the treatment of the wiring or the encoder shield line, causing the inflow of noise in the encoder signal line.

1.1.38.2. Causes and examine methods

(1) Check the encoder wiring

(2) Please replace the motor(encoder) and test it.

(3) Please replace the Servo Board and test it

(4) Please examine the communication status of wiring after the repair

For more details about the checking methods, refer to "**E02450 (○ axis) Encoder not replying to the request**."

1.1.39. E02459 (○ axis) Encoder disconnected or defective contact – motor on

Previous error code: E0223 (○ axis) Encoder disconnected or communication failure

1.1.39.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the encoder does not reply to the encoder data request from the servo board while the motor is on.

If the encoder does not reply to the encoder data request from the servo board, the abovementioned error could occur due to the disconnection of the encoder wiring or a problem with the encoder power.

1.1.39.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder

(2) Check the encoder wiring

(3) Please replace the Servo Board and test it

(4) Please replace the motor(encoder) and test it.

(5) Please examine the communication status of wiring after the repair

For more details about the checking methods, refer to "**E02450 (○ axis) Encoder not replying to the request**."

1.1.40. E02460 (○ axis) Encoder state error (CE) received

Previous error code: E0224 (○ axis) Abnormal encoder state

1.1.40.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the data received from the encoder is normal, but for the encoder data, the result of the monitoring of the inside of the encoder itself is in an erroneous state (CE).

Counter error (CE): Occurs when deviation in position occurs in the data of the first rotation due to a malfunction or fault when the encoder main power is turned on

1.1.40.2. Causes and examine methods

(1) Please check the supply voltage to the encoder.

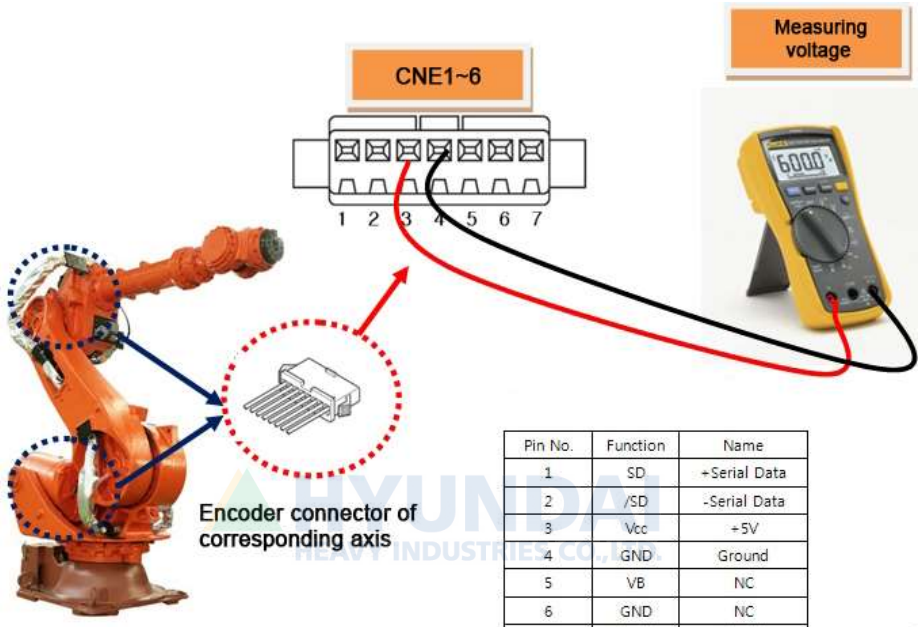
(2) Turn off/on the main power after deactivating the error..

(3) If the error keeps occurring, replace the motor (encoder) and then test it.

(1) Please check the supply voltage to the Encoder.

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

Please measure the voltage of encoder side's connector-pin (3-4).



Pin No.	Function	Name
1	SD	+Serial Data
2	/SD	-Serial Data
3	Vcc	+5V
4	GND	Ground
5	VB	NC
6	GND	NC
7	Shield	Shield

If the measured voltage is lower than the reference voltage, it is required to turn '+5V ADJ(E) voltage adjustment terminal of the encoder power supply to ensure that the connector voltage at the encoder side can be adjusted within the reference voltage.

(2) Turn off/on the main power after deactivating the error. .

If the error keeps occurring even when turning off/on the main power after deactivating the error, replace the motor (encoder) and then test it.
Deactivate the error in the following menu.

- System
- 5. Initialize
- 4. Serial encoder reset

(3) If the error keeps occurring, replace the motor (encoder) and then test it

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

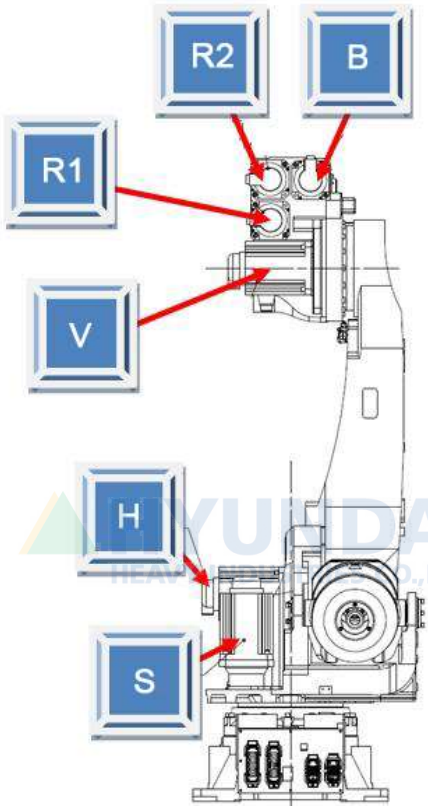


Figure 1.150 locations of each axis's motor (HS165 Robot).

1.1.41. E02461 (○ axis) Encoder state error (OS) received

Previous error code: E0224 (○ axis) Abnormal encoder state

1.1.41.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the data received from the encoder is normal, but as for the encoder data, the result of the monitoring of the inside of the encoder itself is in an erroneous state (OS)..

Overspeed (OS): While driving from the external battery power after the main power of the encoder is turned off, if the encoder rotates, exceeding the regulated value (6,000 rpm) for the power failure mode, the main power will be turned on before an error is generated.

1.1.41.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder.

(2) Turn off/on the main power after deactivating the error.

(3) If the error keeps occurring, replace the motor (encoder) and then test it.

For more details about the checking methods, refer to "**E02460 (○ axis) Encoder state error (CE) received**"

1.1.42. E02462 (○ axis) Encoder state error (FS) received

Previous error code: E0224 (○ axis) Abnormal encoder state

1.1.42.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the data received from the encoder is normal, but as for the encoder data, the result of the monitoring of the inside of the encoder itself is in an erroneous state (FS).

FS (Full scale): This error occurs when the main power is turned on while the encoder axis is rotating at a speed of 100 rpm or higher. When this flag is generated, the position resolution is 5 bit, and if the resolution is 17 bit, deactivation will take place automatically.

1.1.42.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder.

(2) Turn off/on the main power after deactivating the error.

(3) If the error keeps occurring, replace the motor (encoder) and then test it.

For more details about the checking methods, refer to "**E02460 (○ axis) Encoder state error (CE) received**"

1.1.43. E02463 (○ axis) Encoder state error (ME) received

Previous error code: E0224 (○ axis) Abnormal encoder state

1.1.43.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the data received from the encoder is normal, but as for the encoder data, the result of the monitoring of the inside of the encoder itself is in an erroneous state (ME).

ME (Multi-turn error): This error occurs when there is a jump in the multi-turn signal when the encoder main power is turned on.

1.1.43.2. Causes and examine methods

(1) Please check the supply voltage to the Encoder.

(2) Turn off/on the main power after deactivating the error..

(3) If the error keeps occurring, replace the motor (encoder) and then test it.

For more details about the checking methods, refer to "**E02460 (○ axis) Encoder state error (CE) received**"

1.1.44. E02464 (○ axis) Encoder state error (BE) received

Previous error code: E0224 (○ axis) Abnormal encoder state

1.1.44.1. Outline

While the servo board receives the encoder data periodically through serial communication with the encoder to carry out the servo control of the motor, this error occurs when the data received from the encoder is normal, but as for the encoder data, the result of the monitoring of the inside of the encoder itself is in an erroneous state (BE).

BE (Battery error): This error occurs when the external battery voltage reaches below 3.1 V after the encoder main power is turned off.

1.1.44.2. Causes and examine methods

(1) Please check the voltage of encoder's backup battery.

(2) Please examine the encoder's battery connection status.

(3) Please replace the motor(encoder) and test it. .

(1) Please check the voltage of encoder’ s battery.

Encoder’s batter uses 3.6V. If the voltage decreases to 3.0V~3.2V, a message of “W0104 (○ Axis) Encoder battery voltage is low” will be displayed. Please replace the encoder’s battery if this warning occurs. Replacement of encoder’s battery must be done while the controller’s power is on. If the encoder battery is replaced at this stage, Robot’s operation will not be interrupted.

If the encoder battery voltage reaches 2.5‐ 3.0 V after the due date for replacing the encoder battery, the error “E2470 ○ axis encoder abnormal: Required to reset the encoder” will be generated when the controller power is turned on. At the point of this error occurs, the encoder already lost the location data.
Please move the Robot to reference position by using an axis coordinate manual control to re-adjust the axis’s encoder followed by a replacement of encoder’s battery and the reset of encoder.

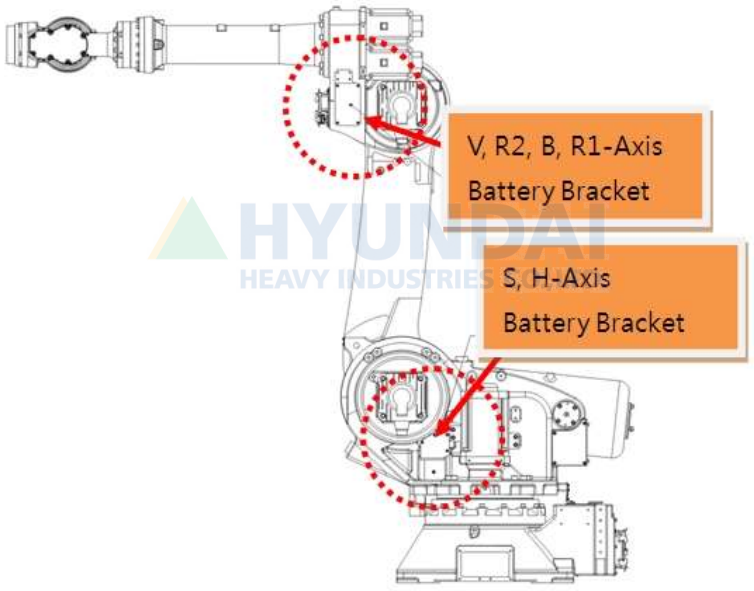


Figure 1.151 Location of Encoder’s Battery Replacement

Encoder reset can be executed from the below menu.

- System
- 5. Initialize
- 4. Serial encoder reset

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(2) Please examine the Encoder's battery connection status.

Please examine the connection status from encoder's battery to the motor.

(3) Please replace the motor(encoder) and test it. .

If the error keeps occurring even when turning off/on the main power after resetting the error, replace the motor (encoder) and then test it. If there is no error after the replacement, the servo motor is defective. Replace the servo motor with a normal one.. The following figure shows the position of each of the axis motors of the HS165 robot, while it is required to carry out replacement by referring to the maintenance manual of the relevant equipment in case of other types of robot.

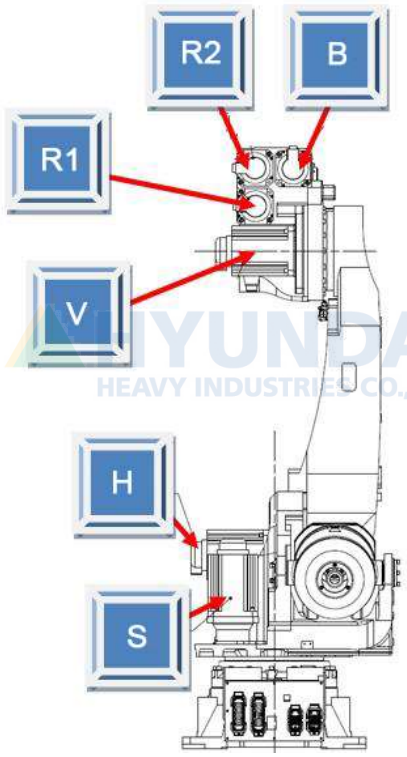


Figure 1.152 Locations of Each Axis's Motor (HS165 Robot)

1.1.45. E02470 (○ axis) Encoder error: Encoder reset required

Previous error code: E0108 (○ axis) Encoder error: Encoder reset required

1.1.45.1. Outline

Power must be supplied to the encoder at all time for it to be able to store the motor's location data.
Encoder's power will be supplied when the controller's power is on or from the encoder's back up battery. This error will occur, if the controller's power goes off while the encoder's back up battery is discharged. (as it will cause the encoder to lose the location data)
The same error will also occur when the motor is being replaced, because the new motor's encoder is not supplied with power.
Please move the Robot to reference position by using an axis coordinate manual control to re-adjust the axis's encoder as encoder reset will change the reference position data of the axis.

1.1.45.2. Causes and examine methods

(1) Please check the voltage of encoder's battery.

(2) Please examine the Encoder's battery connection status.

(3) Please replace the motor and test it.

(4) Re-adjustment of the encoder from Robot's reference position must be done after the encoder reset.

(1) Please check the voltage of encoder’ s battery.

Encoder’s batter uses 3.6V. If the voltage decreases to 3.0V~3.2V, a message of “W0104 (○ Axis) Encoder battery voltage is low” will be displayed. Please replace the encoder’s battery if this warning occurs. Replacement of encoder’s battery must be done while the controller’s power is on. If the encoder battery is replaced at this stage, Robot’s operation will not be interrupted.

If you miss the time to replace the encoder’s battery, and the battery voltage reaches to 2.5V~3.0V, and error of “E0108 ○ Axis) Encoder error: Encoder reset required” will occur.
At the point of this error occurs, the encoder already lost the location data.
Please move the Robot to reference position by using an axis coordinate manual control to re-adjust the axis’s encoder followed by a replacement of encoder’s battery and the reset of encoder.

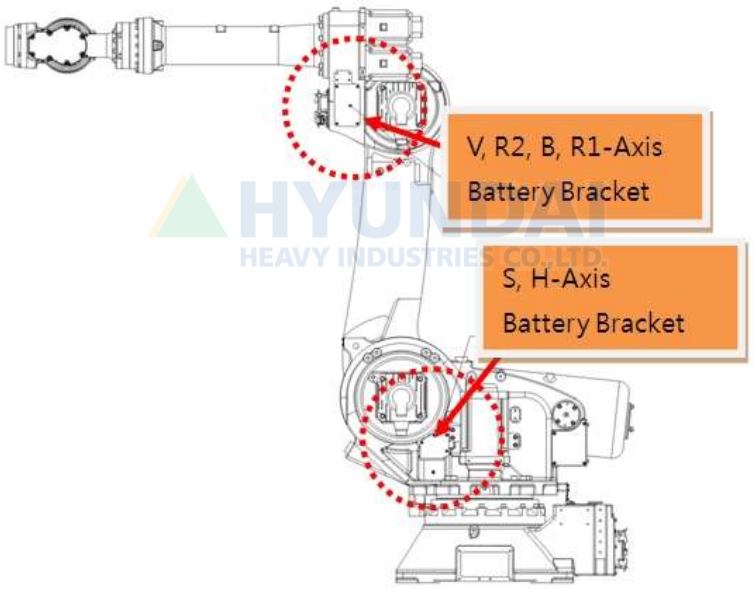


Figure 1.153 Location of Encoder’s Battery Replacement

Encoder reset can be executed from the below menu.

- System
- 5. Initialize
- 4. Serial encoder reset

(2) Please examine the Encoder's battery connection status.
Please examine the connection status from encoder's battery to the motor.

(3) Please replace the motor and test it.
If the above do not solve the problem, there is a high possibility that the encoder itself is the cause. Please replace the motor and test it.

1.1.46. E02520 (○ axis) IPM fault

Previous error code: E0112 (○ axis) IPM fault

1.1.46.1. Outline

A fault output has occurred from an IPM (Intelligent Power Module) – a switch device inside of Servo Drive Unit that drives the motor. IPM fault may occur due to an increased temperature of heat sink, IPM's control voltage reduction or an over-current output.

1.1.46.2. Causes and examine methods

< Error occurs non periodically when the motor turns on >

(1) Please examine the components that are related to the motor drive.
- Please examine the output cable that connects to the Servo Drive Unit.
- Please examine the terminal(socket) of switching device in the Servo Drive Unit.
- Please replace CNBS1,2,3 cables and confirm the error.
- Please replace the Servo Board and confirm the error.
- Please replace the Servo Drive Unit and confirm the error.
- Please replace the Servo motor and confirm the error.

< Case: Error occurs after 5 minutes from the start up of Robot's operation >

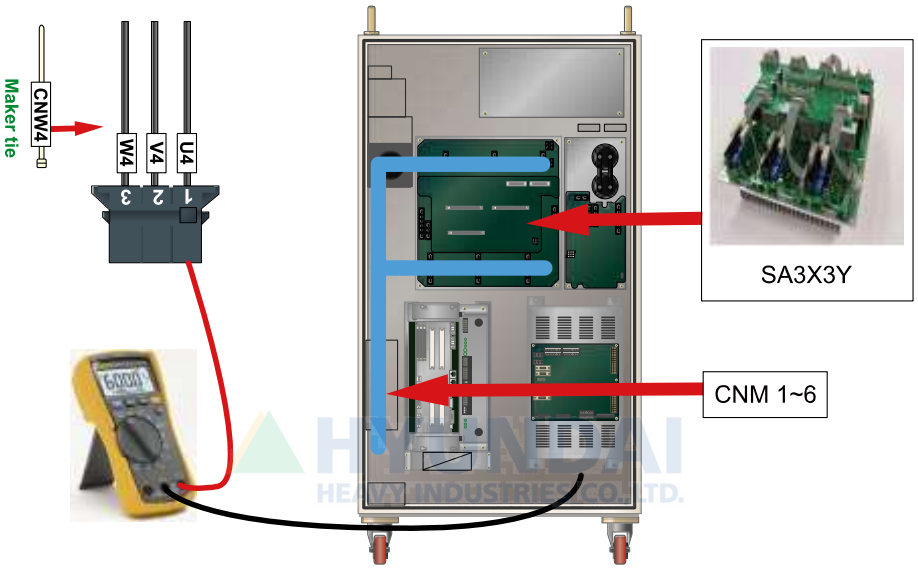
(2) Check the controller's cooling fan.
- Please examine the operational status of each fan
- Please examine the power voltage of each fan

(1) Please examine the components that are related to the motor drive.

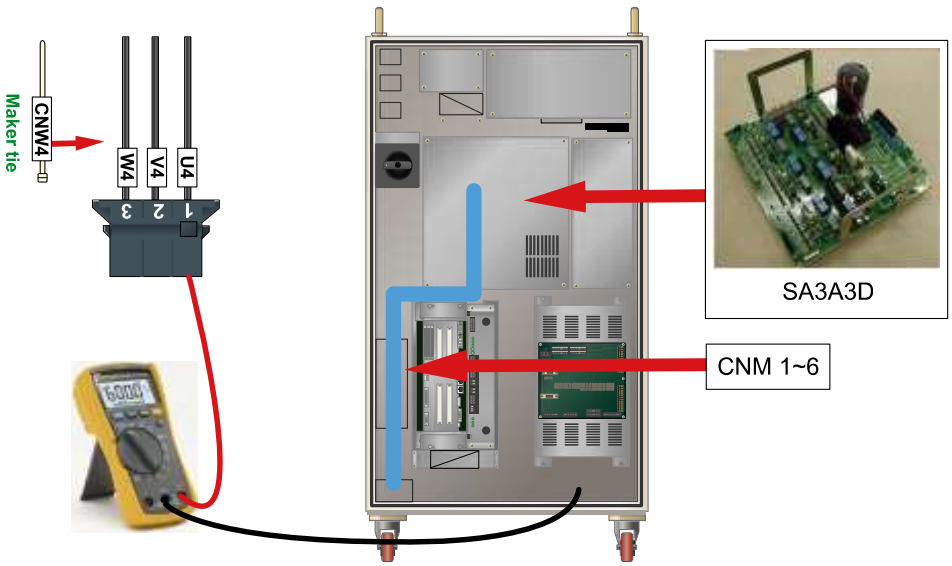
Servo Drive Unit that drives the motor receives a command from the Servo Board through CNBS cable, and the current output of internal amplification circuit will be transferred to the motor through wirings that connected to each connectors of axis.

■ **Examine the output cable that connects to the Servo Drive Unit**

Examine the wirings that connect the Servo Drive Unit to the motor. Please turn off the power of controller, and remove the connector from the Servo Drive Unit and measure the resistance value between grounds to inspect the occurrence of short circuit.



(a) Hi5-N00 controller

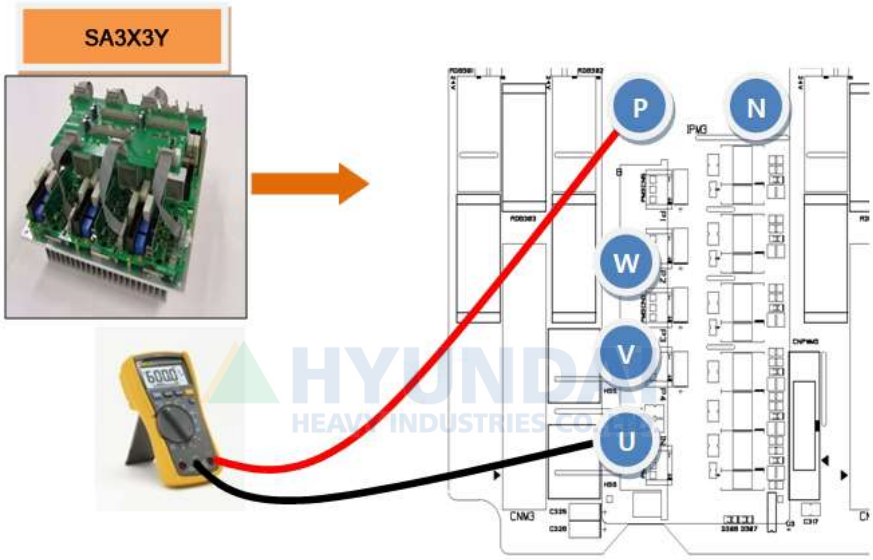


(b) Hi5-N30 controller

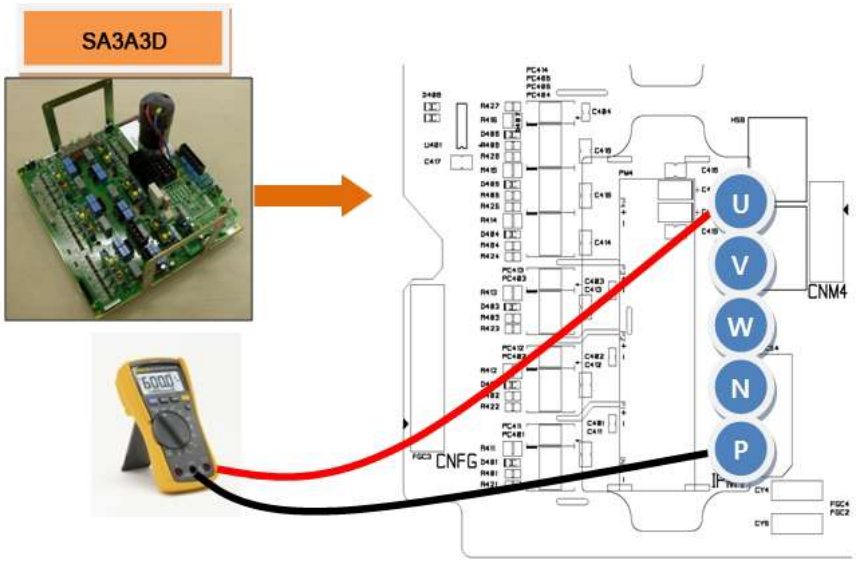
Figure 1.154 Checking the servo drive unit output cable

■ Examine the switch device of Servo Drive Unit
Switch device of Servo Drive Unit switches the direct current voltage that supplied from diode module and output the alternating current for each phases. If a short circuit occurs at the internal terminal of switch device, over-current flow and it will cause an IPM fault error. Please remove the connector and check if a short circuit has occurred between the output terminal in a switch device of Servo Drive Unit and the P (or N).
If a short circuit exists, the Servo Drive Unit need to be replaced and also the cable that connects the Servo Drive Unit to the motor needs to be examined.

- Medium size Robot's Servo Drive Unit : SA3X3Y
- Small size Robot's Servo Drive Unit : SA3A3D



(a) Hi5-N00 controller (SA3X3Y)



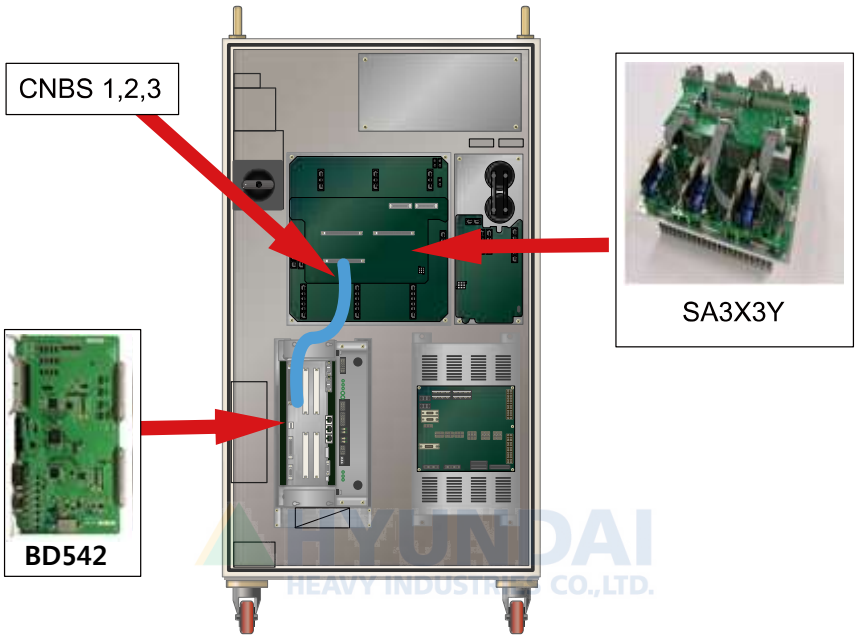
(b) Hi5-N30 controller (SA3A3D)

Figure 1.155 Checking the switching device short-circuiting

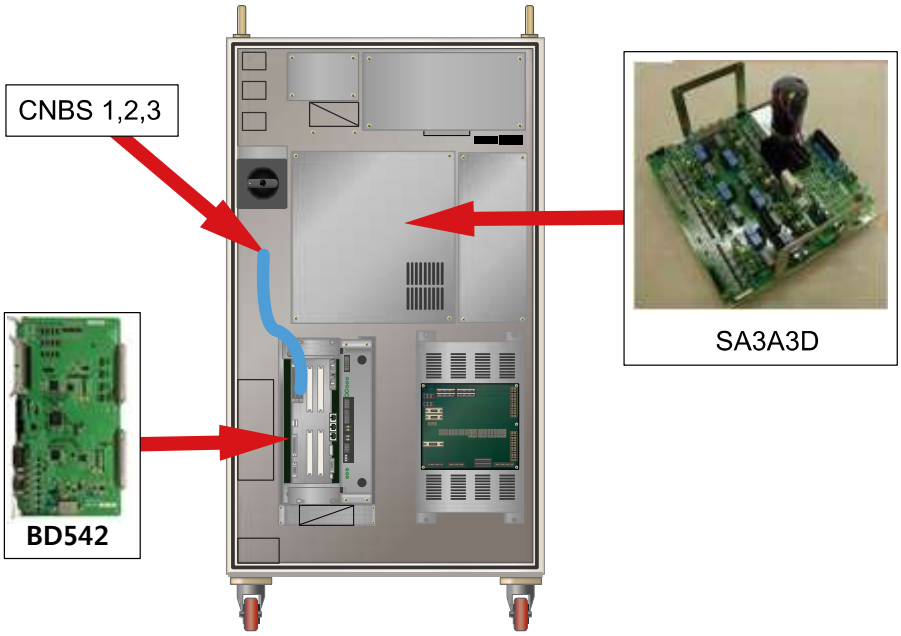
(2) Replacement of CNBS cable and examining the error CNBS

Servo Drive Unit that drives the motor receives a command from the Servo Board (BD542) through CNBS cable, and the current output of internal amplification circuit will be transferred to the motor through wirings that connected to each connectors of axis.

If the error does not persist after the replacement of cable, cable is faulty. Please replace the CNBS cable with new one.



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.156 Arranging the parts related to the motor driving

(3) Replacement of Servo Board and examine it

If the error does not persist after the replacement of Servo Board, Servo Board is faulty. Please replace the Servo Board with new one.

(4) Replacement of Servo Drive Unit and examine it

If the error does not persist after the replacement of Servo Drive Unit, Servo Drive Unit is faulty. Please replace the Servo Drive Unit with new one.

- Medium size Robot's Servo Drive Unit : SA3X3Y
- Small size Robot's Servo Drive Unit : SA3A3D

(5) Replacement of Servo Motor and examine it

If the error does not persist after the replacement of Servo Motor, Servo Motor is faulty. Please replace the Servo Motor with new one. Below diagram describes the locations of each axis's motor (HS165 Robot). For other Robot, please refer to the Robot's maintenance manual to replace it.

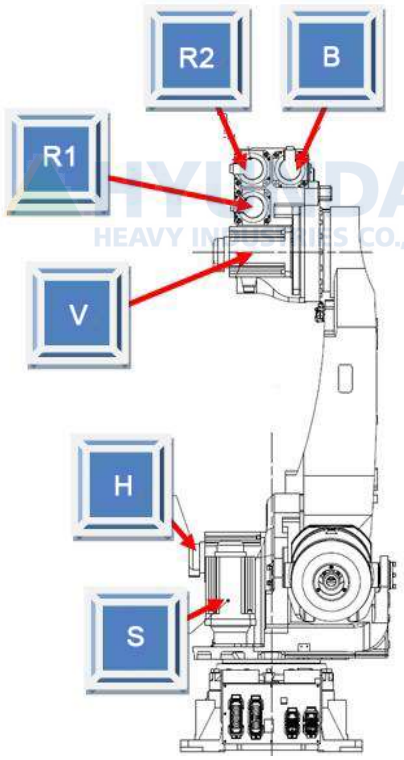
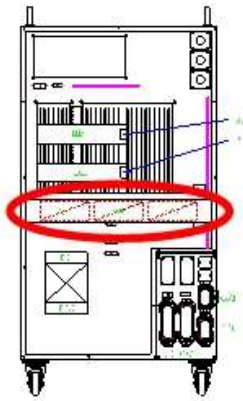
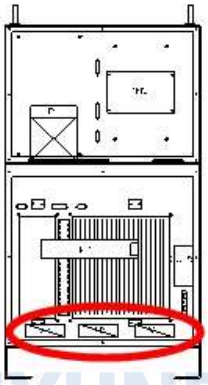


Figure 1.157 Locations of Each Axis's Motor (HS165 Robot)

(6) Check the controller's cooling fan.

If the IPM fault error occurs after over 5 minutes since the start of the robot, it means that the controller's cooling system has caused abnormalities, surpassing the allowable temperature specifications of the IPM motion. The rear face of the controller is equipped with the heat sinking plane of the servo driving gear and the fan for cooling the regenerative discharge resistance.

Table 1-6 Position for installing the controller pan(Hi5)

Hi5-N**	Hi5-C1*	Hi5-C0*
		

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(7) Checks for the motion of each fan

When the fan does not rotate or the speed is abnormally low, change the involved fan, please. The fan's life span changes depending on motion, environments and time.

(8) Checks for the voltage of fan power supply

If all fans do not work, check the fan for the input voltage, please. The input voltage has been set as AC 220V, and the allowable range is within 10 % of rated voltage. When the voltage is low more than 10 %, the fan's reduced RPM causes the decline in cooling effectiveness. When the voltage is low, check the rear side cooling fan power connector and the controller input voltage.

1.1.47. E02521 (○ axis) IPM fault – low-voltage gate drive power

Previous error code: E0112 (○ axis) IPM fault

1.1.47.1. Outline

A fault output has occurred from an IPM (Intelligent Power Module) - a switch device inside of Servo Drive Unit that drives the motor. IPM fault could occur due to a temperature increase in the heat protection plate, a drop in the control voltage, or an overcurrent output in the IPM. This error occurs when the IPM fault is detected while the servo is off. While in the servo off state, the IPM will carry out inspection only on the control voltage drop. Therefore, checking the gate drive power is required.

1.1.47.2. Causes and examine methods

< When the IPM fault error occurs while in the servo off state >

(1) Please examine the components that are related to the motor drive.

- Replace the CNBS cable of the relevant axis and then check the error.
- Please replace the servo drive unit and confirm the error.
- Please replace the servo board and confirm the error.

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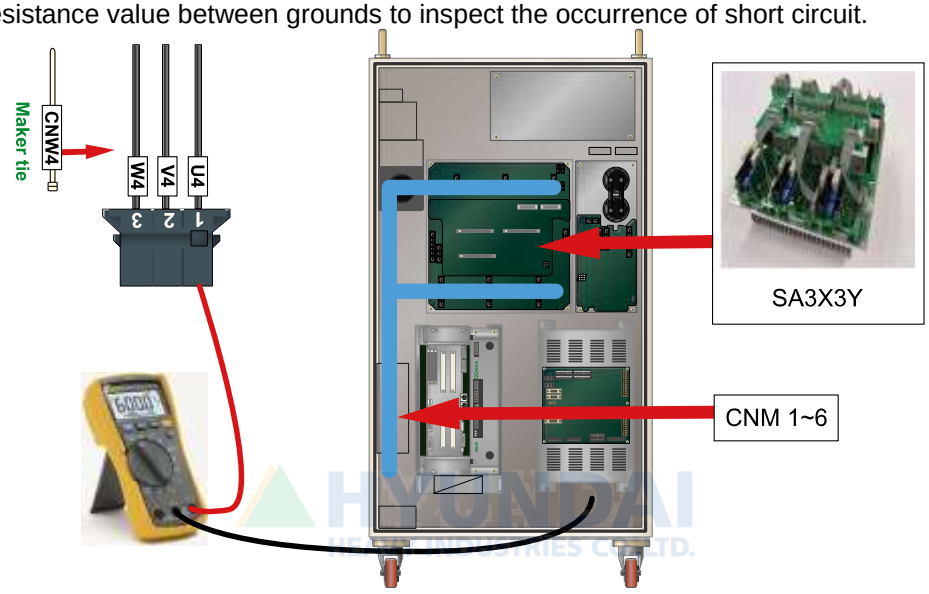
(1) Please examine the components that are related to the motor drive.

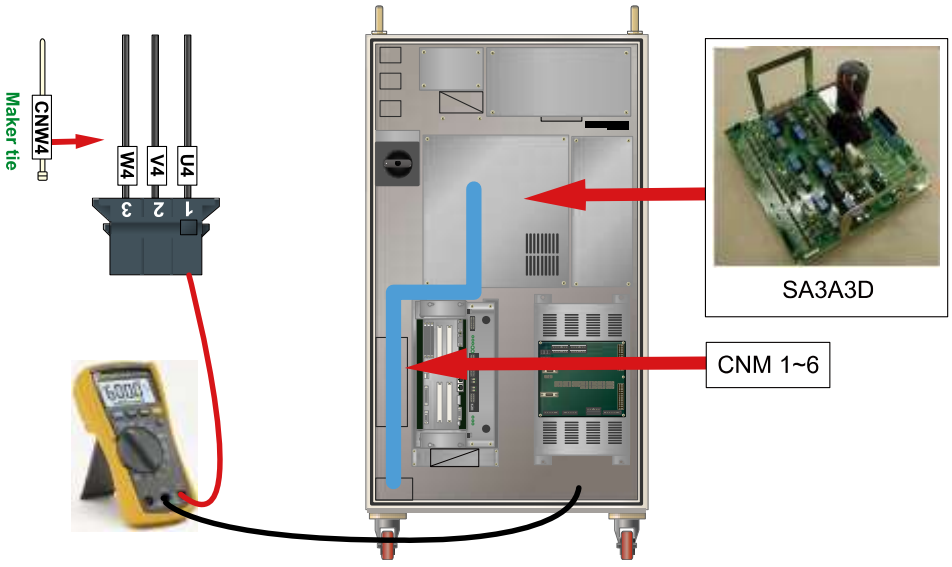
Servo Drive Unit that drives the motor receives a command from the Servo Board through CNBS cable, and the current output of internal amplification circuit will be transferred to the motor through wirings that connected to each connectors of axis.

(2) Examine the output cable that connects to the Servo Drive Unit

Examine the wirings that connect the Servo Drive Unit to the motor. Please turn off the power of controller, and remove the connector from the Servo Drive Unit and measure the resistance value between grounds to inspect the occurrence of short circuit.



(a) Hi5-N00 controller



(b) Hi5-N30 controller

Figure 1.158 Checking the servo drive unit output cable

(3) Replacement and inspection of servo drive unit

If the error does not persist after the replacement of Servo Drive Unit, Servo Drive Unit is faulty. Please replace the Servo Drive Unit with new one.

- Medium size Robot's Servo Drive Unit : SA3X3Y
- Small size Robot's Servo Drive Unit : SA3A3D

(4) Replacement of Servo Board (BD542) and examine it

If the error does not persist after the replacement of Servo Board (BD542), Servo Board (BD542) is faulty. Please replace the Servo Board (BD542) with new one.

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1.1.48. E02522 (○ axis) IPM fault – specific step

Previous error code: E0112 (○ axis) IPM fault

1.1.48.1. Outline

A fault output has occurred from an IPM (Intelligent Power Module) - a switch device inside of Servo Drive Unit that drives the motor. IPM fault may occur due to an increased temperature of heat sink, IPM's control voltage reduction or an over-current output.

1.1.48.2. Causes and examine methods

< Error occurs at a certain step >

(1) Please examine the robot at the step that an error occurs,

- Please examine the robot's wiring at the location where the error occurs.
- Please reduce the speed of robot's operation in order to confirm the error
- Please make changes on teached step's interpolation and confirm the error.

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(1) Please examine the Robot at the step that an error occurs.

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

(2) Examine the internal wiring at the location of an error

Examine the wiring status of corresponding axis that connected to the motor (inside of Robot). During the examination, please turn off the controller's power and remove the output connector from the Servo Drive Unit. After that please measure the resistance value between grounds of each phases (cable side) to test a short circuit.

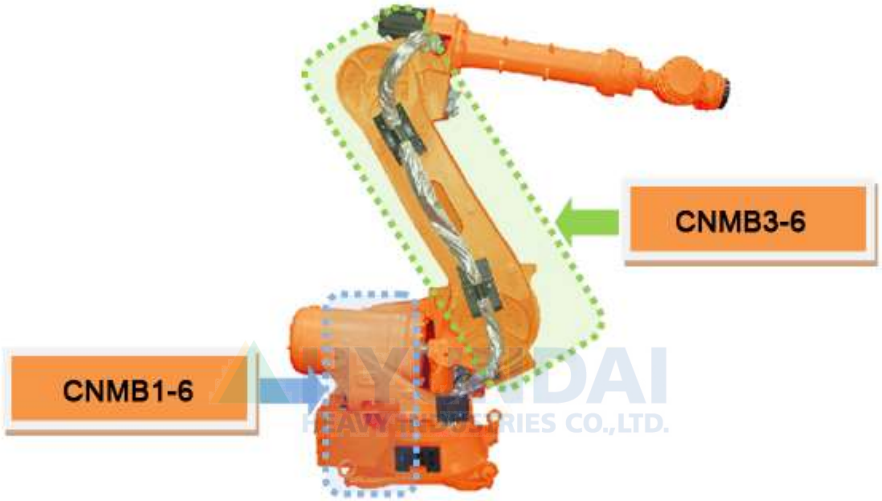

Figure 1.159 Location of Wiring Examination for Each Axis (HS165)

(3) Reduce the speed of Robot's operation in order to confirm the error

If an error occurs at a step that generates rapid changes of axis speed which is caused by the position changes of Robot, reduce the operation speed to confirm the error. If the error does not persist after the speed is reduced, please change the Teach speed of corresponding step and record the job program to use.

(4) Change the teached step's interpolation to confirm the error

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

1.1.49. E02530 Disconnection/defective contact in the PWMON wiring between the AMP and the system

Previous error code: E0014 Safety switch (such as EM, OTR, and TS) instant contact

1.1.49.1. Outline

The AMP detects abnormality (PWMON signal off) with the sequence and then shuts off the motor power. The main reason includes disconnection or defective contact in the PWMON signal wiring. Accordingly, AMP shuts off the PWM command.

1.1.49.2. Causes and examine methods

(1) Check the CNSGA cable.

(2) Check / replace the system board.

(3) Check / replace the servo AMP.

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(1) Check the CNSGA cable.

As shown in the following figure, there is a CNSGA cable connecting the servo AMP and the system board to send and receive the PWMON signals. Check if the cable is connected well to the cable connector of the servo AMP or the system board.
As the CNSGA cable may be damaged, replace it and then check.

Figure 1.160 CNSGA connection between the servo AMP and the system board

(2) Check/replace the system board.

If there is no problem with the CNSGA cable, replace the system board and then check. There could be an abnormality with the PWMON signal output circuit.

(3) Check/replace the servo AMP.

If there is no problem with the CNSGA cable and the system board, replace the servo AMP and then check. There could be an abnormality with the PWMON signal output circuit and the monitoring section.

1.1.50. E02538 PWM error – Fault with the PWMON signal generation circuit

Previous error code: E0014 Safety switch (such as EM, OTR, and TS) instant contact

1.1.50.1. Outline

Due to an abnormality with the PWMON signal generation circuit of the system board, the servo AMP shuts off the motor power.

1.1.50.2. Causes and examine methods

(1) Check/replace the system board..

The PWMON signal is a signal that the system board generates after checking the operation state of the magnetic contactor. When the PWMON signal is on, servo ON will be possible in the servo AMP.

However, when there is a problem related to the circuit, preventing the normal generation of the PWMON signal, this error will occur. Replace the system board and then check if the problem occurs again.
.

Figure 1.161 Fault with the system board PWMON signal generation circuit

1.1.51. E02541 Drive unit control voltage drop

Previous error code: E0114 Drive unit control voltage drop

1.1.51.1. Outline

Control power that supplied to the Servo Drive Unit +15V has been reduced. This error is detected by the Servo Drive Unit and transferred to the Servo Board through CNBS cable.

1.1.51.2. Causes and examine methods

(1) Please check the power indicator LED.
- Please check the 'POW' LED of servo drive unit
- Please check the '+15V' LED of SR1 (control power supply unit).

< Case: Both of module's LED are OFF >

(2) Please check the output of SR1. (Control power supply unit).
- Please remove CNBS cable from BD542 and check the LED.
- Please remove the Servo Board from the Rack and check the LED.

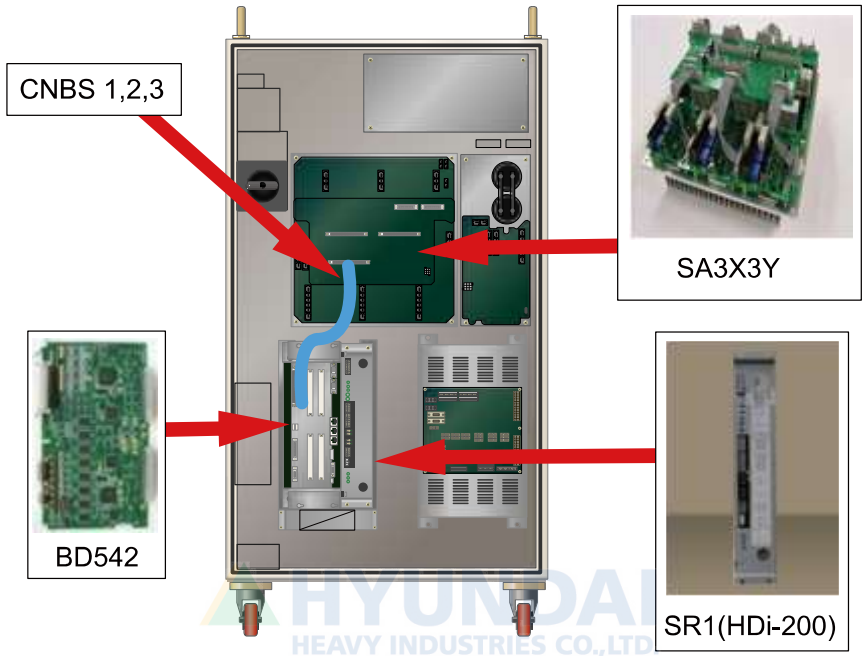
(3) Please examine the SR1 (control power supply unit).
- Please check the input voltage to SR1.
- Please replace the SR1 and check the LED.

< Case: Only the Servo Drive Unit's 'POW' LED is OFF >

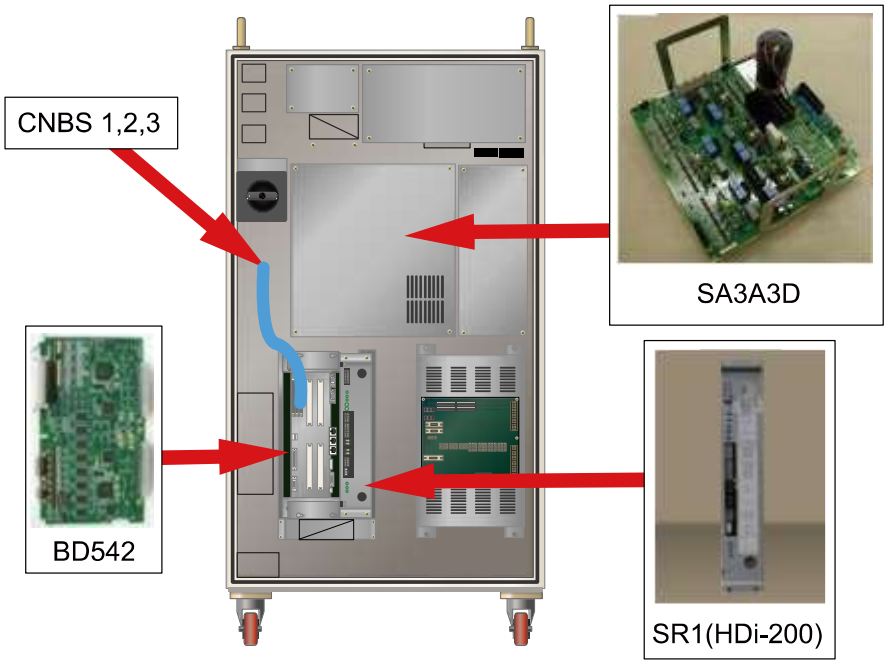
(4) Please replace the related components and check the power indicator LED.
- Please replace CNBS cable and check the LED.
- Please replace the Servo Board and check the LED.
- Please replace the Servo Drive Unit and check the LED.

(1) Please check the power indicator LED.

Drive unit control voltage reduction error is caused by a reduction of control voltage +15V. This error will be detected by the Servo Drive Unit and transferred to the Servo Board (BD542) through CNBS1, 2, 3 cables to be handled.



(a) Hi5-N00 controller



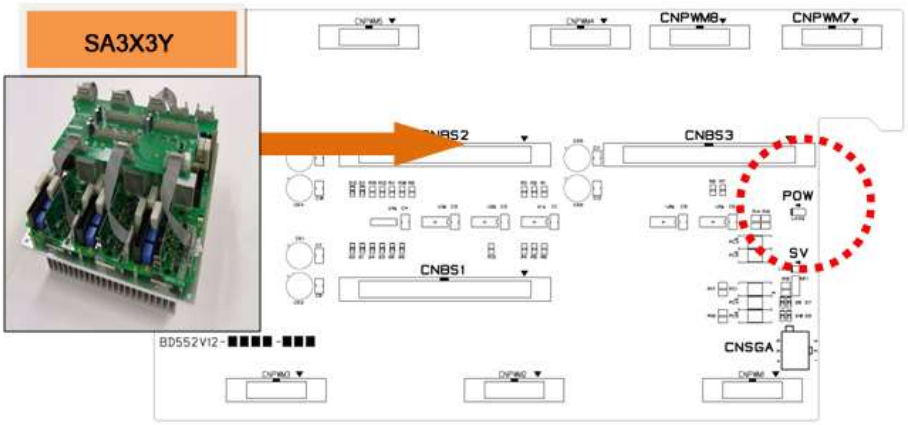
(b) Hi5-N30 controller

Figure 1.162 Arranging the parts related to the drive unit control voltage drop

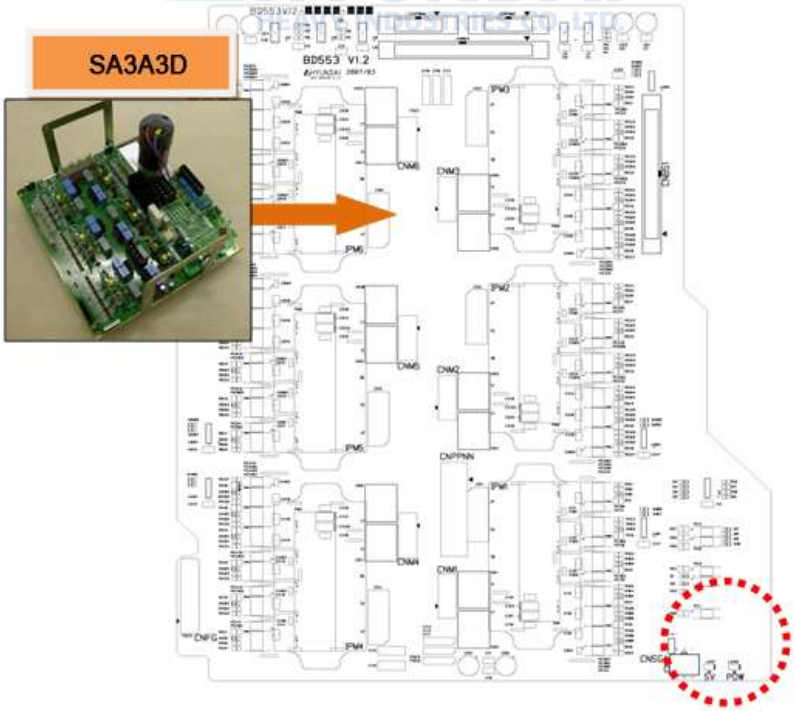
■ **Examine the ‘POW’ LED of Servo Drive Unit**

Check the "POW" of the drive unit control voltage error detection module.
If the power is being supplied normally, the LED light should be stays on.

- Medium size Robot’s Servo Drive Unit : SA3X3Y
- Small size Robot’s Servo Drive Unit : SA3A3D



(a) Hi5-N00 controller (SA3X3Y)



(b) Hi5-N30 controller (SA3A3D)

Figure 1.163 Arranging the parts related to the “POW” LED

- Examine the '+15V' LED of SR1
  Please check the LED of SR1 if the Servo Drive Unit's 'POW' LED light is off.
  Please check if the LED of SR1 and the LED of Servo Drive Unit are both off at the same time.

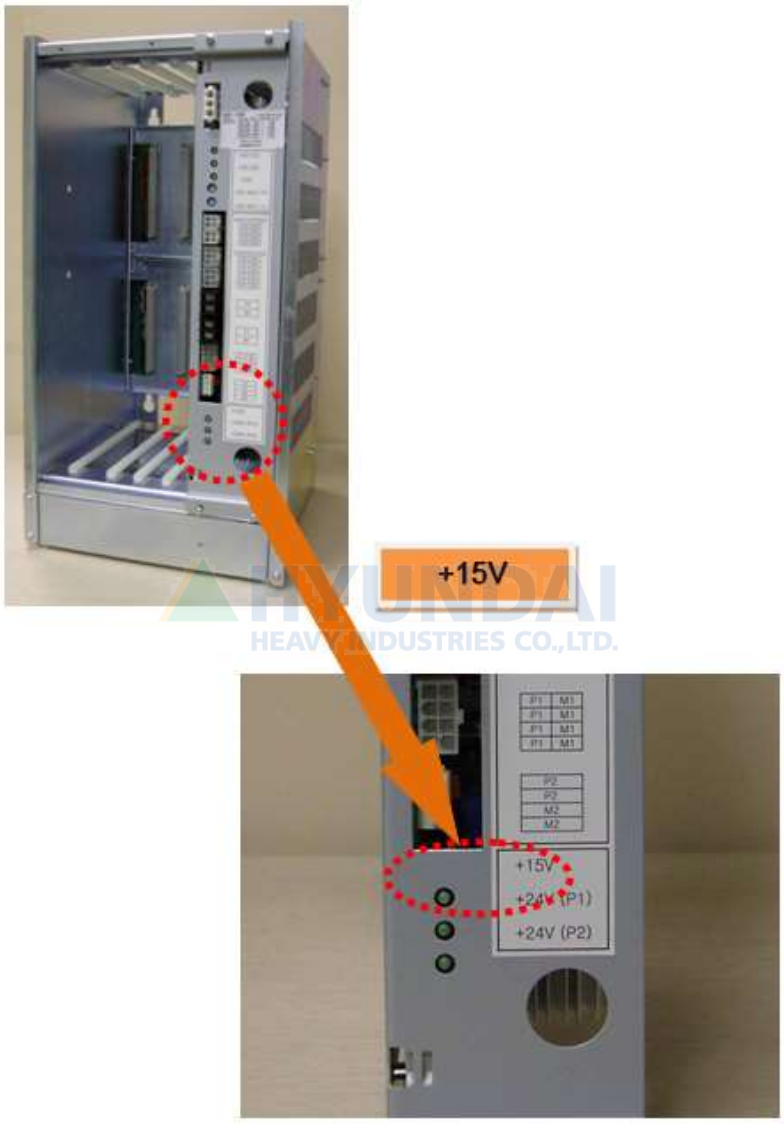


Figure 1.164 Locations of '+15V' LED Related Components of SR1

(2) Please check the output of SR1.

Please remove the wirings and components that are connected to the Servo Drive Unit and examine the '+15V' LED in order to check the output of SR1 itself.

- Remove CNBS cable and check the LED
  Please remove the CNBS1, CNBS2, CNBS3 that connect the Servo Drive Unit and the Servo Board. After the removal, please check the LED of SR1. If the '+15V LED' of SR1 turns to ON after the removal of cables, the Servo Drive Unit is faulty. Please replace the Servo Drive Unit with new one.

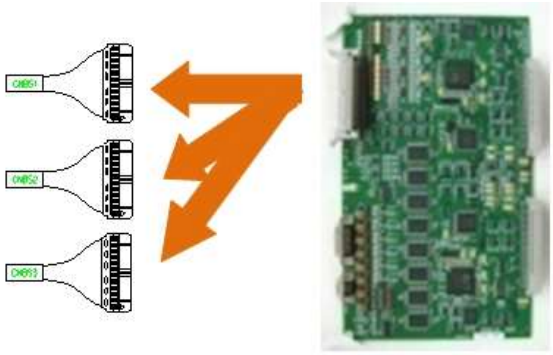


Figure 1.165 Removal of CNBS cable

- Remove the Servo Board (BD542) and examine the LED
  Please check the SR1's LED after you remove the Servo Board from a Rack. If the '+15V LED' of SR1 turns to ON after the removal of Servo Board, the Servo Board is faulty. Please replace the Servo Board with new one.

Figure 1.166 Removal of Servo Board from the Rack

(3) Please examine the SR1 (control power supply unit).
Control power supply unit received AC 220V (input) and output the necessary control power to each board from the internal circuit.

- Examine the input voltage of SR1
  If the input voltage to SR1 exceeds the specification, the output of control power may have an error. If the input voltage exceeds the allowed range, please examine according to a controller's input voltage examination procedures and a controller's single-phase internal voltage examination procedures.

  - SR1 input voltage specification: single-phase AC 48V
  - Allowed range: 44V ~ 52V

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

(4) Please replace the related components and check the power indicator (LED).
Please replace the Servo Drive Unit, Servo Board, CNBS cable and check the 'POW' LEF of the Servo Drive Unit.

- Replace the CNBS cable and check the 'POW' LED
  Please replace the CNBS1, CNBS2, CNBS3 that connects the Servo Drive Unit and the Servo Board, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, cable is faulty. Please replace it with new one.

- Replace the Servo Board and check the 'POW' LED
  Please replace the Servo Board, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, the Servo Board is faulty. Please replace it with new one.

- Replace the Servo Drive Unit and check the 'POW' LED
  Please replace the Servo Drive Unit, and check the 'POW' LED. If the 'POW' LED is ON after the replacement, the Servo Drive Unit is faulty. Please replace it with new one.

  - Medium size Robot's Servo Drive Unit: SA3X3Y
  - Small size Robot's Servo Drive Unit: SA3A3D

1.1.52. E02610 (○ axis) Motor UV-phase overcurrent

Previous error code: E0113 (○ axis) Overcurrent

1.1.52.1. Outline

The current (UV-phase current) that flows through the motor or the drive unit is larger than the set limit value. When the current that generated by the Servo control to operate the Robot (or the drive unit) exceeds the allowed safe voltage range, the Servo Board will detect an error and immobilize the Robot.

1.1.52.2. Causes and examine methods

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

(2) Examine the motor power line.
- Check the wiring that connects the robot and controller.
- Check the robot's internal wiring.
- Check the controller's internal wiring.

(3) Examine the CNBS cable between the Controller's internal Servo Board and the Drive Unit.

(4) Replace other components.

(1) Check if the axis with an error has mechanical interference with other equipment.
This error may occur if the Robot had a mechanical interference or collisions. If the Robot is out of the operation area, please move it back into the operation area by using a manual control.

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

Warning
Be cautious. Examination while the power is on may cause an electrocution.

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

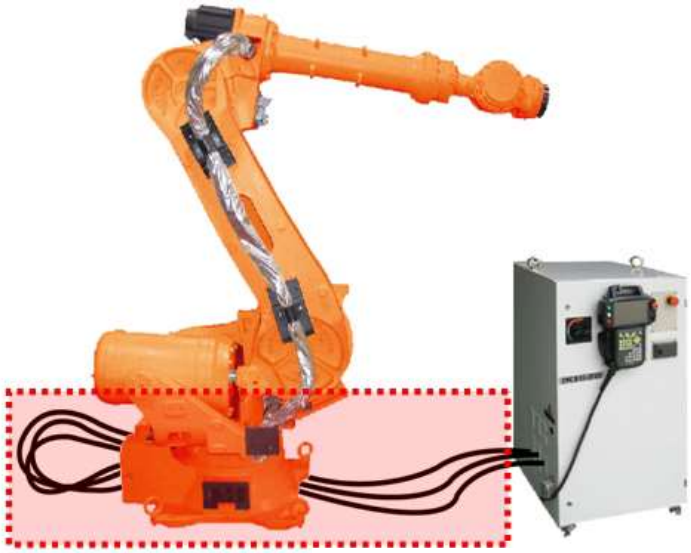


Figure 1.167 Basic Installation Diagram of the Robot and Control Period

- Check the Robot's internal wiring
  Examine for a short circuit, faulty on a wiring that connected to Robot's internal motor is required.

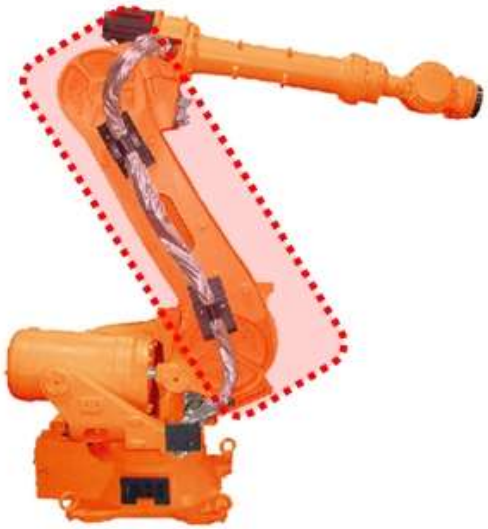


Figure 1.168 Robot's Internal Wiring

■ Check the Controller's internal wiring.
Examine on a controller's internal AMP and installed wiring is required.

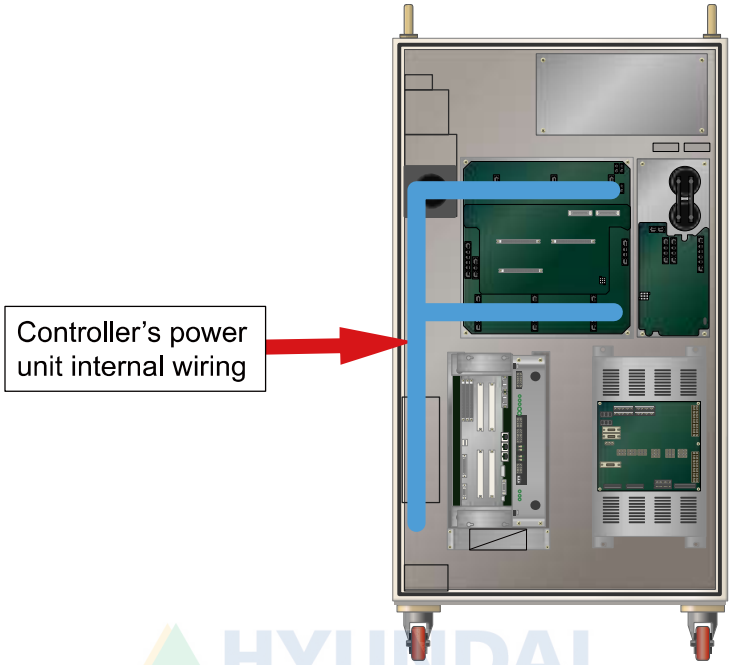


Figure 1.169 Controller internal side (Power unit)

(3) Examine the CNBS cable between the Controllers' internal Servo Board (DSP board) and the Drive Unit.
Please examine if the CNBS cable is installed properly. If the cable is not installed properly, or the cable is faulty, this error may occur.

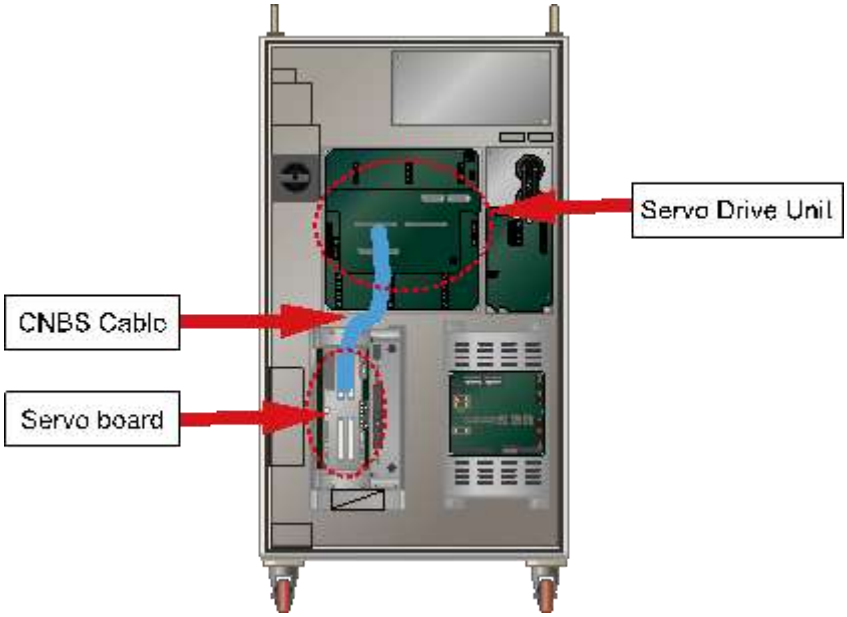


Figure 1.170 Controller internal side (CNBS cable)

(4) Replace other components

Replace the component in order of Servo Board (BD542) → Servo Drive Unit → Motor to confirm the occurrence of an error.

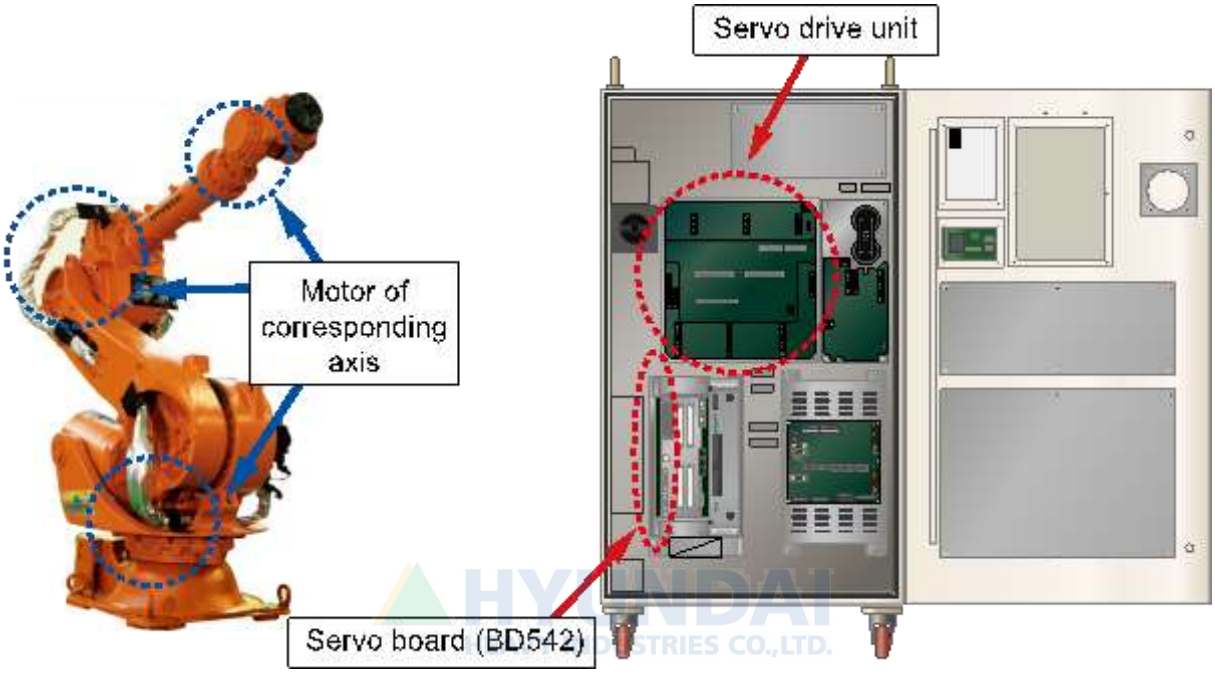


Figure 1.171 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.53. E02611 (○ axis) Motor U-phase overcurrent

Previous error code: E0113 (○ axis) Overcurrent

1.1.53.1. Outline

The current (U-phase current) that flows through the motor or the drive unit is larger than the set limit value. When the current that generated by the Servo control to operate the Robot (or the drive unit) exceeds the allowed safe voltage range, the Servo Board will detect an error and immobilize the Robot.

1.1.53.2. Causes and examine methods

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

(2) Examine the motor power line.
- Check the wiring that connects the robot and controller.
- Check the robot's internal wiring.
- Check the controller's internal wiring.

(3) Examine the CNBS cable between the Controller's internal Servo Board and the Drive Unit.

(4) Replace other components.

For more details about the checking methods, refer to "**E02610 (○ axis) Motor UV-phase overcurrent**".

1.1.54. E02612 (○ axis) Motor V-phase overcurrent

Previous error code: E0113 (○ axis) Overcurrent

1.1.54.1. Outline

The current (V-phase current) that flows through the motor or the drive unit is larger than the set limit value. When the current that generated by the Servo control to operate the Robot (or the drive unit) exceeds the allowed safe voltage range, the Servo Board will detect an error and immobilize the Robot.

1.1.54.2. Causes and examine methods

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

(2) Examine the motor power line.
- Check the wiring that connects the robot and controller.
- Check the robot's internal wiring.
- Check the controller's internal wiring.

(3) Examine the CNBS cable between the Controller's internal Servo Board and the Drive Unit.

(4) Replace other components.

For more details about the checking methods, refer to "**E02610 (○ axis) Motor UV-phase overcurrent**".

1.1.55. E02613 (○ axis) Motor W-phase overcurrent

Previous error code: E0113 (○ axis) Overcurrent

1.1.55.1. Outline

The current (W-phase current) that flows through the motor or the drive unit is larger than the set limit value. When the current that generated by the Servo control to operate the Robot (or the drive unit) exceeds the allowed safe voltage range, the Servo Board will detect an error and immobilize the Robot.

1.1.55.2. Causes and examine methods

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

(2) Examine the motor power line.
- Check the wiring that connects the robot and controller.
- Check the robot's internal wiring.
- Check the controller's internal wiring.

(3) Examine the CNBS cable between the Controller's internal Servo Board and the Drive Unit.

(4) Replace other components.

For more details about the checking methods, refer to "**E02610 (○ axis) Motor UV-phase overcurrent**".

1.1.56. E02620 (○ axis) Abnormality with the received command code (E02620 ~ E02626)

Previous error code: E0115 (○ axis) Abnormality with the received command code

1.1.56.1. Outline

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

1.1.56.2. Causes and examine methods

(1) Please examine if the main board and the servo board are installed properly.
- Examine if the board is installed properly.
- Examine if board is faulty.

(2) Examine if the versions of the main board and the servo board matches.

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(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.172 Methods for inserting a USB into the teach pendant

Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to,

- Service
- 5. File manager

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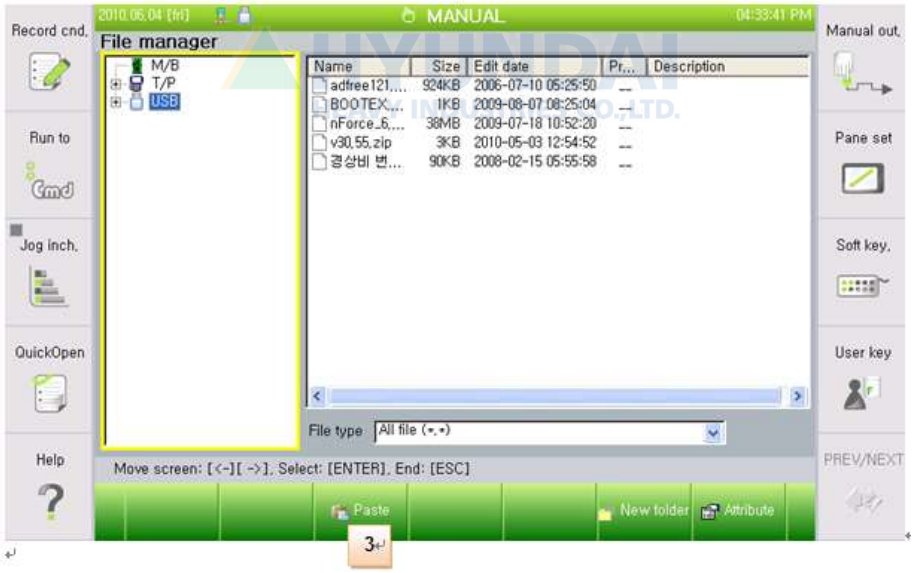
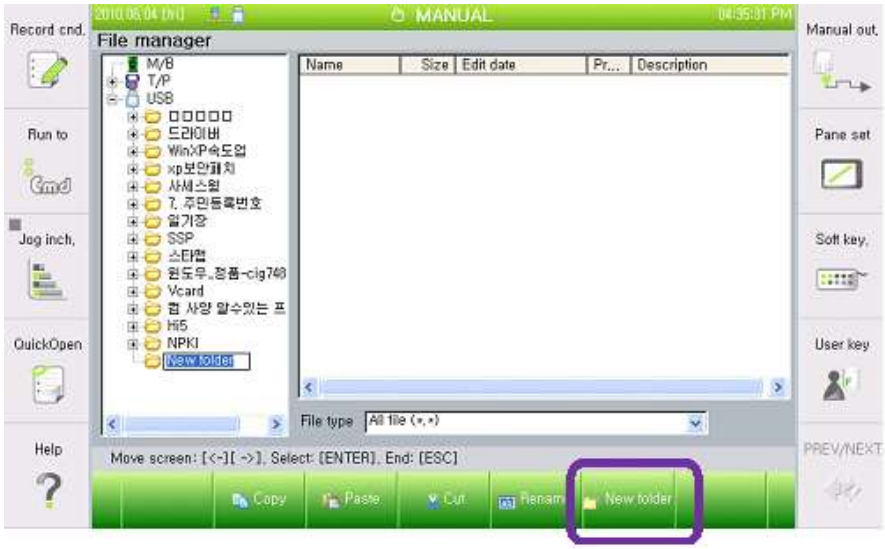
And the screen that is similar to windows explorer will be displayed.

At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Please remove the Main Board and the Servo Board from the Rack and re-install them again.

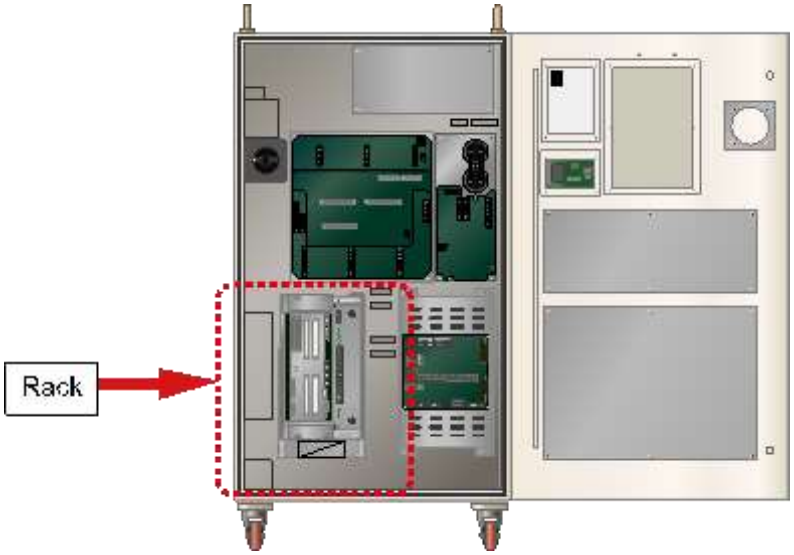


Figure 1.173 Location of Rack Inside of the Controller

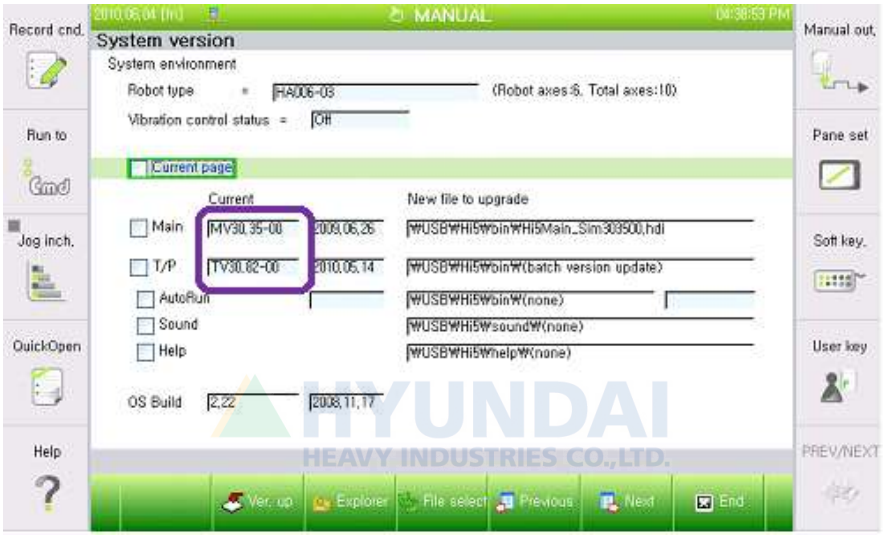
- Examine if the board is faulty.
  To examine if the board is faulty, please replace it with new one.

(2) Examine if the versions of the main board and the servo board matches.

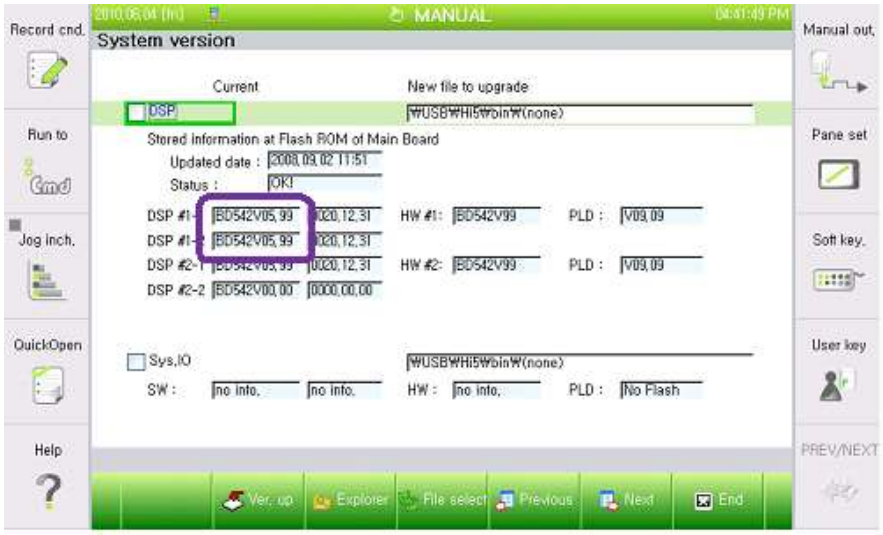
When turning on the controller power, check the version of the main board and the servo board. If they do not match, the error "No. ○ DSP version is lower" will be generated. Please contact to our A/S department in order to update the system with a proper version.

Versions of the Main Board and the Servo Board can be checked from the below menu.

- Service
- System diagnosis
- System version



Press [F6: next page] to check the version of Servo Board



1.1.57. E02630 (○ axis) Position deviation exceeded

Previous error code: E0117 (○ axis) Position deviation set value exceeded

1.1.57.1. Outline

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

1.1.57.2. Causes and examine methods

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

(2) Check if the brake release works properly.
- Examine if the brake release of each axis has an error
- Examine the error on brake's power supply.

(3) Examine the wiring status.

(4) Check if the rated load is used.

(5) Position deviation setting level error.

(6) Please replace other components.

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(1) Check if the axis with an error has mechanical interference with other equipment.
This error may occur if the Robot had a mechanical interference or collisions. If the Robot is out of the operation area, please move it back into the operation area by using a manual control.

(2) Check if the brake release works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

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

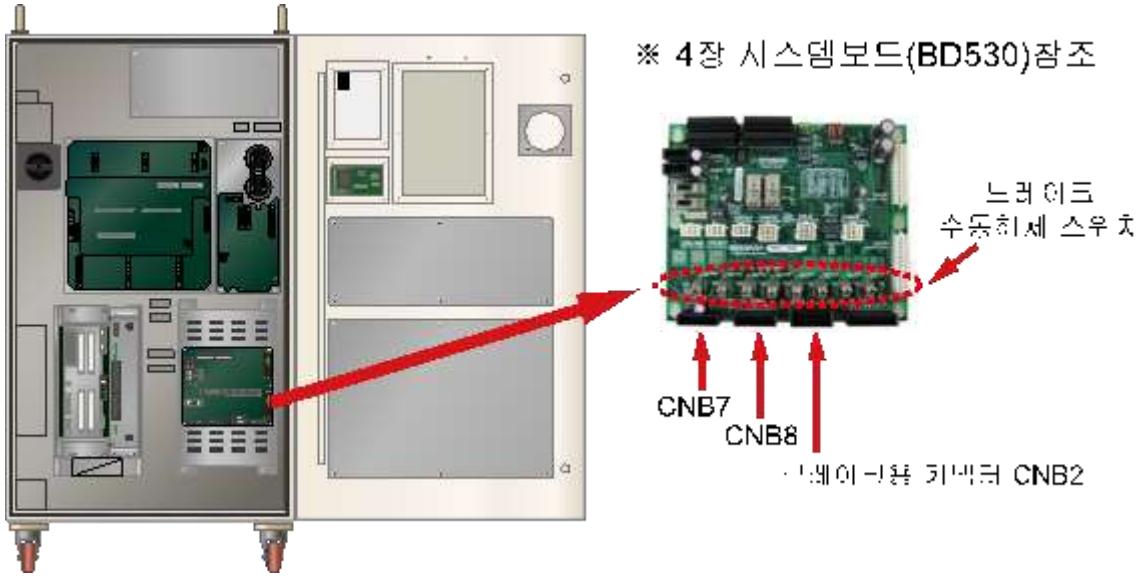
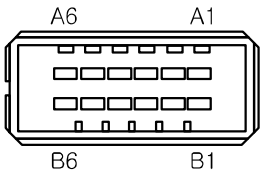


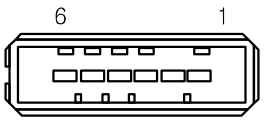
Figure 1.174 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, and CNB8 connector) and use the manual brake switch for the brake voltage's output. Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.



CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.175 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1:Private input signal』 → 『Overload (Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

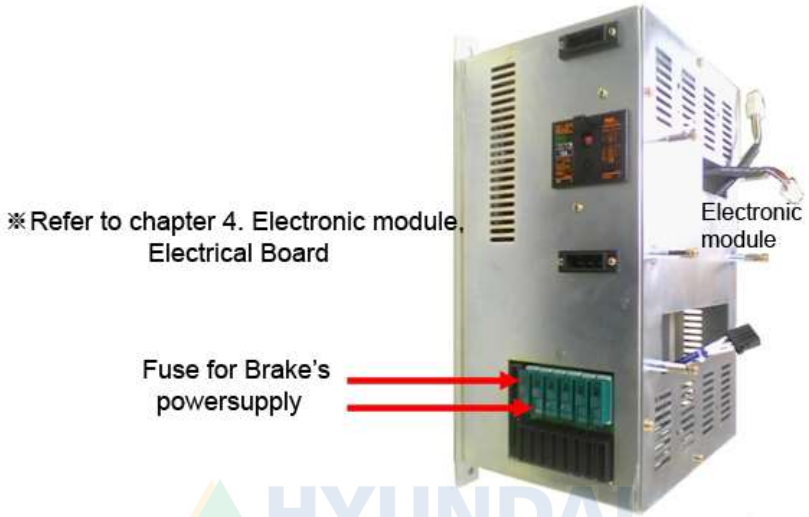


Figure 1.176 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

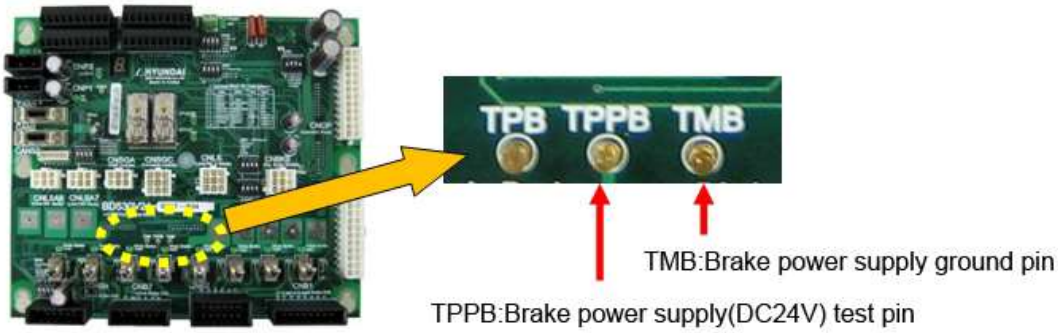


Figure 1.177 Brake Power Supply Test Pin

(3) Examine the wiring status.
Check if the motor wiring (U, V, W phase) has been short-circuit from the other wiring or ground lines (FG).

(4) Check if the rated load is used.

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

(5) Position deviation setting level error

If the position deviation setting value is smaller than the next maximum measured value, please increate the setting value.

Maximum measured value of position deviation after few cycles of operation x 1.5

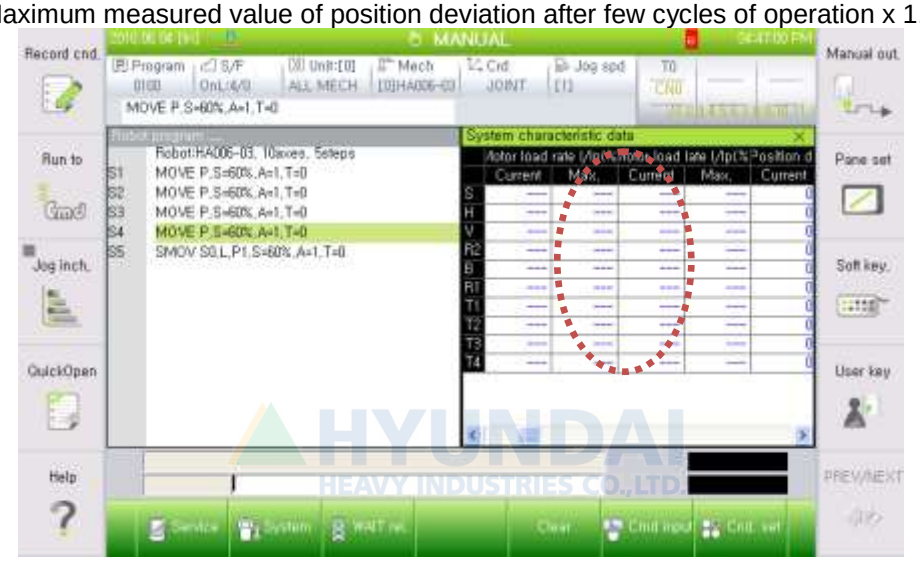


Figure 1.178 Monitoring Screen of the Maximum Measured Position Deviation Value from TP

Figure 1.179 Modifying Screen of Position Deviation Value from TP

(6) Please replace other components.
Replace the component in order of Servo Board → Servo Drive Unit → Motor to confirm the occurrence of an error'.

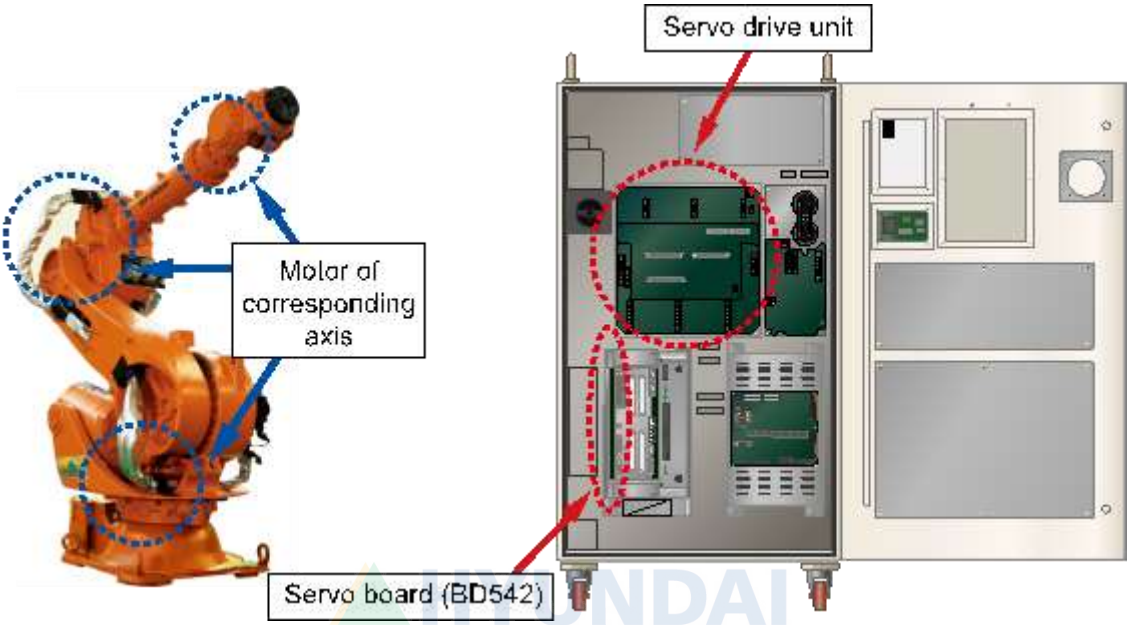


Figure 1.180 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.58. E02631 (○ axis) Position deviation exceeded for individual speed

Previous error code: E0117 (○ axis) Position deviation set value exceeded

1.1.58.1. Outline

The position deviation that will occur during jog operation or low-speed operation is larger than the position deviation set value. If the difference between the location of moving command and the actual location is too large during the operation of robot that controlled by the servo, the servo board will detect an error (during servo operation) and immobilize the robot.

1.1.58.2. Causes and examine methods

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

(2) Check if the brake release works properly.
- Examine if the brake release of each axis has an error
- Examine the error on brake's power supply.

(3) Examine the wiring status.

(4) Check if the rated load is used.

(5) Position deviation setting level error.

(6) Please replace other components.

For more details about the checking methods, refer to "**E02630 (○ axis) Position deviation exceeded**".

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

1.1.59. E02632 (○ axis) Position deviation exceeded – brake voltage decreased

Previous error code: E0117 (○ axis) Position deviation set value exceeded

1.1.59.1. Outline

The position deviation is larger than the set value. If the difference between the location of moving command and the actual location is too large during the operation of robot that controlled by the servo, the servo board will detect an error (during servo operation) and immobilize the robot.
This error will occur when the position deviation is large and a drop in the brake voltage is detected.

1.1.59.2. Causes and examine methods

(1) Check if the brake release works properly.
- Examine if the brake release of each axis has an error
- Examine the error on brake's power supply.

(1) Check if the brake release works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

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

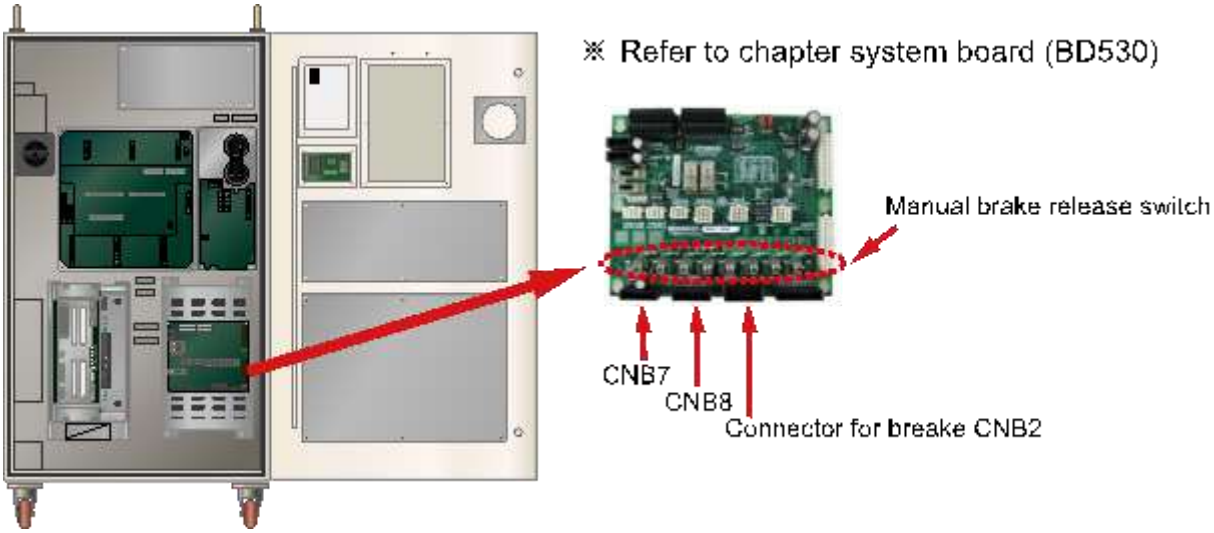
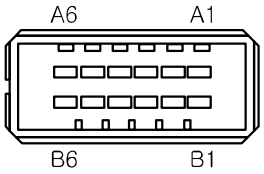


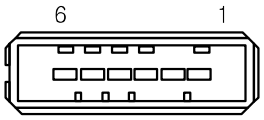
Figure 1.181 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, and CNB8 connector) and use the manual brake switch for the brake voltage's output. Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.



CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.182 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1:Private input signal』 → 『Overload (Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

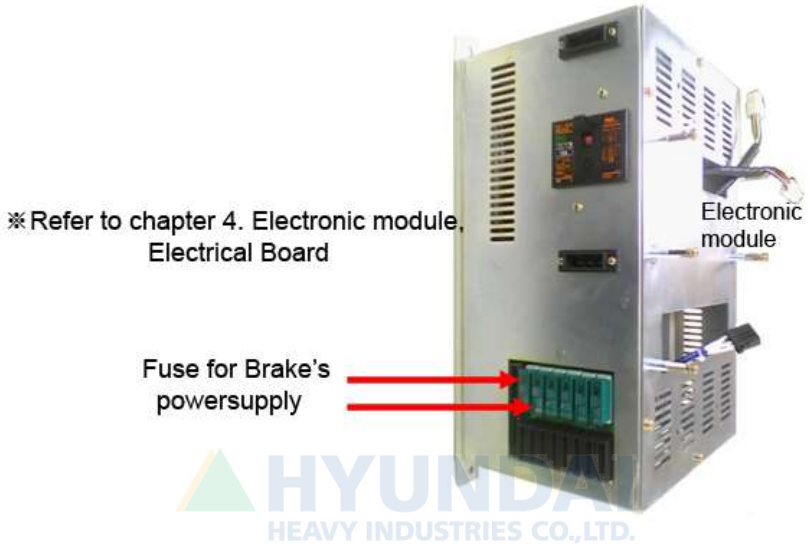


Figure 1.183 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

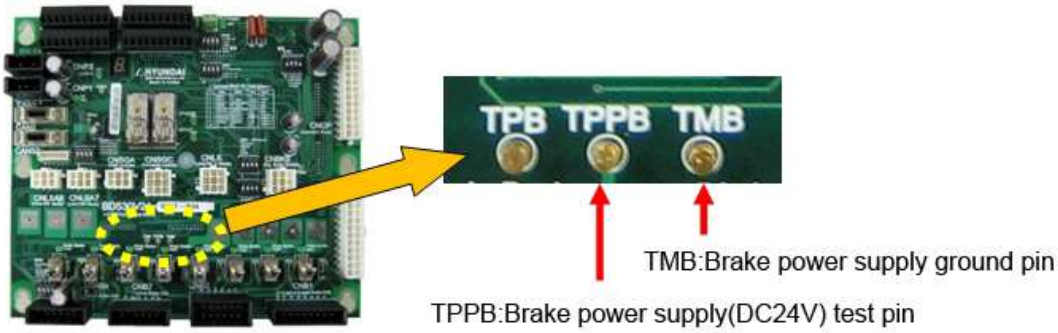


Figure 1.184 Brake Power Supply Test Pin

1.1.60. E02633 (○ axis) Position deviation exceeded – load estimation not executed

Previous error code: E0117 (○ axis) Position deviation set value exceeded

1.1.60.1. Outline

The position deviation is larger than the set value. If the difference between the location of moving command and the actual location is too large during the operation of robot that controlled by the servo, the servo board will detect an error (during servo operation) and immobilize the robot.
This error will occur when the position deviation is large and the load estimation is not executed.

1.1.60.2. Causes and examine methods

(1) Execute load estimation and then check if the error occurs again.

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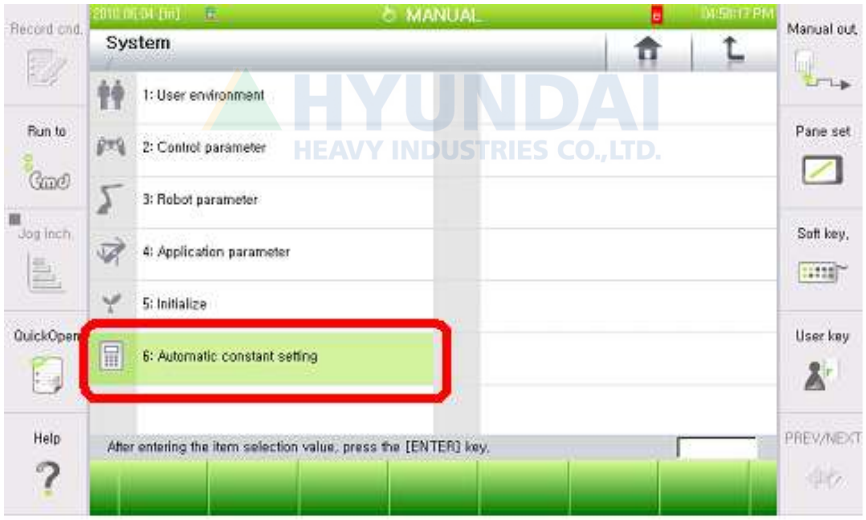
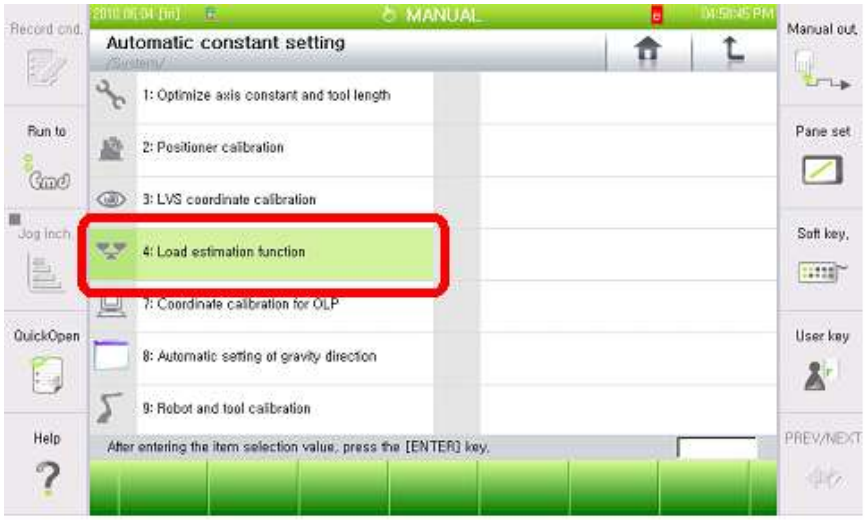
(1) Execute load estimation and then check if the error occurs again.

Using measuring equipment is recommended, but if it is not an option, load can be measured by using a 'load estimation function' from the controller. However this function only can measure the load of a tool that attached at the end of the Robot.

Method to estimate the load is as below.

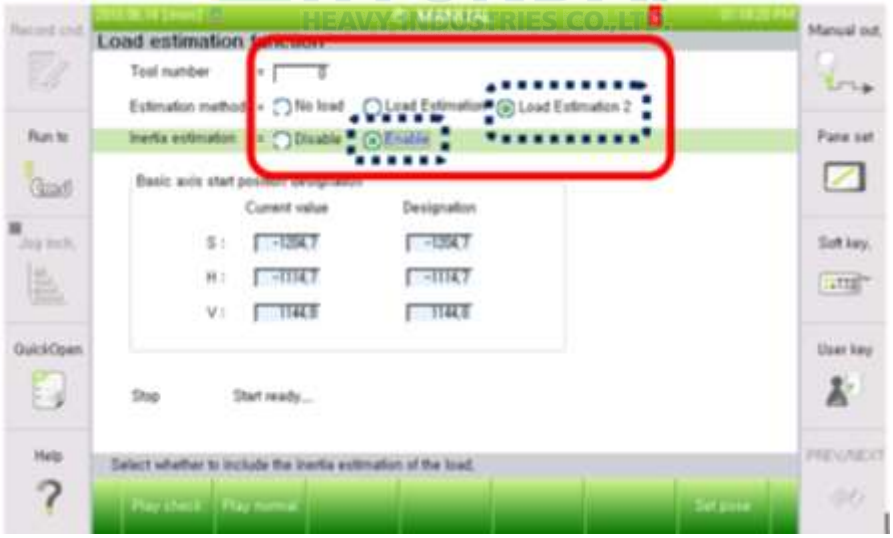
■ Enter to the load estimate function
『[F2]: System』 → 『6: Automatic constant setting』→ 『4: Load estimation function』



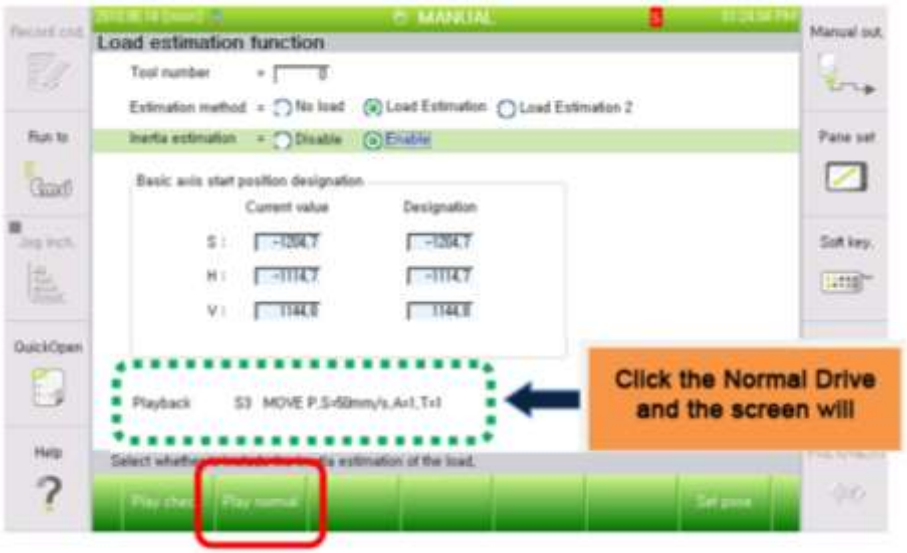


■ Select the tool number, estimation method, enable status of inertia estimation from the load estimation function.

- Tool number to save after the load estimation
- Estimation method: Load estimation 2
- Inertia estimation: Enable



- Click Normal Drive to execute.
  Press the Motor On switch, and hold the deadman and click the Play Normal.



Decide if you want to register the result of load estimation.

- Once the load estimation drive has completed, the estimated result will be displayed on the screen.

If you press the close button, a message box will appear to ask you if you want to reflect the result. If you click 'yes' it will be saved.

1.1.61. E02634 (○ axis) Position deviation exceeded – low-temperature friction increased

Previous error code: E0117 (○ axis) Position deviation set value exceeded

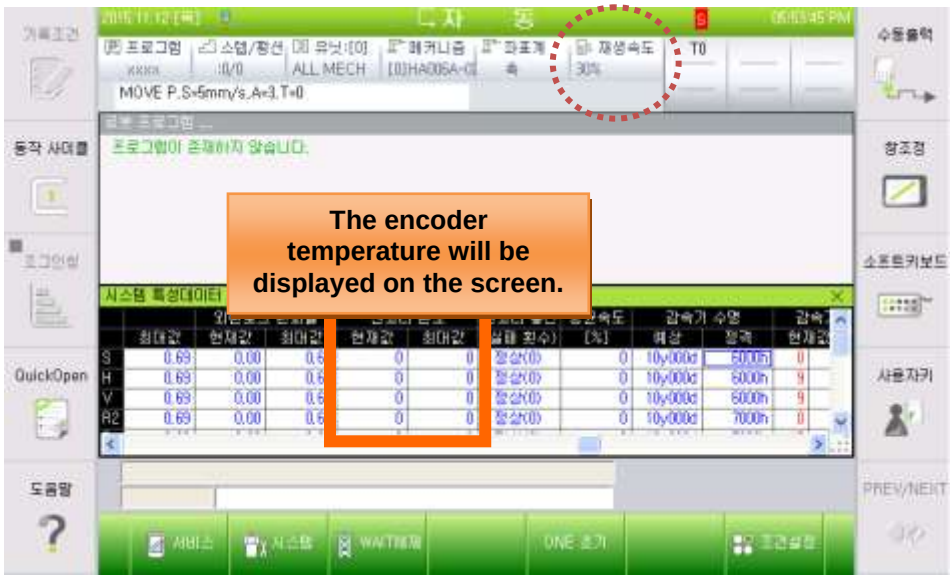
1.1.61.1. Outline

Position (speed) deviation exceeds the set value. If the difference between the location of moving command and the actual location is too large during the operation of robot that controlled by the servo, the servo board will detect an error (during servo operation) and immobilize the robot.
This error will occur when the position deviation is large and the encoder temperature is low.
In normal low temperatures (encoder, 5℃ or lower), additional torque is required, as compared with normal conditions, because the friction element increases due to the viscosity of grease. Operating the robot at a high speed in this condition could cause this error.

1.1.61.2. Causes and examine methods

(1) Drive the robot at a low speed (30% of the playback speed or lower) until the encoder temperature reaches the normal value (about 15℃ or higher).

(1) Drive the robot at a low speed (30% of the playback speed or lower) until the encoder temperature reaches the normal value (about 15℃ or higher).



1.1.62. E02650 (○ axis) Motor overloading

Previous error code: E0119 (○ axis) Motor overloading

1.1.62.1. Outline

Motor or the drive unit is being overloaded. If motor or the drive unit is overloaded, the servo board detects an error and immobilizes the robot.

1.1.62.2. Causes and examine methods

(1) Please check if the Robot is loaded within its rated load.

(2) Please examine if there is a possible collision point during the Robot's operation.

(3) Please check if the axis brake works properly.

(4) Please replace the Servo Board and examine an error.

(5) Please examine if the Drive Unit operates normally.

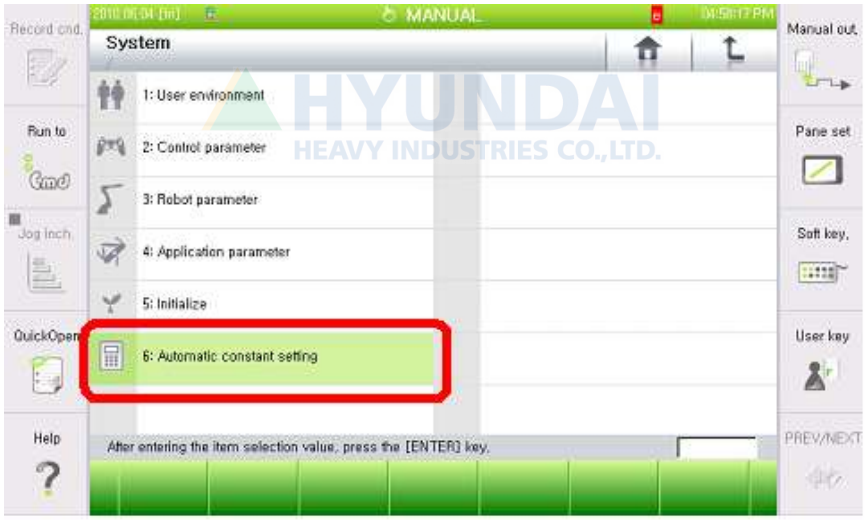
(1) Please check if the Robot is loaded within its rated load.

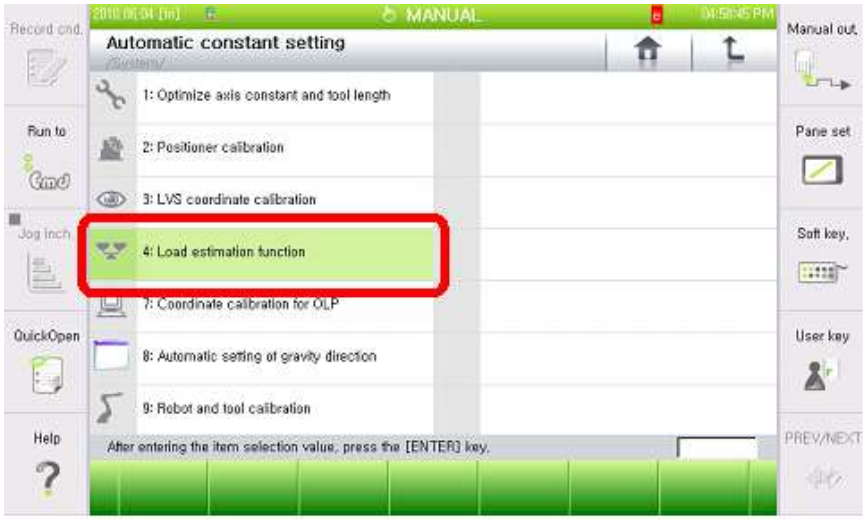
Please check if the Robot is loaded within its rated load. This error may occur if the load exceeds Robot's specification (load does not only include the tools that can be attached at the end of Robot, but also include all the cables and other components that can be attached to the Robot.

Using measuring equipment is recommended, but if it is not an option, load can be measured by using a 'load estimation function' from the controller. However this function only can measure the load of a tool that attached at the end of the Robot.

Method to estimate the load is as below.

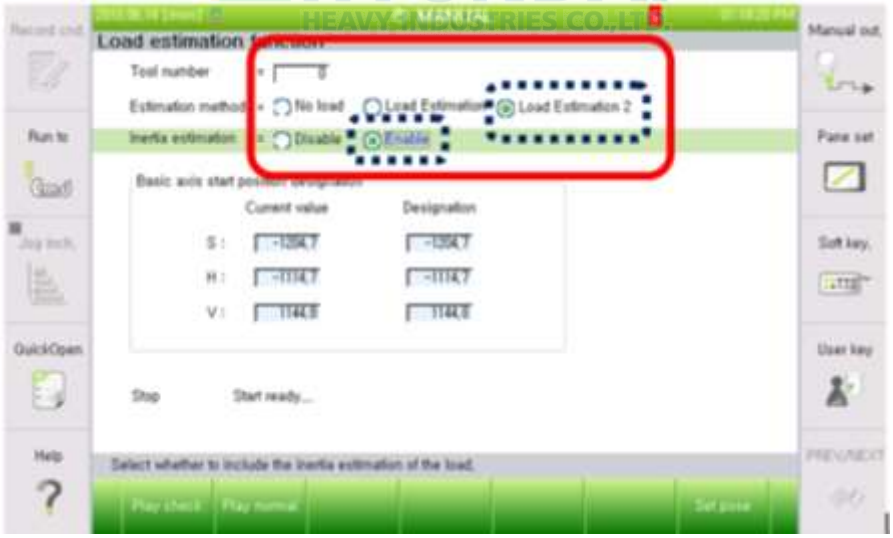
■ Enter to the load estimate function
『[F2]: System』 → 『6: Automatic constant setting』→ 『4: Load estimation function』



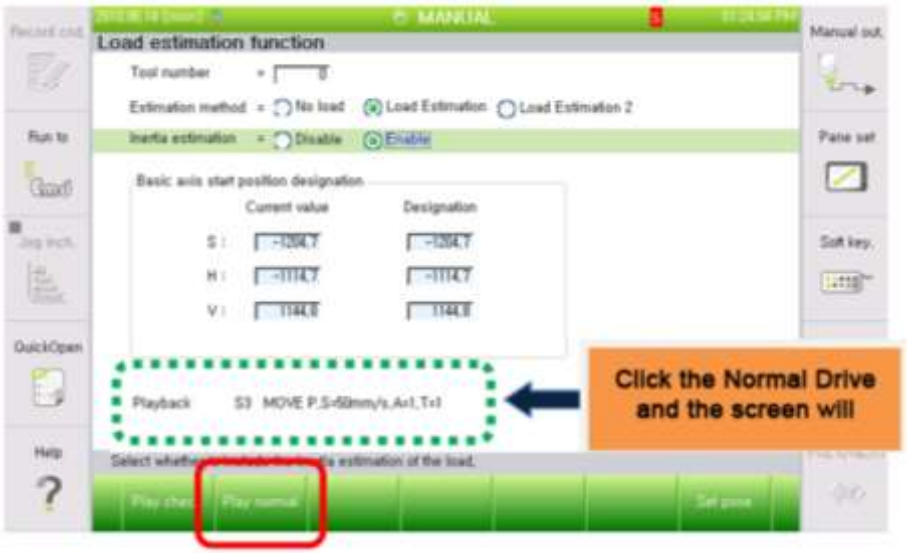


■ Select the tool number, estimation method, enable status of inertia estimation from the load estimation function.

- Tool number to save after the load estimation
- Estimation method: Load estimation 2
- Inertia estimation: Enable



- Click Normal Drive to execute.
  Press the Motor On switch, and hold the deadman and click the Play Normal.



Decide if you want to register the result of load estimation.

- Once the load estimation drive has completed, the estimated result will be displayed on the screen.

If you press the close button, a message box will appear to ask you if you want to reflect the result. If you click 'yes' it will be saved.

(2) Please examine if there is a possible collision point during the Robot's operation.
Please check if there is a point where the Robot may be interfered or have a collision in the operation area. This error may occur if the Robot is interfered by other equipment. In that case, please modify the job program so the interference will not occur.

(3) Please check if the axis brake works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

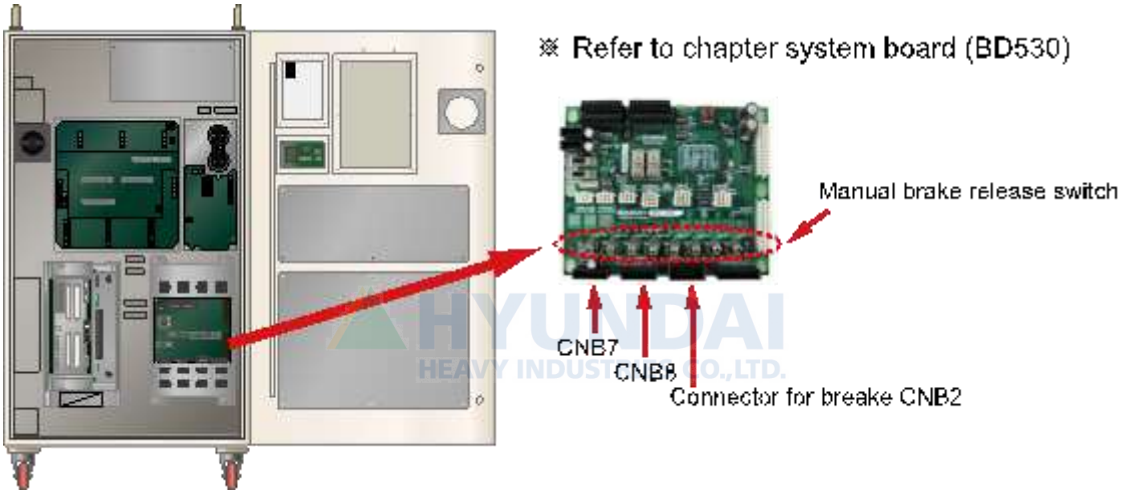
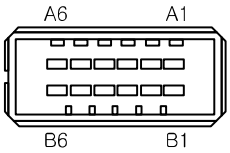


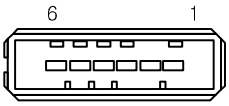
Figure 1.185 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, CNB8 connector) and use the manual brake switch for the brake voltage's output.
Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.



CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.186 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1: Private input signal』 → 『Overload(Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

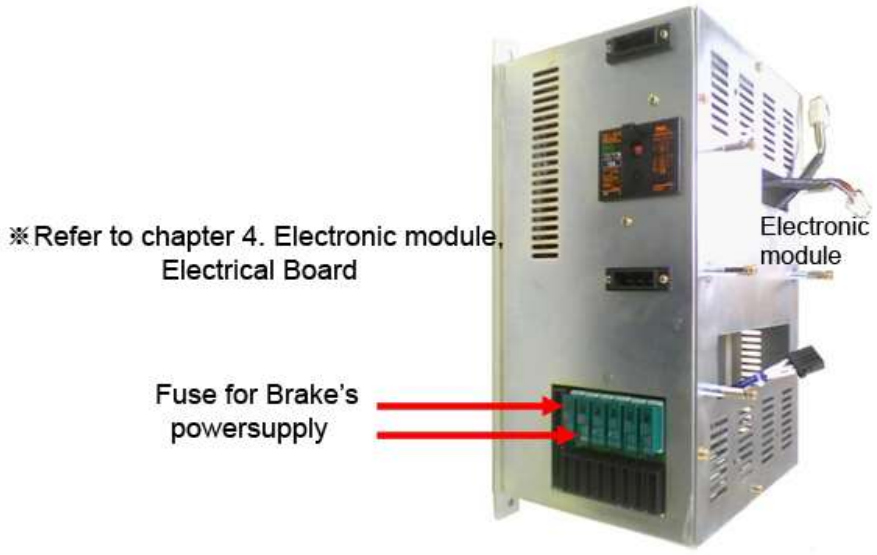


Figure 1.187 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

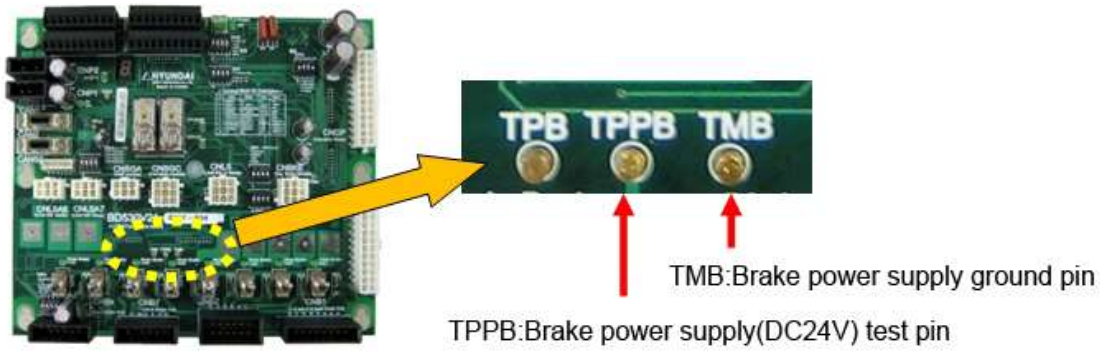


Figure 1.188 Brake Power Supply Test Pin

(4) Please replace the Servo Board and examine an error.
This error may occur if there is an error on the Servo Board. Please replace the board to check.

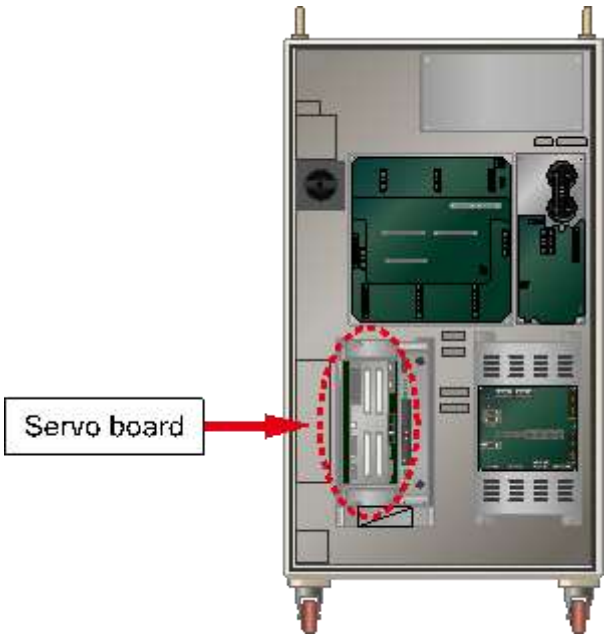


Figure 1.189 Replacing the servo board

(5) Please examine if the Drive Unit operates normally.

Please check if the Drive Unit of corresponding axis (Motor, Decelerator) works properly.

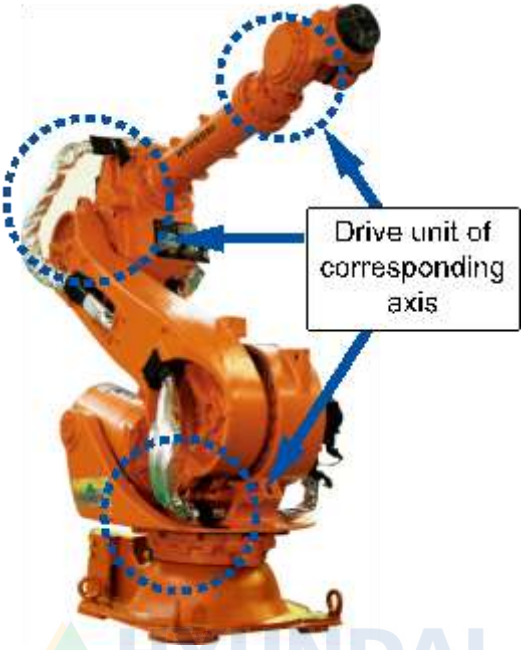


Figure 1.190 Check the normal operation of the drive unit

1.1.63. E02651 (○ axis) Motor overloading - brake voltage decreased

Previous error code: E0119 (○ axis) Motor overloading

1.1.63.1. Outline

Motor or the drive unit is being overloaded. If motor or the drive unit is overloaded, the servo board detects an error and immobilizes the robot.
This error will occur when brake voltage drop is detected while overloaded.

1.1.63.2. Causes and examine methods

(1) Check if the brake release works properly.
- Examine if the brake release of each axis has an error
- Examine the error on brake's power supply.

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(1) Check if the brake release works properly.
Brake release functions of the corresponding axis maybe have an error, or the release voltage of the brake release may have problem.

- Examine if the brake release of each axis has an error
  Please remove the motor's power supply (motor OFF) and check if you can release the brake of the axis with manual brake switch. You can confirm it with the sound of brake release from the motor.

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

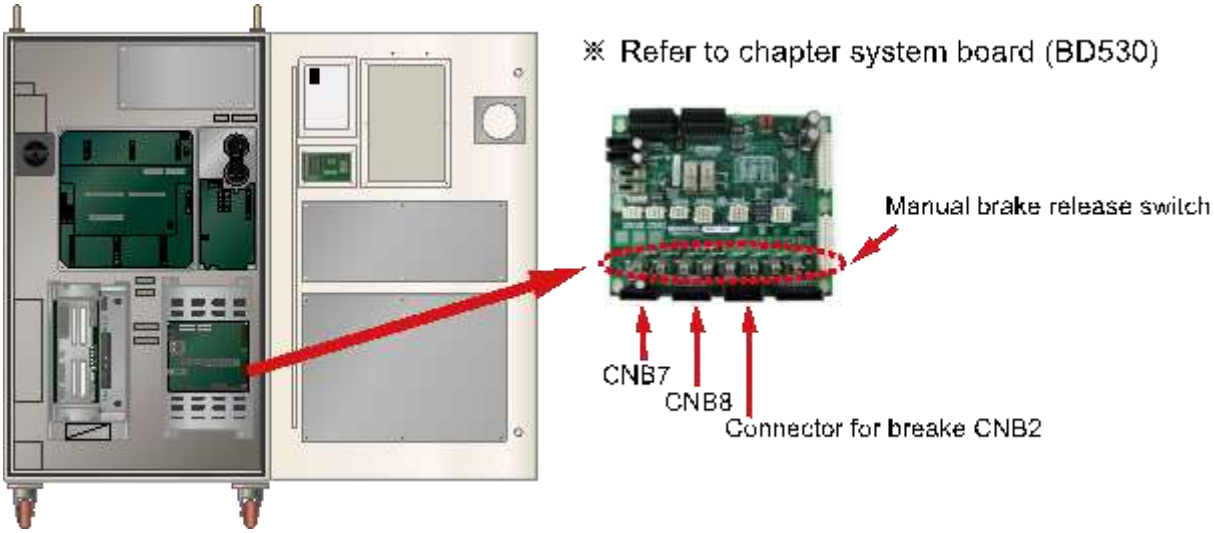
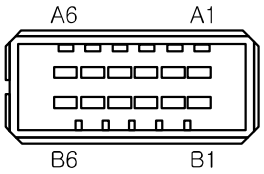


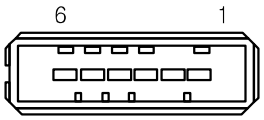
Figure 1.191 Location of the Manual Brake Release Switch

If the corresponding axis's brake cannot be released, output status of the brake release voltage in the System Board need to be examined. Please remove the brake wiring (CNB2, CNB7, and CNB8 connector) and use the manual brake switch for the brake voltage's output. Please measure the brake voltage of corresponding axis output (from the CNB2, CNB7, CNB8 connector) to check if it is over 20V. If there is an axis which has a voltage output under the 20V, System Board (BD530) is faulty. Please replace it.



CNB2

PIN	DESCRIPTION	PIN	DESCRIPTION
A1	BA1	B1	MB
A2	BA2	B2	MB
A3	BA3	B3	/R_FAN
A4	BA4	B4	MONL
A5	BA5	B5	PREPB
A6	BA6	B6	/TS



CNB7

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA7	4	/TS
2	PREPB	5	-> Key Pin
3	MB	6	/TS7

CNB8

PIN	DESCRIPTION	PIN	DESCRIPTION
1	BA8	4	/TS7
2	PREPB	5	/TS8
3	MB	6	-> Key Pin

Figure 1.192 Pin Locations of CNB2, CNB7 Connectors

- Examine the error on brake's power supply.
  If "E0012 Brake power error" message is displayed at the same time, there is an error on Brake's power supply unit. From TP, please access 『[F1]: Service』 → 『1: Monitoring』 → 『2: Input/Output signal』 → 『1:Private input signal』 → 『Overload (Brake Power supply)』. If it is highlighted as yellow, the fuse for Brake (in the Electrical Module)'s power supply has been disconnected. Please replace the fuse.

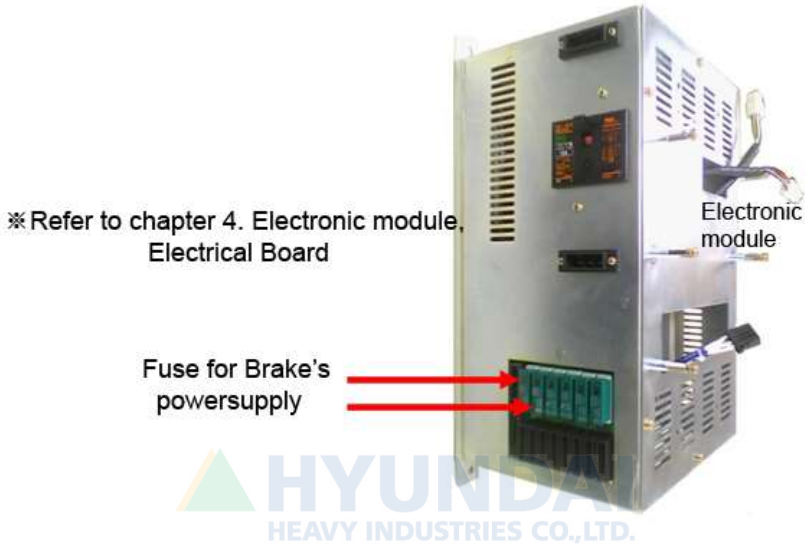


Figure 1.193 Electronic Module

If the fuse is normal, please measure the Brake power supply (DC24V) from the System Board. There are 3 test pins at the center of the board. Use the TMB as a reference terminal and the TPPB terminal value should be over DC20V. If it is below 20V, the power supply unit that generates the power for the brake has an error. Please replace the Electrical Module.

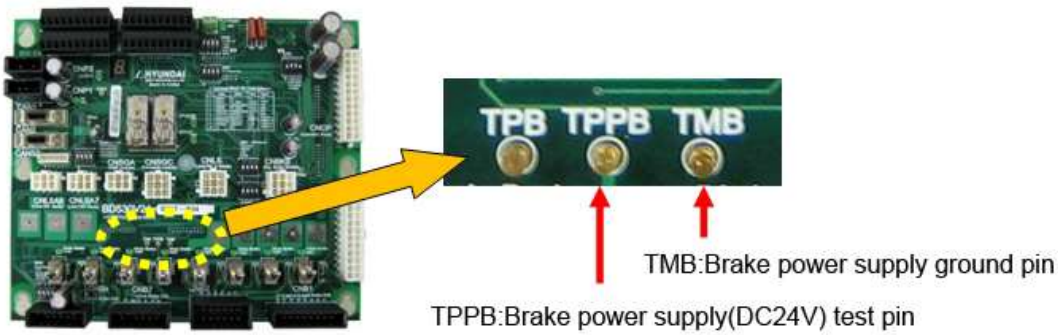


Figure 1.194 Brake Power Supply Test Pin

1.1.64. E02652 (○ axis) Motor overloading - load estimation not executed

Previous error code: E0119 (○ axis) Motor overloading

1.1.64.1. Outline

Motor or the drive unit is being overloaded. If motor or the drive unit is overloaded, the servo board detects an error and immobilizes the robot.
This error will occur when load estimation is not executed while overloaded.

1.1.64.2. Causes and examine methods

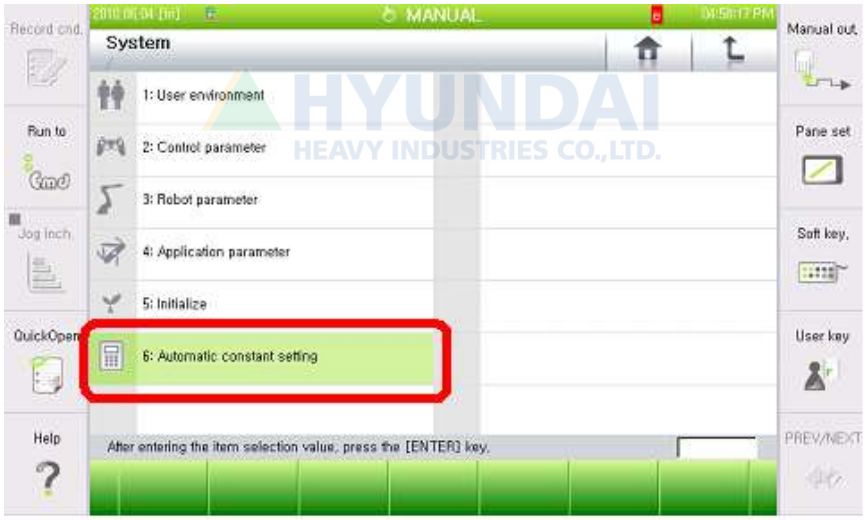
(1) Execute load estimation and then check if the error occurs again.

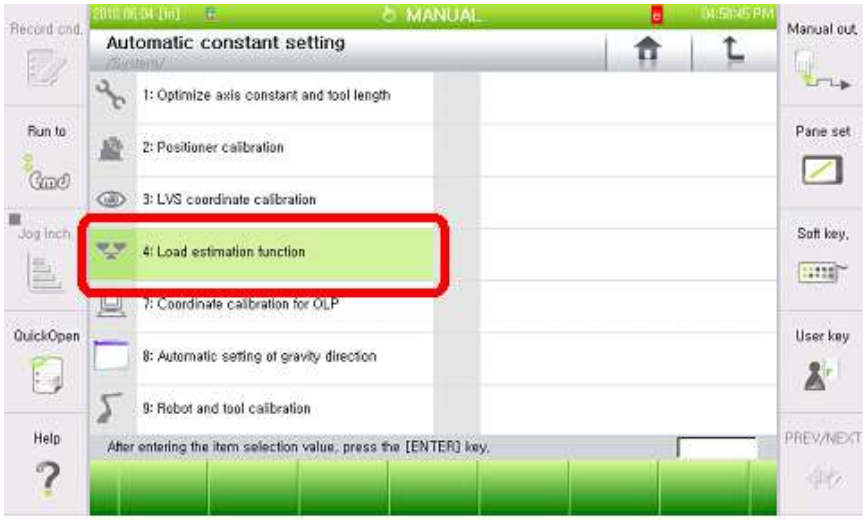
(1) Execute load estimation and then check if the error occurs again.

Using measuring equipment is recommended, but if it is not an option, load can be measured by using a 'load estimation function' from the controller. However this function only can measure the load of a tool that attached at the end of the Robot.

Method to estimate the load is as below.

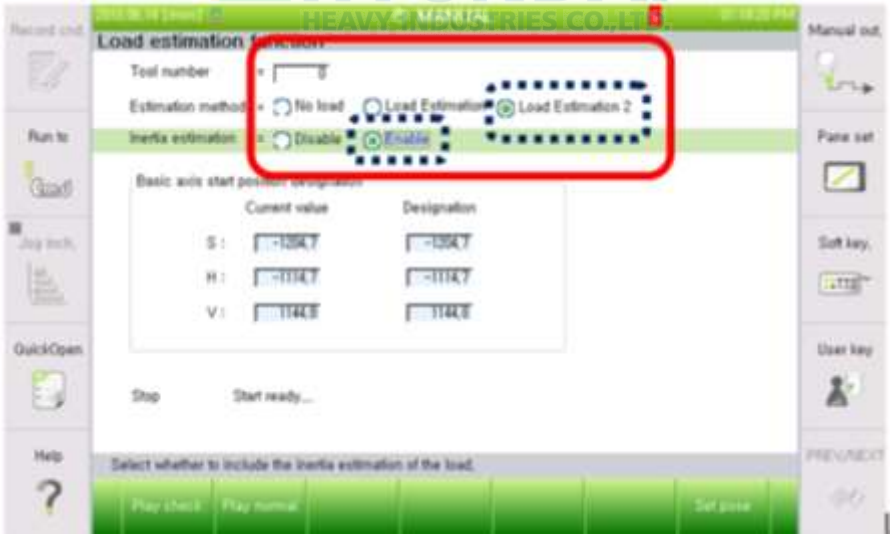
■ Enter to the load estimate function
『[F2]: System』 → 『6: Automatic constant setting』→ 『4: Load estimation function』



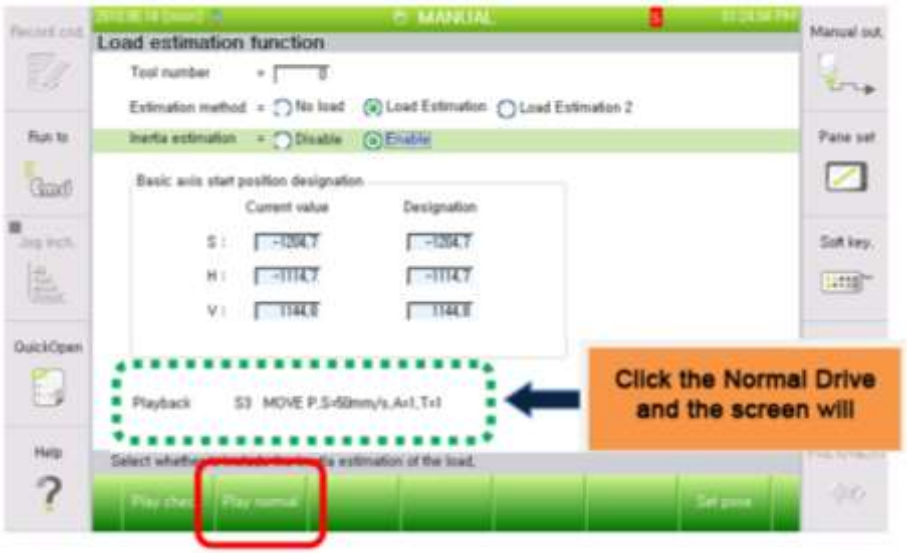


■ Select the tool number, estimation method, enable status of inertia estimation from the load estimation function.

- Tool number to save after the load estimation
- Estimation method: Load estimation 2
- Inertia estimation: Enable



- Click Normal Drive to execute.
  Press the Motor On switch, and hold the deadman and click the Play Normal.



Decide if you want to register the result of load estimation.

- Once the load estimation drive has completed, the estimated result will be displayed on the screen.

If you press the close button, a message box will appear to ask you if you want to reflect the result. If you click 'yes' it will be saved.

1.1.65. E02653 (○ axis) Motor overloading – low-temperature friction increased

Previous error code: E0119 (○ axis) Motor overloading

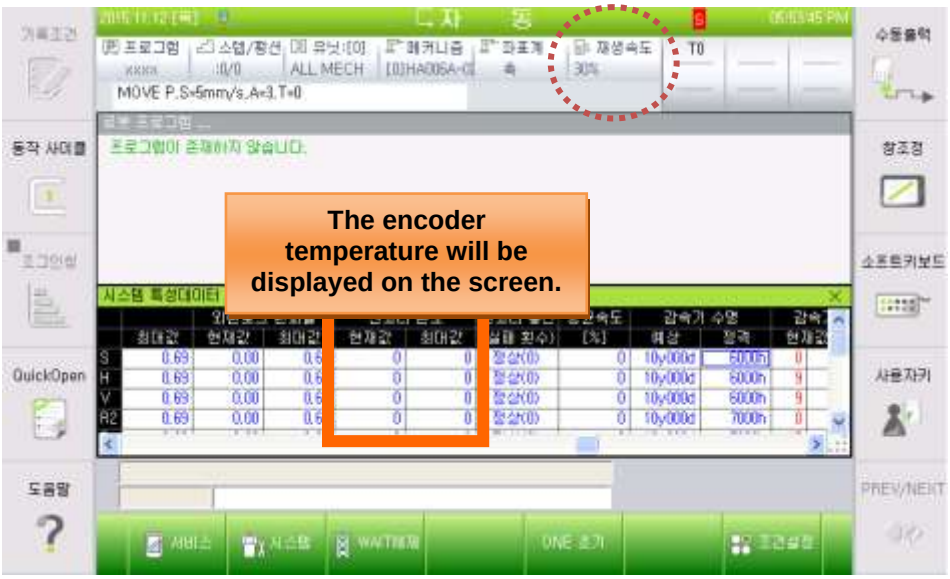
1.1.65.1. Outline

Motor or the drive unit is being overloaded. If motor or the drive unit is overloaded, the servo board detects an error and immobilizes the robot.
This error will occur when the encoder temperature is low while overloaded.
In normal low temperatures (encoder, 5℃ or lower), additional torque is required, as compared with normal conditions, because the friction element increases due to the viscosity of grease. Operating the robot at a high speed in this condition could cause this error.

1.1.65.2. Causes and examine methods

(1) Drive the robot at a low speed (30% of the playback speed or lower) until the encoder temperature reaches the normal value (about 15℃ or higher).

(1) Drive the robot at a low speed (30% of the playback speed or lower) until the encoder temperature reaches the normal value (about 15℃ or higher)



1.1.66. E02690 Servo ON limit time exceeded

Previous error code: E0122 Servo ON limit time exceeded

1.1.66.1. Outline

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

1.1.66.2. Causes and examine methods

(1) Please examine if the main board and the servo board are installed properly.
- Examine if the board is installed properly.
- Examine if board is faulty.

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(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.195 Methods for inserting a USB into the teach pendant

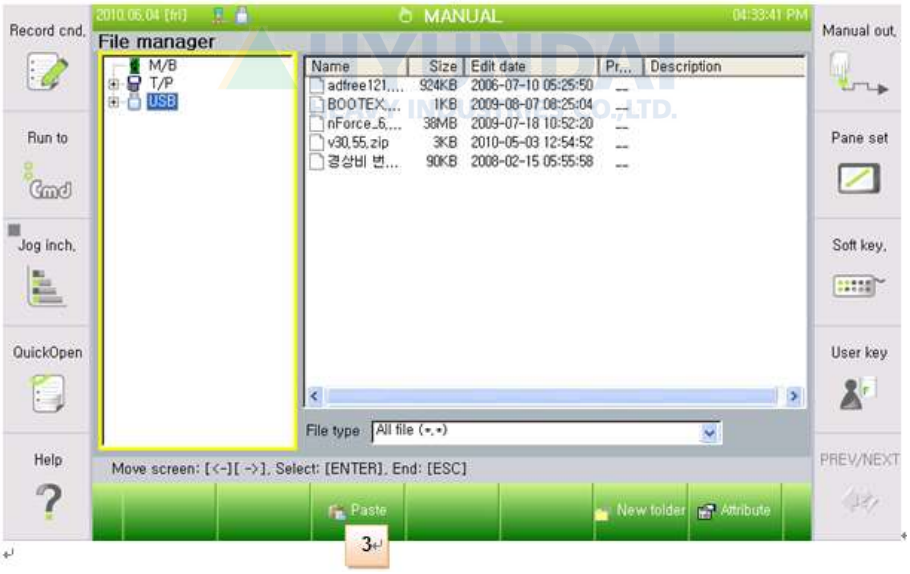
Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to

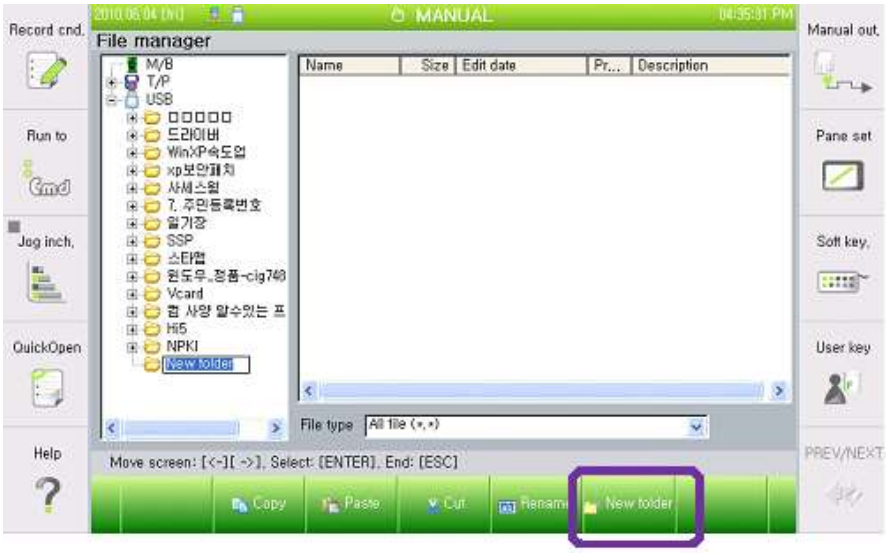
- Service
- 5. File manager

And the screen that is similar to windows explorer will be displayed.

At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Examine if the board is installed properly
  Please remove the Main Board and the Servo Board from the Rack and re-install them again.

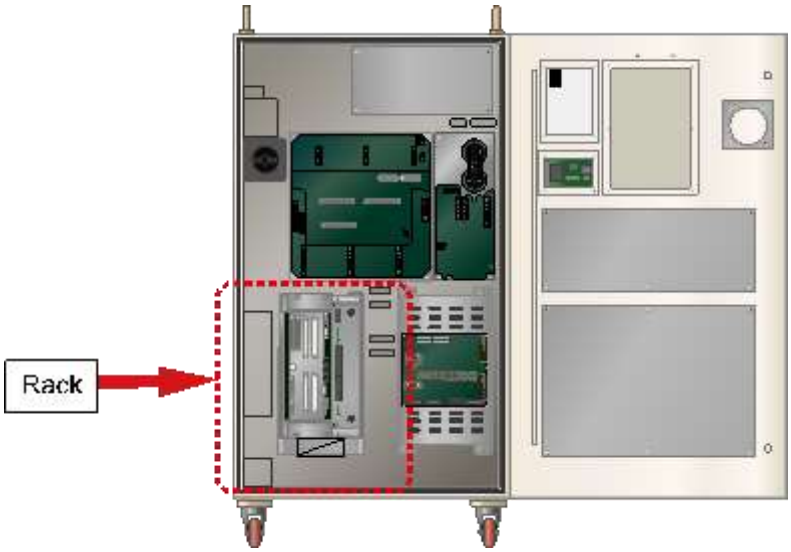


Figure 1.196 Location of Rack Inside of the Controller

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

1.1.67. E02670 (○ axis) Command value error

Previous error code: E0133 (○ axis) Command value error

1.1.67.1. Outline

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

1.1.67.2. Causes and examine methods

(1) Please examine if the main board and the servo board are installed properly.
- Examine if the board is installed properly.
- Examine if board is faulty.

(2) Examine if there is a job program that operates a Robot rapidly.

(1) Please examine if the Main Board and the Servo Board are installed properly.
This error may be caused by a communication problem if the Main Board and the Servo Board is not installed properly on a rack, or the board has an error.

Warning
In order to protect the previous job programs, please back up all the files of Main board to the USB memory before you remove the board from the Rack.

Method to back up the files from Main Board to USB memory is as below.

Figure 1.197 Methods for inserting a USB into the teach pendant

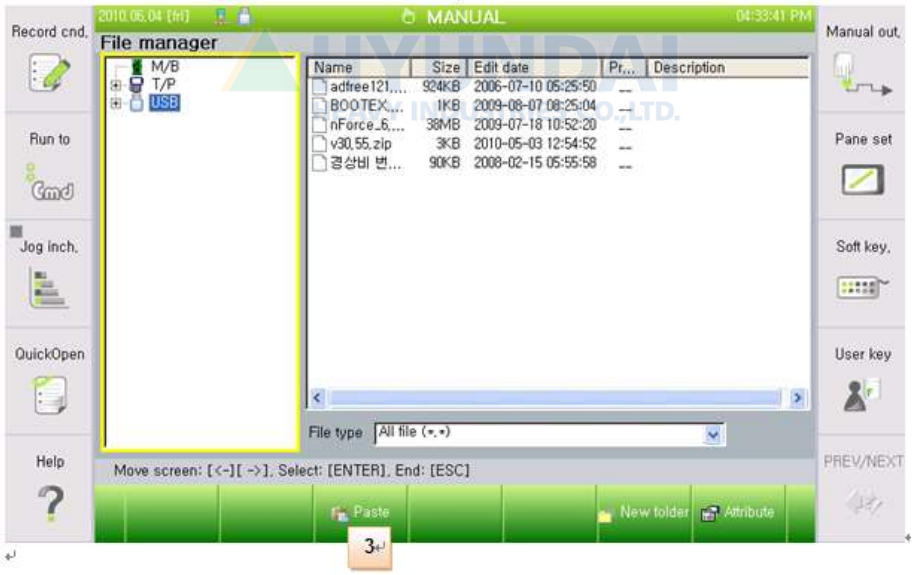
Once the USB is recognized by TP, the below icon will be displayed on a screen.

To back up the files enter to

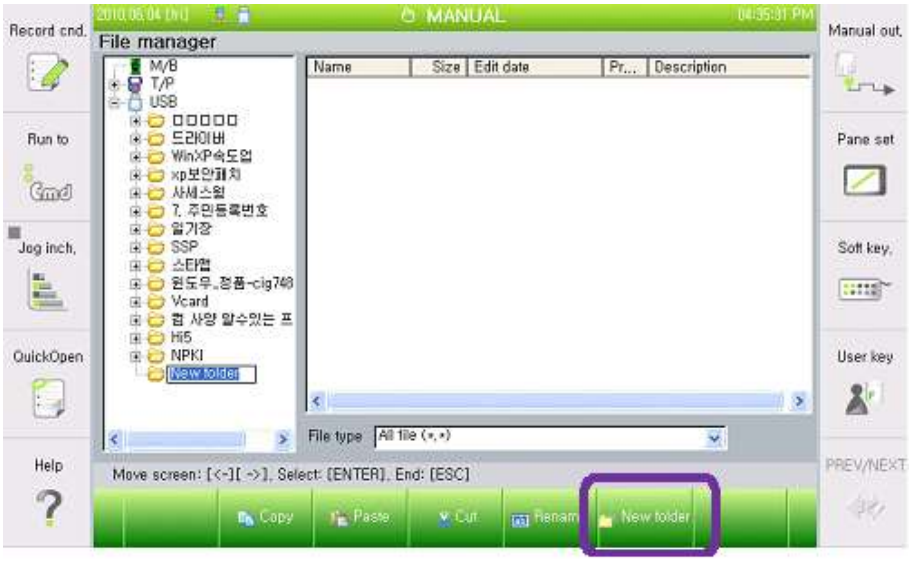
- Service
- 5. File manager

And the screen that is similar to windows explorer will be displayed.

At this stage, please copy the files shown in M/B and move them to USB.



You may create a new folder on USB, or can rename the folder by using the soft keyboard just like the windows explorer.



- Examine if the board is installed properly.
  Please remove the Main Board and the Servo Board from the Rack and re-install them again.

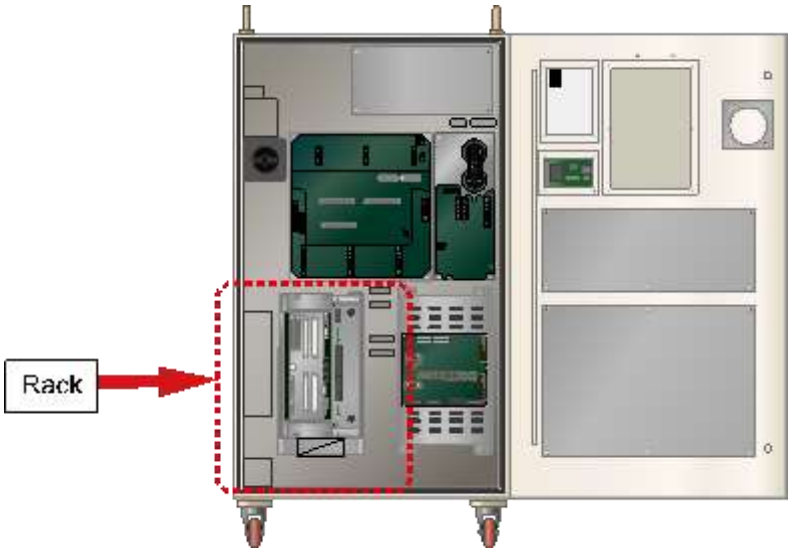


Figure 1.198 Location of Rack Inside of the Controller

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

(2) Examine if there is a job program that operates a Robot rapidly

Please check if the error occurs at a point where the Robot's motion changes rapidly. If the error occurs during the rapid motion, modification of job program is required.

The reason that this error occurs during the rapid motion is as below. During the execution of job program, Robot's position may be twisted in order to move a short distance. At that point, the speed of Robot's axis suddenly increases, and the error may occur if the Servo Board follows the movement. In order to resolve this, please modify the Teaching point of the location (where the position changes rapidly) or make changes on the position of Robot.

1.1.68. E02680 (○ axis) Maximum speed exceeded

Previous error code: E0134 (○ axis) Maximum speed exceeded

1.1.68.1. Outline

Speed of Robot's axis exceeded the maximum speed limit while an operation. An error will be generated and the Robot will be immobilized since the Robot is not being controlled normally.
When the Main Board sends a command to the Servo Board, it will send a limited command so that the Robot will not exceed the maximum speed limit. Maximum speed exceeded error may occurs if the Robot's speed triggers an overshoot because the Robot could not follow the command.

1.1.68.2. Causes and examine methods

(1) Please check if the tool data has entered correctly.

(2) Please check if the position of Robot is close to the singular point.

(3) Please check the setting value of condensation acceleration/deceleration parameter and the load factor.

(4) Please adjust the job program.

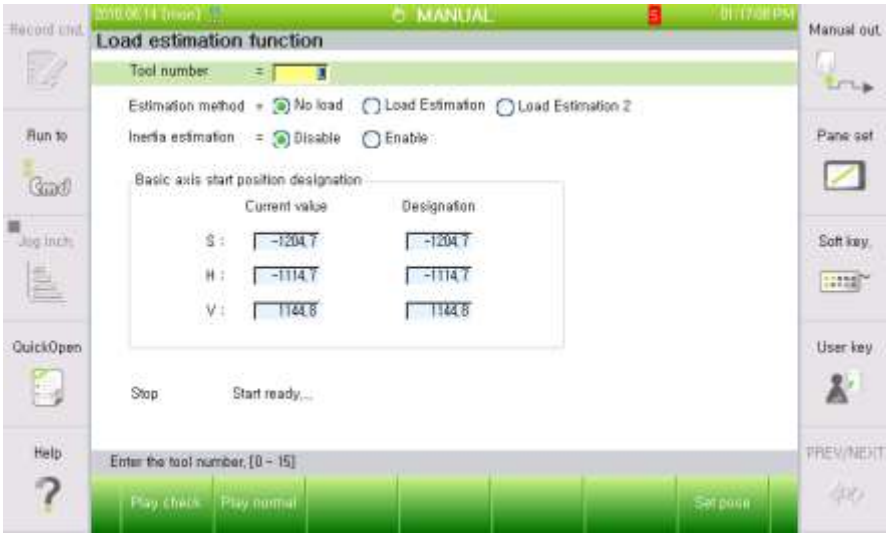
(1) Please check if the tool data has entered correctly.

If the weight or the inertia of tool is different from the registered value at the controller, Robot's control performance will be reduced and the maximum speed limit exceeded error can occur. Tool's weight and the inertia can be registered from the below menu according to the number of tools.

- System
- 3. Robot Parameter
- Tool data

You may use the load estimation function in order to set the weight of tool or the inertia automatically.

- System
- Automatic constant setting
- 4. Load estimation function



(2) Please check if the position of Robot is close to the singular point.

This error may occur, if you execute L interpolation or C interpolation instead of PtP interpolation near the position of singular point.

Singular point occurs when the B axis is close to 0 deg, or the center of wrist part is close to the spin central axis of S axis. When passing near the singular point is required, please change the corresponding step to PtP interpolation.

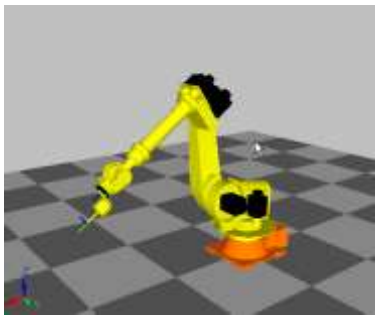


Figure 1.199 Axis B Singular Point

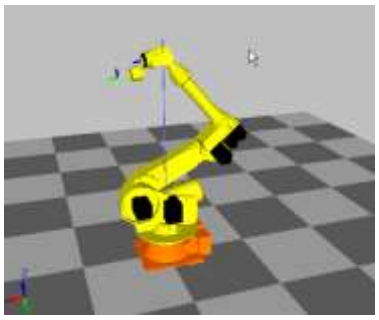


Figure 1.200 Axis S Singular Point

(3) Please check the setting value of condensation acceleration/deceleration parameter and the load factor.

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

- System
- 3. Robot Parameter
- 34. Acceleration /Deceleration Parameter

(4) Please adjust the job program.

Please make changes of conditions (from the job program) on a corresponding step, or the one step prior to it. Firstly, try "Acc=0", secondly, reduce the step speed, and thirdly, add one more step on a movement routine.

1.1.69. E02780 (○ axis) Impossible to sustain the servo lock – problem with the wiring and current generation

Previous error code: E0165 (○ axis) Impossible to sustain the servo lock

1.1.69.1. Outline

Power for the drive of Motor or the drive unit is not being supplied. The current that generated by a Servo control for the Robot or drive unit's operation is not being supplied. For such cases, the Servo Board detects an error and the controller will stop the release of brake and block the current that supplied to the motor or the drive unit.

1.1.69.2. Causes and examine methods

(1) Examine the Motor power line.
- Check the wiring that connects the Robot and Controller.
- Check the Robot's internal wiring.
- Check the Controller's internal wiring.

(2) Examine the CNBS cable between the Controllers' internal Servo Board and the Servo AMP.

(3) Replace other components.

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(1) Examine the power line

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

Warning

Be cautious. Examination while the power is on may cause an electrocution.

- Check the wiring that connects the Robot and Controller

  Please remove the wirings that connect the controller, Robot or the drive unit to examine each phases (U, V, W) for ground, or a short circuit. If a short circuit is found, please replace the wire.

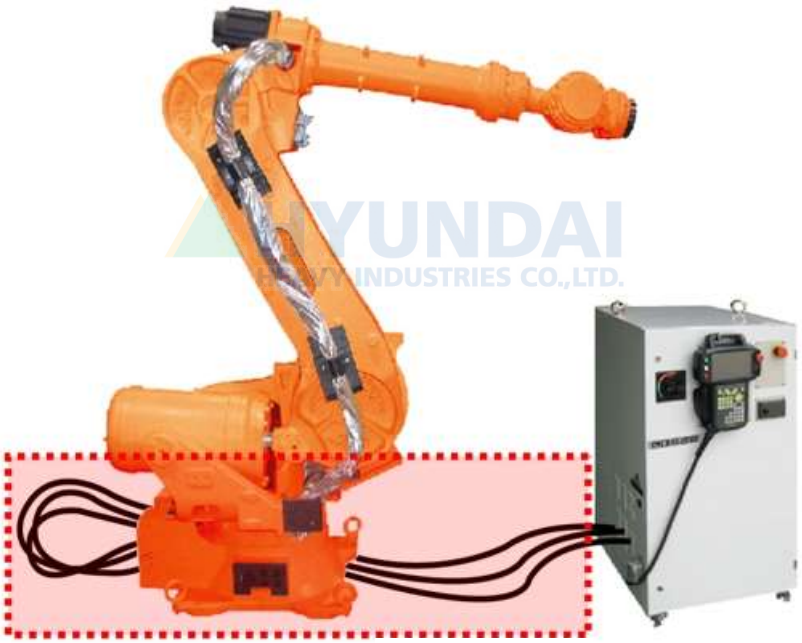

Figure 1.201 Basic Installation Diagram of the Robot and Control Period

■ Check the Robot's internal wiring.
Examine for a short circuit, faulty on a wiring that connected to Robot's internal motor is required.

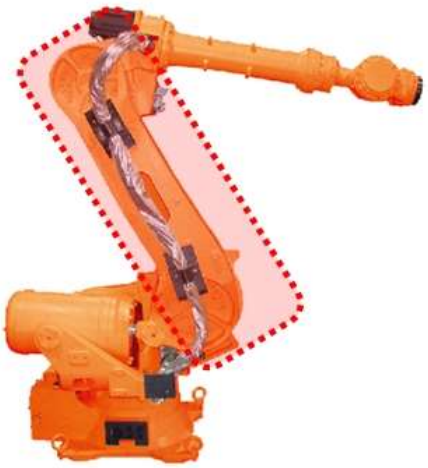

Figure 1.202 Robot's Internal Wiring

■ 제어기 내부 배선을 점검하십시오.
제어기 내부에 앰프와 설치되어 있는 배선 점검이 필요합니다.

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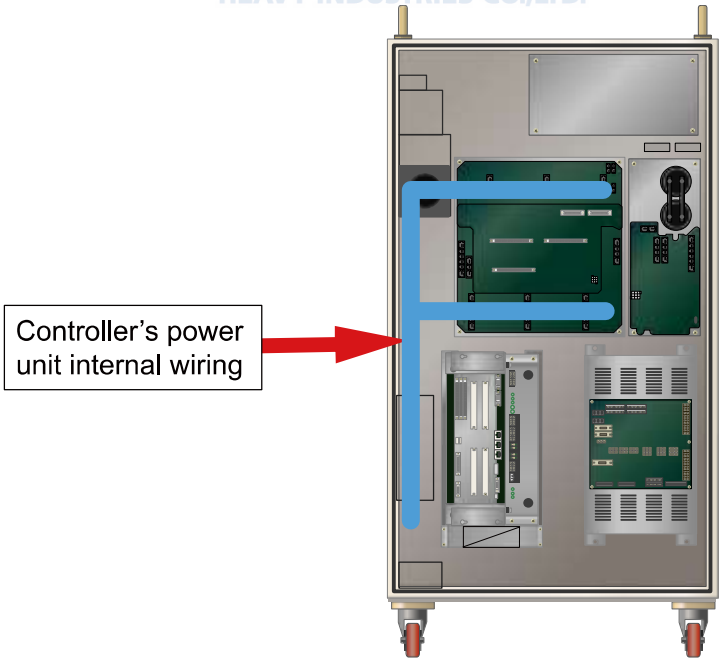


Figure 1.203 Controller internal side (Power unit)

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

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

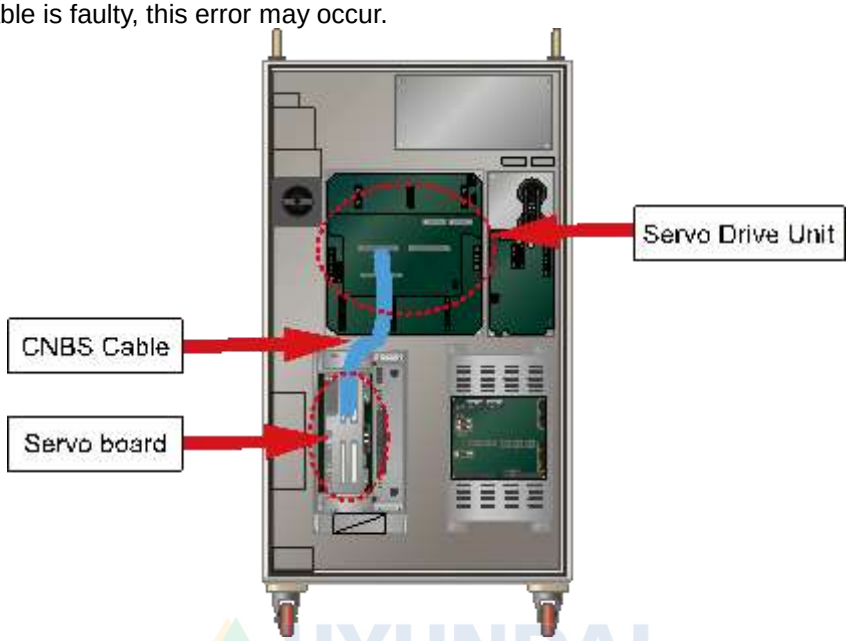


Figure 1.204 Controller internal side (CNBS Cable)

(3) Replace other components.

Replace the component in order of Servo Board → Servo Drive Unit → Motor to confirm the occurrence of an error'.

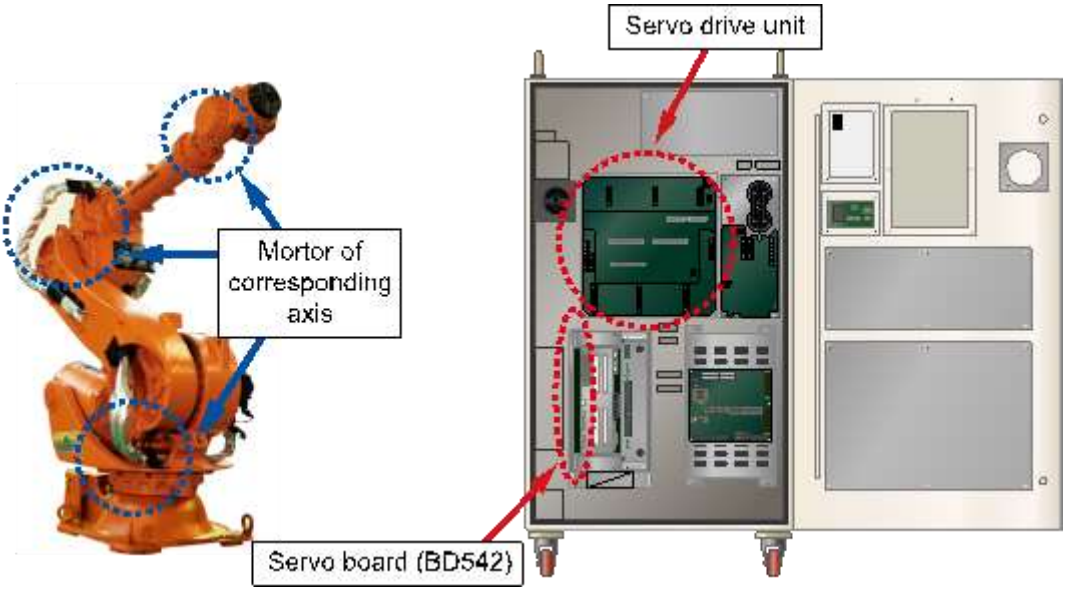


Figure 1.205 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.70. E02781 (○ axis) Impossible to sustain the servo lock – problem with the gain

Previous error code: E0165 (○ axis) Impossible to sustain the servo lock

1.1.70.1. Outline

The motor or the drive unit does not receive a supply of current for driving at a regulated or higher level. As the current, which was generated through the servo control to operate the robot or the drive unit, is not supplied at a regulated level, the servo board detects the error and the controller prevents the release of the brake, cutting off the current to the motor or the drive unit.
The general reason that the current does not flow at a regulated or higher level is because the current loop gain is low due to an error in robot registration (error with the motor registration information).

1.1.70.2. Causes and examine methods

(1) Check if the correct robot type is set.

(2) Examine the motor power line.
- Check the wiring that connects the robot and controller.
- Check the robot's internal wiring.
- Check the controller's internal wiring.

(3) Check the CNBS cable between the servo board and the servo AMP inside the controller.

(4) Replace other components.

(1) Check if the correct robot type is set.

Check if the type of the robot registered in the TP screen and the robot match.

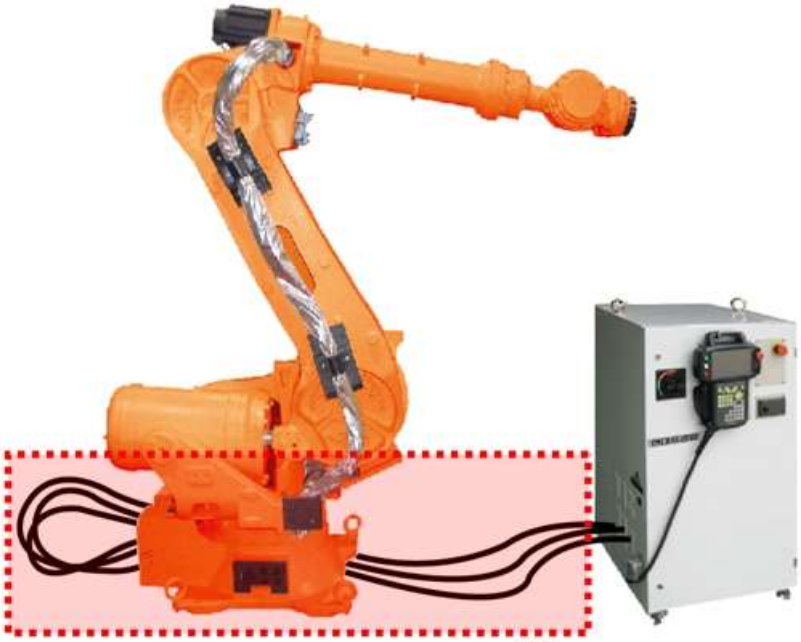
(2) Examine the power line

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

Warning

Be cautious. Examination while the power is on may cause an electrocution.

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



<External wiring>

Figure 1.206 Basic Installation Diagram of the Robot and Control Period

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- Check the Robot's internal wiring.
  Examine for a short circuit, faulty on a wiring that connected to Robot's internal motor is required.

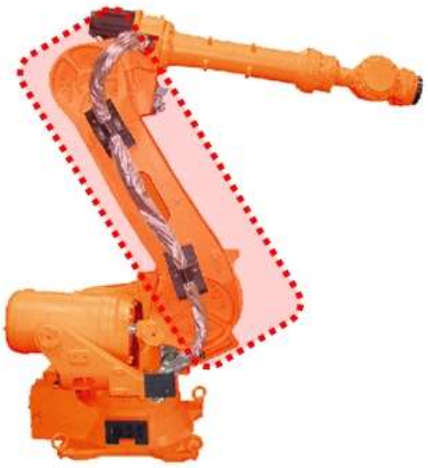

Figure 1.207 Robot's Internal Wiring

- Check the Controller's internal wiring.
  Examine on a controller's internal AMP and installed wiring is required.

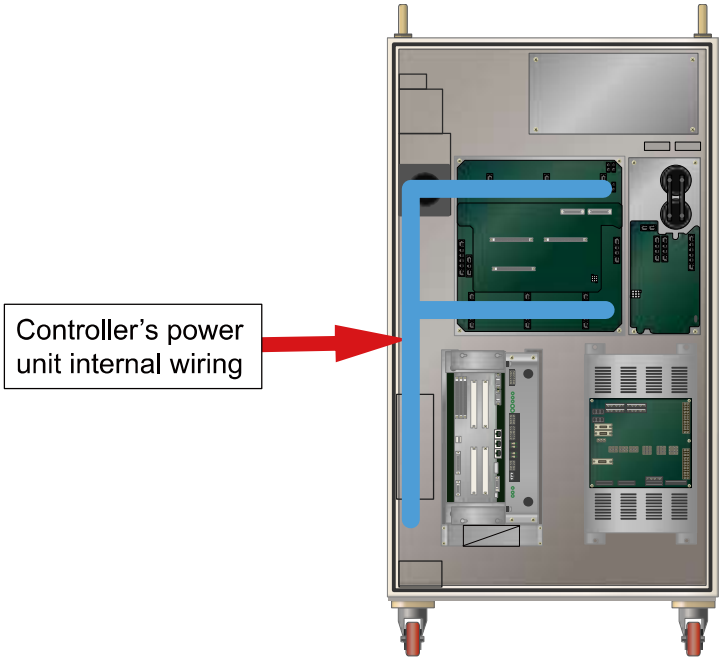

Figure 1.208 Controller internal side (Power unit)

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

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

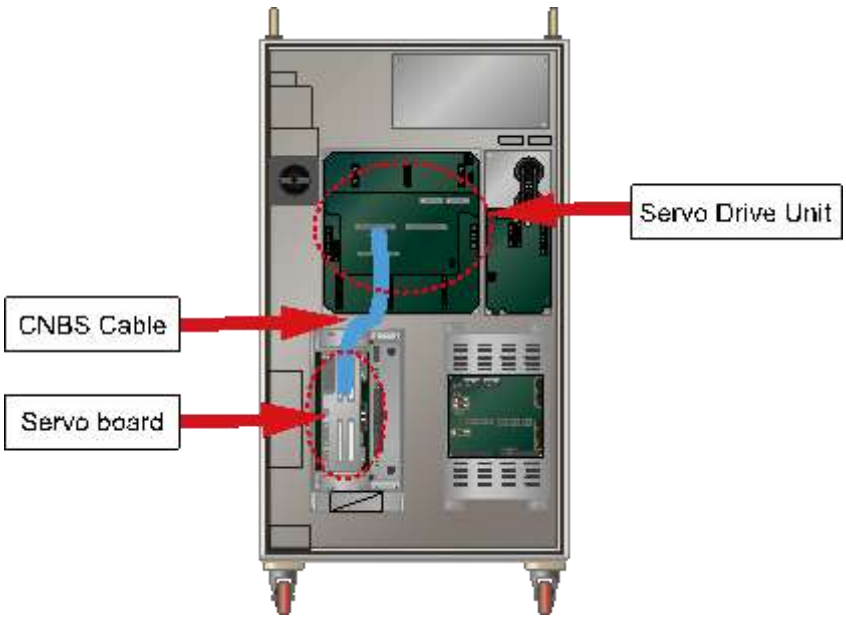

Figure 1.209 Controller internal side (CNBS Cable)

(4) Replace other components.

Replace the component in order of Servo Board → Servo Drive Unit → Motor to confirm the occurrence of an error'.

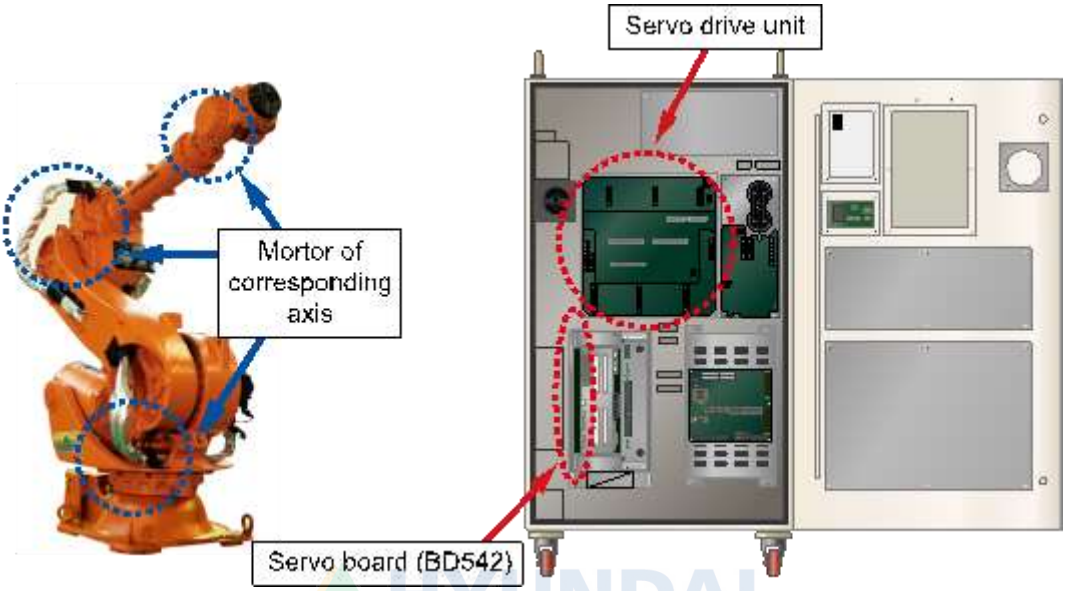

Figure 1.210 Replacing other parts (such as servo boards, servo drive units, and motors)

1.1.71. Instructions in examining the Controller's input voltage (Single-phase)

(1) Please check the voltage on the rating plate and the actual input voltage.
Please check if the voltage of controller's power supply is within the allowed voltage range as described on the rating plate. Allowed range of input voltage is within the 10% of describe value on the rating plate, and it should be over 198V (AC220V standard). Below describes how to measure the input voltage of controller. If the measured voltage is out of the allowed range, please examine the power supply units.

Warning
Please be cautious. Short-circuit between phases or with surrounding components can occur while measuring the high voltage.

- Hi5-C1X Controller: Measuring the Side terminal block's single-phase terminal (socket)

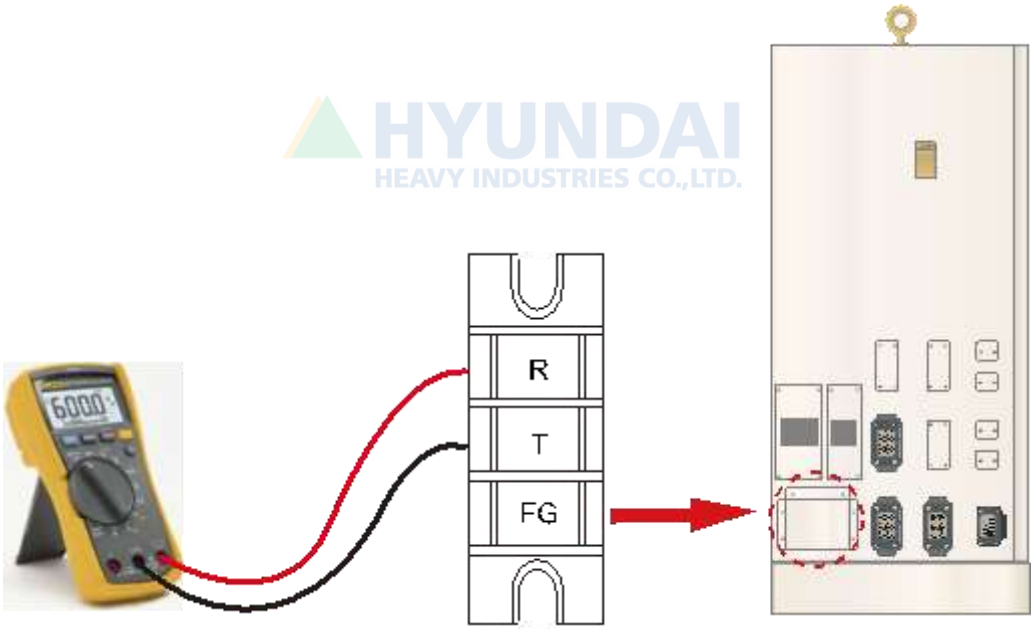

Figure 1.211 Hi5-C1X Controller's Single-Phase Power Terminal Block

■ Hi5-C2X Controller: Measuring the Side Terminal Block's Single-Phase Terminal (Socket)

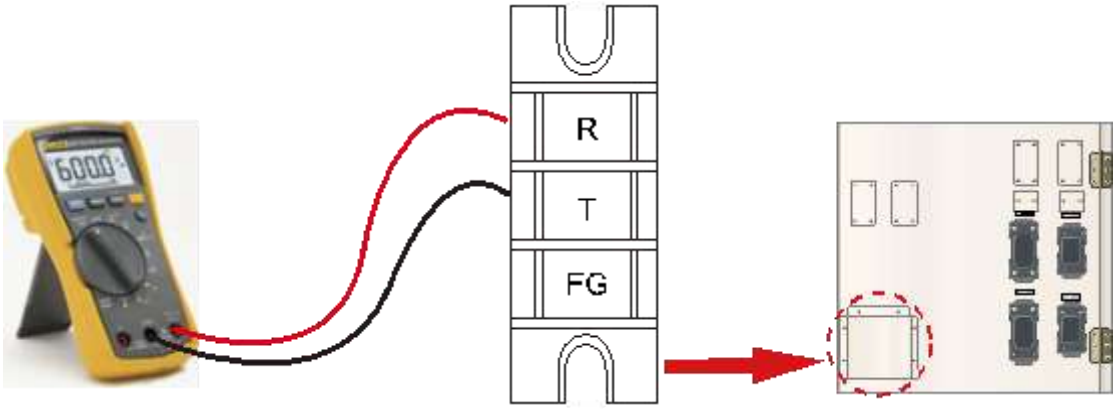

Figure 1.212 Hi5-C2X Controller's Single-Phase Power Terminal Block

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1.1.72. Instructions in examining the Controller's input voltage (3-phase)

(1) Please check the voltage on the rating plate and the actual input voltage.
Please check if the voltage of controller's power supply is within the allowed voltage range as described on the rating plate. Allowed range of input voltage is within the 10% of describe value on the rating plate, and it should be over 198V (AC220V standard). Below describes how to measure the input voltage of controller. If the measured voltage is out of the allowed range, please examine the power supply units.

- Measuring the power line of front switch

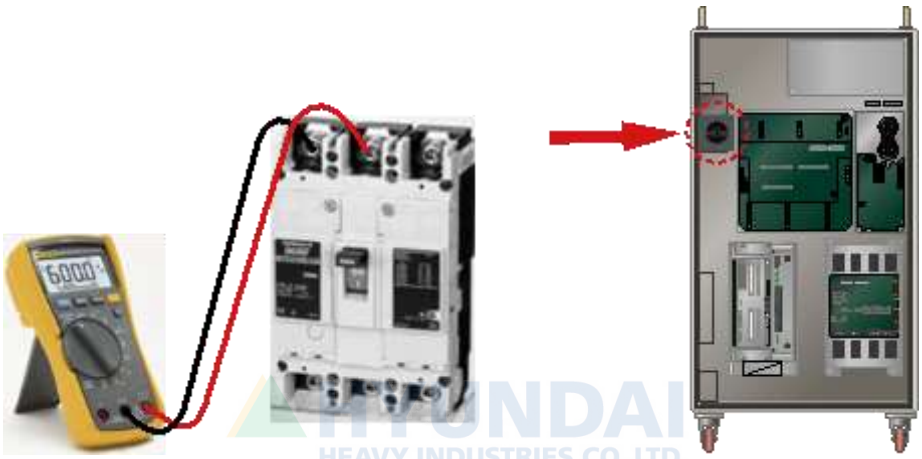

Figure 1.213 Measuring the power line of front switch

Warning
Please be cautious. Short-circuit between phases or with surrounding components can occur while measuring the high voltage.

1) Hi5-C1X Controller: Measuring the Side terminal block's 3-phsae terminal (socket)

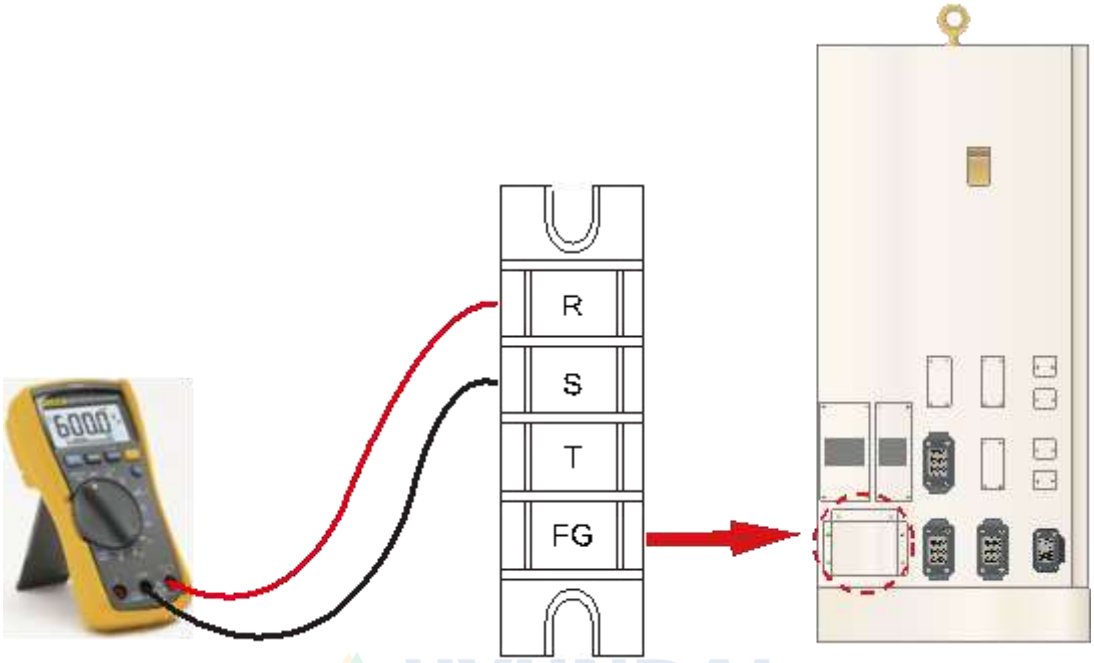

Figure 1.214 Hi5-C1X Controller's 3-Phase Power Terminal Block

2) Hi5-C2X Controller: Measuring the Side terminal block's 3-phase terminal (socket)

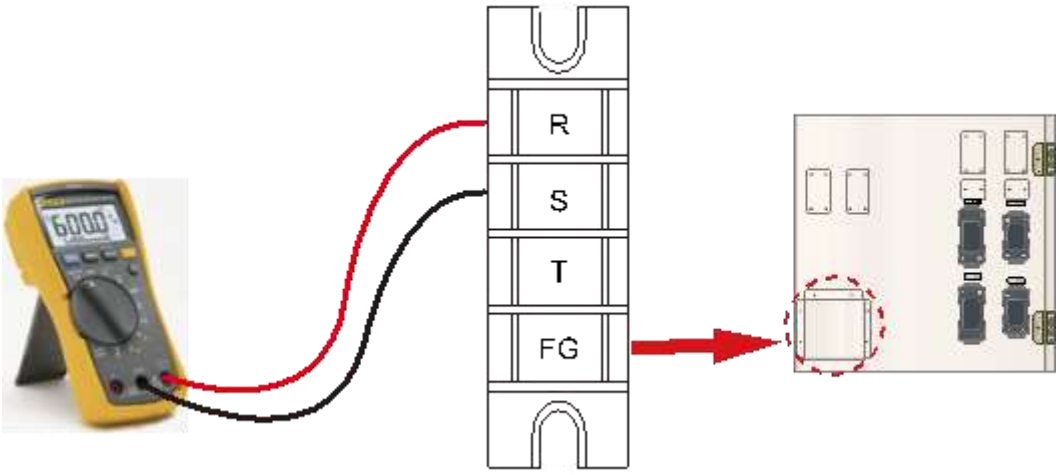

Figure 1.215 Hi5-C2X Controller's 3-Phase Power Terminal Block

1.1.73. Instructions in examining the Controller's internal voltage (3-phase)

(1) Please check the Controller's internal 3-phase power voltage.

Electrical Module (PSM or PDM) that attached at the front of controller is in charge of the distribution and replay of each power supplies and the 3-phase power supply will be turned on/off by a Magnet switch in the Electrical Module. Please examine if the input voltage to the Electrical Module is within the 10% error range of AC220V standard. If the measured voltage is out of the allowed range, please examine as below.

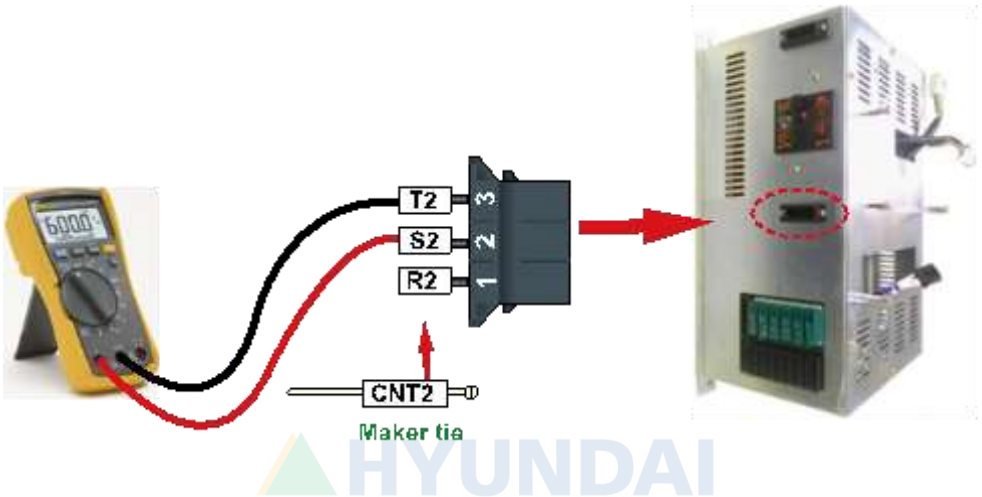

Figure 1.216 3-Phase Power Input to the Electrical Module

Warning
Please be cautious. Short-circuit between phases or with surrounding components can occur while measuring the high voltage.

1) If the input voltage to the controller is AC220V
If the input voltage to the controller is AC220V, input voltage from external to the power switch or terminal block must be same as the measured voltage from the internal Electrical Module. If there is a difference, please examine the 3-phase power supply wiring.

2) If the input voltage to the controller is not AC220V
If the input voltage specification to the controller is not AC220V, please use the internally installed transformer to convert the 3-phase voltage into AC220V and it will be connected to the Electrical Module. Please examine if the voltage of the Electrical Module is within the 10% error range of AC220V standard.
If the measured voltage is out of allowed range, please examine the input of internally installed transformer and the connection status of output terminal (socket). Primary column of the internally installed transformer must be connected with the voltage as it is displayed on a rating panel. Secondary column of the transformer must be set to AC3-phase 220V at all time. If the output from the output terminal (socket) is not AC 3-phase 220V even when the input and output terminals (socket) are connected properly, the transformer is faulty. At this stage the output voltage of transformer's error rate must be within 5 %.

1.2. Instructions in Parts Replacement

This instruction shows how to replace the parts and boards during troubleshooting.

1.2.1. Instructions in Substrate Replacement

Pay attention to the followings during boards replacement.

① Be sure to turn power off before working.

② Keep your hands clean to prevent boards from being stained with oils or water. If you need to grasp the board, please hold around the board. Be sure not to touch the contacting surface of electric parts or pattern, and especially connector.

③ Align the electric potential between the body (hand) of the user and the controller.

④ Each board has a number of connectors. Be sure to insert completely to prevent false inserting, omission, or looseness when replacing. Match the printed names on the nameplate of connector and on the one of boards.

Separation of Boards

Please take the followings actions before taking out main board.

① If the main board needs to be replaced, backup files of programs / constant data should be first made by using the HR-VIEW S/W of a PC (or a notebook) or a USB memory before replacing it.

② Since the teaching-program / constant data is stored in SRAM of main board, the previous program / constant data you want is not existed after replacement.

③ 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.

④ Besides, in a case in which the connectors of a battery for backup have been separated by mistake or because of the replacement of the board, the capacitor for backup maintains programs / constant data for up to about seven days. The battery for backup must be connected to keep the board for long period of time because program/constant data may be deleted afterwards.

Please be aware of the above cautions, and make a replacement of board following the below instructions.

① First, remove input power from power unit.

② Loosen slightly the screw upholding the supporting stand which is above and below of Rack, move the supporting stand to the left, and pull it out.

③ Take all the connectors out of board. Here, for the connector connected by screws, loosen them by using a suitable screwdriver. And be careful of excessive force to connector.

④ Pull out the Ejector mounted on the upper and lower front side of board and the board will be taken out along the guide rail of Rack.

Insert of Board

① First, turn off the input power of power unit.

② Push inward the Ejector mounted on the upper and lower front side of board along the guide rail of Rack. Here, push it hard until you feel that the connector is inserted into backplane board which is located in the back side of Rack.

③ Connect all the connectors of the board. Here, for the connector connected by screws, tighten it again by using a suitable screwdriver.

④ Move the supporting stand to the right, hooking up to the screw on the upper and lower part of Rack, and then tighten the screw.

Pay attention to the followings after inserting main board.

① Copy the programs / constant data, the backup files of which were made before replacing the main board, into the memory of the main board by using a PC (or a notebook) or a USB memory

② Check whether the backup battery connector is connected.

③ If the battery connector is not connected, it is safe while the controller power is ON. However, if the power is OFF for more than seven days, the programs / constant data will all be deleted.

1.2.2. How to replace a servo drive unit

Refer to the followings when replacing a servo drive unit.

It may not be compatible with other servo drive unit models so check the front nameplate.

Removal of servo drive unit

① First, turn off the input power of power unit.
② Remove the bolts from the protecting cover of servo drive unit and then remove it.
③ Take off wires tightened to terminal block with screws.
④ Take off all the connected connectors.
⑤ Remove the screws to protect the servo drive unit.
⑥ Remove the servo drive unit.
The servo drive unit is heavy so avoid any injury when removing it. And make sure not to damage wires around it.

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Reassembly of servo drive unit

① First, turn off input power of power unit.
② Lift up and then insert the servo drive unit.
The servo drive unit is heavy so avoid any injury when inserting it. And make sure not to damage wires around it.
③ Fix the servo drive unit with screws.
④ Screw on the wires to terminal block.
⑤ Connect all the connectors.
⑥ Bolt the servo drive unit protecting cover.

1.2.3. Instructions in Battery Replacement

This controller is a backup battery for SRAM, and uses 3.6V Lithium battery.
Replace the battery every 2 years on a regular basis.
To prevent a damage of SRAM data, back up SRAM data first by using HRVIEW or USB memory.
When replacing the battery, it can be done with the primary power is ON.

① Prepare a new Lithium battery.

② Disconnect the primary power of controller.

③ Replace Lithium battery with a new one.

④ Supply the primary power to controller.

[Warning]

① Do not litter the spent battery.

② Dispose of the spent battery as an industrial waste under the relevant regulations or rules.

③ Do not recharge the used-up battery. It involves a danger of explosion.

④ Use the specified battery only.

⑤ Do not make a short circuit of positive and negative poles.

⑥ Do not burn the spent battery, nor leave it in a high temperature.

1.2.4. Instructions in SMPS Replacement

This SMPS is a complex power unit which is used as a primary control power. Pay close attention to this sophisticated device.

Separation of SMPS

① First, turn off input power of power unit.

② Unscrew the terminal stand of SMPS 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, and pull it out. Then SMPS 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

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① First, turn off input power of power unit.

② Grasp the SMPS with the right hand and push it into the first guide rail of Rack, while clearing the surrounding wires away. Here, make sure not to damage the wires around it.

③ Screw it to the Rack.

④ Screw on the wires to terminal stand.

1.3. Instructions in Adjustment

This controller does not require extra adjustment because it has been fully adjusted when delivered from warehouse. However, in case of parts replacement, an adjustment may be needed to some extent. This instruction 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.

1.3.1. 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 1-7 power standard value

Power	Measuring Location	Standard	Adjustment
Primary Power	CB1 input terminal	**AC220V ± 10%**	The first tap of the transformer TR1 is defined as AC220V
R6,S6,T6	Servo AMOP R, S, T	**AC220V ± 10%**	Check the CB1 input voltage (AC220V).
B2-C2	TB1 B2-C2	**AC220V ± 10%**	Transformer TR1 second tap change
P1-M1	SR1 +24V-G2	**DC24V ± 2.0V**	(Note 1)
P5-M0	SR1 +5V-G1	**DC5.1V ± 0.1V**	SR1 volume resistivity
P15-M0	SR1 +15V-G1	**DC15V ± 0.5V**	(Note 1)
N15-M0	SR1 -15V-G1	**DC-15V ± 0.5V**	(Note 1)
P5E-M5E	SR1 +5V-GND	**DC5.4V ± 0.1V**	SR1 volume resistivity (Note 2)
	Robot external wiring terminal and connector pins P5E-M5E	**DC5.1V ± 0.1V**	SR1 volume resistivity (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.

1.3.2. Transformer

For the transformer (TR1) input, the primary power must be three-phase AC220V. 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.
Remaining controllers of voltage specifications are preset before shipment so it is not allowed to change the tabs without prior consent.

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